ISSN 0100-6991
ISSN ONLINE: 1809-4546

85 anos CBC 1929 – 2014

CBC

Revista do Colégio Brasileiro de Cirurgiões

Journal of the Brazilian College of Surgeons

ENGLISH

Volume 42 • Nº 5
setembro/ outubro de 2015

www.cbc.org.br

COLÉGIO BRASILEIRO DE CIRURGIÕES

Orgão oficial de divulgação

SBH
Sociedade Brasileira de Hérnia e Parede Abdominal

SUMÁRIO / CONTENTS

Rev Col Bras Cir 2015; 42(5)

EDITORIAL

ARTIGOS ORIGINAIS

NOTA TÉCNICA

ENSINO

REVISÃO

RELATO DE CASO BASEADO EM EVIDÊNCIA

Revista do Colégio Brasileiro de
Cirurgiões

Órgão Oficial do Colégio Brasileiro de Cirurgiões

A REVISTA DO COLÉGIO BRASILEIRO DE CIRURGIÕES é indexada no Latindex, Lilacs e Scielo, Scopus, Medline/PubMed, DOAJ, Free Medical Journals e enviada bimestralmente a todos os membros do CBC, aos seus assinantes, a entidades médicas, bibliotecas, hospitais, e centros de estudos, publicações com as quais mantém permuta, e aos seus anunciantes.

REDAÇÃO, ASSINATURAS e ADMINISTRAÇÃO

Rua Visconde de Silva, 52 - 3° andar - Botafogo - 22271-092 - Rio de Janeiro - RJ - Brasil
Tel.: + 55 21 2138-0659; Fax: + 55 21 2286-2595; E-mail: revistacbc@cbc.org.br
http//www.cbc.org.br

Preço da assinatura anual: a vista, R$ 150,00
ou três parcelas de R$ 60,00
Números avulsos e/ou atrasados: R$ 40,00
Preço da assinatura para o exterior: US$ 248,00
Tiragem: 5.000 exemplares

International Standard Serial Number
ISSN 0100-6991

PUBLICIDADE

Tel.: (21) 3116-8300
E-mail: medline@medlineeditora.com.br

IMPRESSÃO e ACABAMENTO
Gráfica e Editora Prensa Ltda
Rua João Alvares, 27
Saúde - Rio de Janeiro - RJ
Tel.: (21) 2253-8343

PROJETO GRÁFICO
Márcio Alvim de Almeida

PROJETO GRÁFICO - CAPA
Tasso

REVISTA DO COLÉGIO BRASILEIRO DE CIRURGIÕES

Indexada no Latindex, LILACS e SciELO, Medline/PubMed, Scopus, DOAJ e Free Medical Journals

Evidence based case report

Relato de caso baseado em evidência

Carlos Alberto Guimarães, TCBC-RJ[1]

Clinical cases are presented everywhere: on daily ward rounds, in seminars, in meetings, in the medical press and at conventions. Clinical case reports in the medical press represent a scientific effort comparable to other observational or experimental research projects. If the report is good, its publication should be encouraged without hesitation[1].

Case reports can initiate scientific studies – they may serve to create a hypothesis that is put to the test using systematic research. But can case reports ever be evidence?[2].

Do clinical case reports play a role in the present and future of evidence-based medicine (EBM)? Surely clinical case reports play a role in the present and future of EBM. In terms of EBM, a clinical case report can be viewed from two different angles: 1) it is a source of evidence, and 2) an evidence-based approach is needed in the interpretation of the case and in its clinical management. The first angle leads to the development of an "evidence-based case report". With respect to the second angle, it has been shown how available evidence can and should be used in an individual case of any disease[1].

While clinicians are urged to use up-to-date research evidence to give patients the best possible care, actually doing so in individual patients is difficult. The research literature is poorly organized, largely of poor quality and irrelevant to clinical practice. The most valid and relevant information may be based on highly selected groups of patients with little resemblance to the patient in front of you[3].

To help readers develop the increasingly necessary art of using research evidence in practice, the British Medical Journal launched a new type of article in 1998 – the evidence based case report[4].

Evidence based case reports attempt to show how evidence can be applied at all stages of patient care. Information from cohort studies about the frequency of different conditions can suggest the most likely diagnosis. Decisions about which tests to order can be guided by information on the sensitivity and specificity of different tests. Decisions about which interventions to advise can be gathered from randomized clinical trials and systematic reviews looking at effectiveness and safety. Information on long term or rare side effects can be acquired from well designed cohort or case control studies[3].

Case reports have long been used to report new findings and to give educational impact to review articles. Evidence based case reports will not report new findings. Instead of presenting new findings, evidence based case reports are intended to illustrate a process. Contributors are being asked to take an approach now familiar to students of critical appraisal—to define the clinical question; to search the literature for studies of appropriate relevance, design, and quality; to apply the information; and to audit the result[3].

In this issue, Guimarães *et al*. report, to our knowledge, the first evidence based case report published in a Brazilian journal, which is entitled "Evidence-based case report: agenesis or pseudo-agenesis of the dorsal pancreas".

REFERENCES

1. Jenicek M. Clinical Case Reporting in Evidence-Based Medicine. 2nd ed. London: Arnold; 2001.
2. Achenbach S, Einstein AJ, Ferencik M. How much evidence is in a case report? A road trip of scientific evidence, including skeptics, Ockham's razor, Hume's Fork, and Karl R. Popper [editorial]. J Cardiovasc Comput Tomogr. 2015;9(4):267-9.
3. Godlee F. Applying research evidence to individual patients. Evidence based case reports will help [editorial]. BMJ. 1998;316(7145):1621-2.
4. Glasziou P. Twenty year cough in a non-smoker. BMJ. 1998;30:316(7145):1660-1.

1. Comitê de Ética em Pesquisa do Hospital Universitário Clementino Fraga Filho da Universidade Federal do Rio de Janeiro.

DOI: 10.1590/0100-69912015005002

Robotic surgery. A reality among us

A cirurgia robótica. Uma realidade entre nós

Delta Madureira Filho-TCBC/RJ[1]

In 1979, at the newly opened Hospital Universitário da Universidade Federal do Rio de Janeiro (HU-UFRJ), Professor Ugo Pinheiro Guimarães, now retired, was invited by Professor Levão Bogossian for a lecture at the Department of Surgery. During his speech, he uttered these words: "*As a boy I was taken by my father to Derby Club (now the region where the Maracanã is) to watch the first flight of the 14-Bis. Santos Dumont flew 500 meters just above the ground and was the big event of that time. I feel privileged because, in this very life, I saw man reach the moon.*" . In this editorial I want to parody Professor Ugo. In 1990, I attended and participated in the beginning of laparoscopic surgery in Brazil. I feel privileged because, in this very life, only a few years later, I attended another major event in modern surgery, the emergence of Robotic Surgery.

The first time I saw a surgical robot was in the exhibit sector at the Congress of the American College of Surgeons (ACS) in 1998. There was the Da Vinci's console and, at his side, the robot arms on a mannequin. I was excited and I was sure that one day I could use one in Brazil. Back then it was available in only a few medical centers in the US and Europe. In the following Conferences of the ACS and the Society of American Gastrointestinal Endoscopic Surgeons (SAGES), I attended all meetings where the subject robotic surgery was approached. A dream was born!

In 2006, a company that sells medical equipment brought to Rio de Janeiro the Zeus robot and the robotic arm Aesop, models that competing with Da Vinci. Immediately we made contact with this company and we held an event at the Hospital Universitário Clementino Fraga Filho (HUCFF) in association with the Sociedade de Cirurgia Vídeo Endoscópica do Rio de Janeiro (SOCIVERJ), addressing the Theoretical Foundations of Robotic Surgery and performing some procedures on animals (pigs). The Aesop consisted of a robotic arm that could be used alone or coupled to Zeus. When used without Zeus it served to make the camera move under voice command. We got permission to perform the operation in some patients. Our team used it at HUCFF and by Dr. Ricardo Zorron team used it at Hospital Lourenço Jorge. The seed of enthusiasm among young surgeons about robotic surgery was being planted. The Zeus and Asoep were purchased by Intuitive, the company that makes Da Vinci, and removed from circulation. Today, Da Vinci is the only surgical robot in the market.

In 2008, during a meeting of the Academia Nacional de Medicina, Brazil, and the Academia Nacional de Medicina de Portugal, Lisbon, to celebrate the 200th anniversary of D. João IV in Brazil, we had a meeting with the then Secretary of Science and Technology of the State of Rio de Janeiro, who attended the event, and we sensitized him to help us achieve the purchase of Da Vinci to Rio de Janeiro. We carried out a project at UFRJ for the implementation of a multidisciplinary Center for Research in Surgical Robotics, with the participation of doctors, biomedical engineers and technicians from Núcleo de Computação Eletrônica da UFRJ (NCE). The purpose would be the formation of knowledge in the area, involving the School of Medicine, COPPE and NCE. Several meetings were held, but unfortunately it was not possible, for various reasons, to acquire the Da Vinci at that time.

The big dream began to be held in Rio de Janeiro when the Hospital do Instituto Nacional do Câncer (INCA) began negotiating the purchase of the Da Vinci robot. At the time, at a conference held at the Hotel Windsor in 2011, several topics were presented on robotic surgery and Da Vinci simulator (Mimic) was exhibited. The following week, it was possible to organize a one-day event at the Hospital Samaritano in Rio de Janeiro, with theoretical issues about surgical robotics and training in the Mimic simulator. In 2012, the Hospital Samaritano bought the Da Vinci, forming groups of General Surgery, Urology, Gynecology and Head and Neck Surgery. It provided a long and responsible training period for these doctors, bringing to Brazil foreign surgeons to guide their first surgeries. Today, they have held more than 700 robotic surgeries successfully. Recently, the Marcilio Dias Navy Hospital acquired the Da Vinci, and Rio de Janeiro has three hospitals performing robotic surgery.

Robotic surgery is a minimally-invasive procedure that follows the same line of laparoscopic surgery. Long working instruments within trocars introduced through the abdominal wall and / or chest are used. The difference is that in laparoscopy the clamps are manipulated by the surgeon's hand. In robotics, the surgeon controls the robot arms from a distance, sitting at a console with his thumb,

1. Professor Titular de Cirurgia Geral da Escola Médica de Pós Graduação da PUC-Rio, Rio de Janeiro, Brasil.

index and middle fingers introduced in a device that drives and directs the movements of the robot (assisted robotic surgery).

Early researches on robotic surgery were held in military institutions. It was thought that the main benefit would be to conduct operations at places distant from the patient, for example, in field hospitals during armed conflict or in space stations. Despite the performance of a transatlantic operation, with the surgeon in New York (professor Jacques Marescoux) and the patient in Strasbourg, France, – "Lindbergh Surgery", the name of the first man to cross the Atlantic by plane –, this operation was not repeated due to high cost, the communication being made through optical fiber across the Atlantic Ocean.

The real advantage of robotic surgery is its accuracy. Today it is performed with the surgeon at the console in the same operating in which the patient and the robot arms are. The surgeon's vision is three-dimensional, very good, and superior to laparoscopy. The instruments are accurate and perform movements similar to the human hand (Endowrist). There is no tremor or fatigue. These facts enable advantage over laparoscopic surgery, it being therefore suitable for carrying out complex and difficult operations of being performed by laparoscopy. For the surgeon there is great advantage in ergonomics. He works sitting, relaxed, with his forehead resting on the console display. If he turns his head away from the console, the robot arms stop immediately, allowing the doctor a little break to look at an exam, discuss the case with a colleague, or even make a small snack.

The cost of each operation is still high. One company holds the patent and manufactures the Da Vinci. But like everything else in technology, over time the cost should decrease. I believe that before long the surgical robot will be available in most good hospitals. Most surgeons will have access to its use and simple procedures will also be performed by robotics.

Today, August 2015, in Brazil, operations are performed by robots only in in Sao Paulo, Rio de Janeiro, Porto Alegre, Barretos and, soon, in Fortaleza. I am sure that if one reads this editorial in ten years one will see a major change in the period, ie robotic surgery present in most Brazilian cities, with many different types of surgical robots, specific robots for specific types of operations and surgeons using them routinely, as they do today in laparoscopic surgery.

DOI: 10.1590/0100-69912015005003

Original Article

Chronic subdural hematoma: epidemiological and prognostic analysis of 176 cases

Hematoma subdural crônico: análise epidemiológica e prognóstica de 176 casos

Jamil Farhat Neto[1]; João Luiz Vitorino Araujo[1]; Vinícius Ricieri Ferraz[1]; Luciano Haddad[1]; José Carlos Esteves Veiga TCBC-SP[1]

A B S T R A C T

Objective: To characterize patients with chronic subdural hematoma undergoing surgery and to identify prognostic indicators. **Methods**: We conducted a retrospective analysis of patients diagnosed with chronic subdural hematoma (CSDH) undergoing surgical treatment. We analyzed: age, period from trauma to diagnostic imaging, pre and postoperative Glasgow coma scale, type of surgery, associated comorbidities, use of postoperative drainage and outpatient treatment. **Results**: The sample consisted of 176 patients, 126 male and 50 female patients (ratio 2.5 : 1), ages ranged from six months to 97 years, with an average of 59.3 years. CSDH was caused by trauma in 52% of patients, with the time from trauma to imaging averaging 25.05 days; 37.7% were hypertensive patients and 20% had a neurological disease. Eighty-five (48.3%) patients were elderly and altered consciousness was present in 63% of cases. Of the 91 (51.7%) non-elderly patients, 44% presented with headache, altered consciousness occurred in 40% and motor abnormalities in 27.5%. The CSDH was located on the right in 41%, left in 43% and bilaterally in 16% of patients. **Conclusion**: the change of consciousness was the most common clinical alteration in the elderly and headache in non-elderly. The most associated comorbidity was the arterial hypertension and the most frequent cause, head trauma. The trepanation with two oriffices associated with a closed drainage system was the most used operating, with high efficacy and low complication rate.

Key words: Hematoma, Subdural, Chronic. Intracranial Hemorrhages. Neurosurgery. Epidemiology. Prognosis.

INTRODUCTION

Chronic Subdural Hematoma (CSDH) is one of the most frequent types of intracranial hemorrhage, with favorable prognosis when treated properly. However, as it tends to occur in older patients, its evolution may suffer interference from postoperative complications [1]. It is therefore important to accurately assess complications, recurrences and other factors related to better treatment [2].

Currently, there is a steady increase in the incidence of CSDH in inhabitants of developed countries due to the increase in life expectancy of this population, with incidence values reaching up to 0.0074% in the group of patients over 70 years of age [1].

Surgical treatment of CSDH is widely accepted as the most effective method [3]. Although techniques are diverse and vary among services, the following can be used: one or two trepanations with the use of drainage catheters; small craniotomy and endoscopic removal; subdural shunt as an alternative for pediatric patients; wide craniotomy with removal of the hematoma and resection of the membrane; and others [1].

This study aims to characterize patients with chronic subdural hematoma undergoing surgery and to identify related prognostic factors.

METHODS

We analyzed charts of patient diagnosed with CSDH who were treated consecutively at the Division of Neurosurgery, Department of Surgery of Santa Casa de São Paulo, from November 2001 to September 2008. The analysis included patients aged zero to 97 years. We analized: age, time from trauma to diagnostic imaging, Glasgow coma scale pre and post surgery, type of surgery, associated comorbidities, use of postoperative drainage and outpatient follow-up. To assess symptoms, we classified the patients by age, over 65 years and below 65 years, in accordance with the definition of elderly population of the World Health Organization (WHO) [4].

Outpatient follow-up was scheduled for three months, six months and one year, and the parameters evaluated were: muscle strength in all four limbs and the

1. Disciplina de Neurocirurgia da Faculdade de Ciências Médicas da Santa Casa de São Paulo, SP, Brasil.

Glasgow coma scale. Data were analyzed for statistical significance using the Student's t test, p <0.05 being considered significant.

RESULTS

Our sample consisted of 176 patients, 126 male and 50 female (ratio 2.5: 1), ages ranged from six months to 97 years, with an average of 59.3 years (Figure 1) .

CSDH was caused by trauma in 92 (52%) patients, the time from trauma to diagnosis confirmed by imaging averaging 25 days. Twelve patients (6.5%) were in neurological operations postoperative period, five of them underwent ventricular shunt (VPS) and three, surgical treatment of acute subdural hematoma. Regarding associated diseases, 37.7% of patients were hypertensive, 20% had some neurological disease, 7.5% being cerebrovascular and 12.5%, malformations and tumors. Nineteen percent of patients were alcoholics (Table 1). Ongoing medications were inhibitors of angiotensin-converting enzyme (ACE) in 19%, 10% antiplatelet therapy, 9.6% diuretics and 9% oral hypoglycemic agents (Table 2).

We found 85 (48.3%) patients over 65 years, 25.6% of whom had altered consciousness and 17% changes in motor function. Among the 91 (51.7%) patients younger than 65 years, 22.7%had headache, 21% altered consciousness, and 14.2%, motor abnormalities (Table 3). As for the prognosis, in our sample there was no statistical difference among the elderly and non-elderly, with RR ranging from 0.49 to 1.25.

The Glasgow Coma Scale on admission ranged from 4 to 15 with an average of 13, and after surgery it ranged from 7 to 15 with an average of 14. Anisocoria was present in 7.5% of patients on admission. Motor deficit was distributed among the four limbs, varying from 1 to 5 with an average of 4 in the four limbs, corresponding to a subnormal force that allows walking and performing simple tasks.

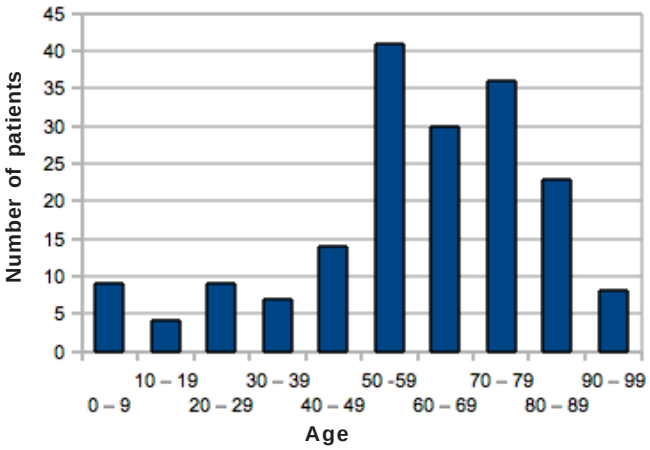

Figure 1 - *Age Classification.*

ICU admission was required in 13.7% of patients and tracheostomy was performed in 7%. Clinical complications were present in 10% of cases, infection being the most frequent, especially airway infection, meningitis and skin infection. Surgical rapprochement was necessary in 9% of cases, with an average of 106 days interval, there being no statistical difference as for prognosis of patients surgically re-approached in our sample, with RR ranging from 0.82 to 8.61.

Diagnostic imaging was done by Computerized Tomography (CT) in 92% and by MRI at 8%. The hematoma was located on the right in 41% of patients, on the left in 43%, and in 16% it was bilateral. Midline deviation was described in 42% of patients. There was no statistical difference in the prognosis of patients with midline deviation (RR 0.23 to 2.85) and bilateral CT findings (RR 0.08 to 3.55).

Table 1 - Associated Diseases.

Diseases	%
Trauma	52
Systemic hypertension	37.7
Neurological diseases (non vascular)	20
Alcoholism	19
Diabetes Mellitus	17
Cardiovascular Diseases	14.4
Smoking	10.3
Cerebrovascular diseases	7.5
Malignant neoplasms	6.2
Nephrological Diseases	4.1
Epilepsy	3.4
Dyscrasias	2.7
Pulmonary Diseases	2.7
Psychiatric Diseases	1.4
HIV +	0.7

Source: Discipline of neurosurgery, Surgery Department, Santa Casa de São Paulo (2001-2008).

Table 2 - Medication in use.

Medicines	%
No medication	55
Angiotensin-converting enzyme (ACE) inhiibitors	19
Diuretics	9.6
Antiplatelet agents	9.6
Hypoglycemic agents	9
Anticonvulsants	7.5
Beta-blockers	5.5
Cardiotonics	4.1
Statins	3.4
Nonsteroidal anti-inflammatory drugs (NSAIDs)	1.4

Source: Discipline of neurosurgery, Surgery Department, Santa Casa de São Paulo (2001-2008).

The treatment of choice was trepanation in 94% and craniotomy in 6%. When the CSDH was unilateral we held two trepanation orifices in 86% and on in 14%; when it was bilateral, on its turn, we performed four orifices in 70%were, two in 25% and three in 5% of operations. The closed drainage system was used in 85% of patients, with a mean time of 2.57 days, ranging from one to seven days.

The average Glasgow coma scale was four at follow-up. Only 62% of patients returned after three months, 32% in six months and 21% in one year.

Hospital stay ranged from two to 177 days, with an average of 12.1 days. Sequelae were present in 6.5% of patients, 10% of patients died, 7.8% for clinical causes.

DISCUSSION

Chronic subdural hematoma is characterized by a well defined and encapsulated collection between the dura mater and arachnoid membranes containing a mixture of fluid and coagulated blood in various stages[5,6]. It is one of the most common forms of intracranial hemorrhage, being considered a benign lesion, though chronically progressive, but in most cases, the evolution without the imposition of surgical treatment can be fatal due both to brain compression exerted by hematoma and to the associated diseases. On the other hand, early diagnosis and surgical drainage allow complete recovery in most cases[7].

Most patients are in the third decade or older, with the highest incidence between the fifth and sixth decades[8], as was found in our series, average 59.3 years, which was lower than that found in cases of review studies[1,9,10]. In all series men were more commonly affected than women, corroborating our findings.

The pathophysiology of CSDH is not fully understood. There are two major theories proposed to explain its growth: the osmotic theory and the theory of recurrent bleeding in encapsulated hematoma. The osmotic theory is based on the assumption that the liquefaction of hematoma increases the protein content and osmotic pressure, attracting fluid from blood vessels into the neighboring cavity by an osmotic pressure gradient across a semipermeable membrane (hematoma capsule)[11]. However, Weir questioned this theory by demonstrating that the osmolarity of the hematoma fluid is identical to the blood and cerebrospinal fluid ones[12]. The recurrent bleeding theory is the most accepted. The hematoma capsule possesses abnormal and dilated blood vessels, being a source of bleeding. Ito et al.[13], after the administration of red blood cells labeled with Cr, six to 24 hours before the hematoma drainage, showed that the hematoma content was 0.2 to 28% new blood. They also demonstrated that hematoma relation with the use of antiplatelet agents and anticoagulants, reinforcing this theory. Since most patients have cortical atrophy and decreased blood buffering effect, there is a contribution to the gradual expansion of CSDH[11].

The most common cause of hematoma in all series is traumatic, being associated with chronic alcoholism, implantation of vascular shunts,coagulation disorders, epilepsy, and trauma[8].

Our series is in line with the literature [2], since over 50% of patients had history of head trauma, and, for patients in neurosurgical postoperative period, the use of bypass systems was the most frequent previous operation [2].

The imaging exam of choice for the diagnosis remains the TC, mainly because it is faster and less costly compared to MRI, and also can be used in patients with metallic implants and cardiac pacemakers[14,15]. The most common type of CSDH is hypodense (70.5%), followed by hematoma with various densities (19.6%), isodense (7.5%), and less commonly, hyperdense (2.4%) [1]. MRI is useful to mark the various stages of hematoma and provides detailed information on size, age and complexity of the hematoma, but is only indicated for the diagnosis of isodense or bilateral hematoma.

Table 3 - Symptoms.

Symptoms	Age			
	<65		>65	
	%	N	%	N
Headache	22.7%	40	10.2%	18
Altered consciousness	21%	37	25.6%	45
Motor disorder	14.2%	25	17%	30
Sensitivity disorder	0.5%	1	0	0
Seizure	5.1%	9	3.4%	6
Vomiting	5.1%	9	1.1%	2
Incidental	1.1%	2	1.7%	3
Fever	1.7%	3	0	0
Aphasia	1.1%	2	2.8%	5
Urinary incontinence	0	0	1.1%	2

Source: Discipline of neurosurgery, Surgery Department, Santa Casa de São Paulo (2001-2008).

Functional results were satisfactory at discharge, that is, with good recovery for patients with Glasgow score greater than 13 and outpatients with higher scores than 3, ie with independent living. Our patients showed good recovery in 82% of cases, a result similar to that found in the literature [2,16,17], which shows that, if treated properly, CSDH has a good prognosis.

Spontaneous resolution or clinical treatment of CSDH is well documented, but in some series hospitalization ranged from three weeks to 42 days and some patients are eventually surgically treated[18,19]. Several treatment options are proposed: bed rest, corticosteroids, mannitol and other hypertonic solutions have been used. However, the clinical treatment is not the choice for most patients, since surgical techniques are minimally invasive and recovery is made in less than a week for most patients. In our series, only 24% of patients were in hospital for more than a week. The type of drainage to be employed has been much discussed over the years, but there is a current trend of using trepanation for drainage of the hematoma, given the increased mortality when performing craniotomy[1]. Neuroendoscopic techniques are being used to multiloculated or septate hematomas, but are still rarely recommended.

Recurrence of CSDH after the first drainage is not uncommon and studies show values of 7 to 18%[2,16,17]; in our series it was 9%. Risk factors for recurrence of the hematoma are usually divided into three categories: factors associated with the patient, such as age, sex, alcohol consumption, tendency to bleeding, cortical atrophy or intracranial hypotension; factors associated with the pathogenesis of CSDH, as the structure of neomembrane or hematoma characteristics; and factors associated with surgery, how long it took until the beginning of the operation, additional irrigation procedures or closed drainage system. Studies[20,21] have shown that age, coagulation disorders, alcoholism and bilateral CSDH are risk factors for increased hematoma recurrence. Nonetheless, Oishi *et al*. [22] did not observe risk factors associated with patient characteristics, but only with the pathogenesis and operation. As for pathogenesis,they found time of operation as a factor, since they observed a in higher reoperation rate in patients operated early due to a rapidly expanding hematoma [22,23].

The CSDH the cure rate after drainage by trepanation is high, but the neurological deterioration occasionally complicates the course of the postoperative period, requiring postoperative surveillance[24,25]. Acute subdural hematoma, intracranial hypertensive hemorrhage, hypertensive pneumoencephalus and other cerebrovascular diseases can occur as postoperative complications[2,26-28]. In our series there were no cases of surgical postoperative complications, only clinical ones, such as infections and heart disease, in 9% of patients.

CSDH is a common disease in the neurosurgeon practice, but still associated with significant morbidity and mortality[27,28]. In our patients, the change of consciousness was the most frequent clinical alteration in elderly patients, and headache in the non-elderly. The disease most associated with CSDH was arterial hypertension and the most frequent cause was traumatic.

In conclusion, the change of consciousness was the most common clinical alteration in the elderly and headache in non-elderly. The most commonly associated comorbidity was the SAH and the most frequent cause, head trauma. The trepanation with two orifices associated with a closed drainage system was the most used operation, with high efficacy and low complication rate.

R E S U M O

Objetivo: *caracterizar os pacientes com hematoma subdural crônico submetidos à intervenção cirúrgica e identificar os indicadores prognósticos.* ***Métodos:*** *análise retrospectiva de pacientes diagnosticados com hematoma subdural crônico (HSDC) submetidos a tratamento cirúrgico. Foram analisados: idade, período do trauma ao diagnóstico por imagem, escala de coma de Glasgow pré e pós-operatório, tipo de intervenção cirúrgica, comorbidades associadas, utilização de drenagem pós-operatória e acompanhamento ambulatorial.* ***Resultados:*** *a amostra consistiu em 176 pacientes, 126 do sexo masculino e 50 pacientes do sexo feminino (proporção de 2,5:1), a idade variou de seis meses a 97 anos, com uma média de 59,3 anos. O HSDC foi causado por trauma em 52% dos pacientes, com o intervalo do trauma ao diagnóstico por imagem, em média, de 25,05 dias. Eram hipertensos 37,7% dos pacientes e 20% possuíam alguma doença neurológica. Oitenta e cinco (48,3%) pacientes eram idosos e a alteração da consciência esteve presente em 63% dos casos. Não eram idosos 91 (51,7%)p pacientes, 44% aprresentaram cefaleia, alteração da consciência ocorreu em 40% dos pacientes e as alterações motoras, em 27,5%. O HSDC localizou-se à direita em 41%, à esquerda em 43% e, bilateral em 16% dos pacientes.* ***Conclusão:*** *a alteração de consciência foi a alteração clínica mais comum nos idosos e a cefaleia em não idosos. A comorbidade mais associada foi a HAS e a causa mais frequente, o traumatismo craniano. A trepanação com dois orifícios associada ao sistema de drenagem fechado foi a operação mais utilizada, com alta efetividade e baixo índice de complicações.*

Descritores: *Hematoma Subdural Crônico. Hemorragias Intracranianas. Neurocirurgia. Epidemiologia. Prognóstico.*

REFERENCES

1. Gelabert-Gonzáles M, Iglesias-Pais M, García-Allut A, Martínez-Rumbo R. Chronic subdural haematoma: surgical treatment and outcome in 1000 cases. Clin Neurol Neurosurg. 2005;107(3):223-9.
2. Mori K, Maeda M. Surgical treatment of chronic subdural hematoma in 500 consectuive cases: clinical characteristics, surgical outcome, complications, and recurrence rate. Neurol Med Chir. 2001;41(8):371-81.
3. Yamamoto H, Hirashima Y, Hamada H, Hayashi N, Origasa H, Endo S. Independent predictors of recurrence of chronic subdural hematoma: results of multivariate analysis performed using a logistic regression model. J Neurosurg. 2003;98(6):1217-21.
4. World Health Organization (2002). Active Ageing: A Police Framework. A contribution of the World Health Organization to the Second United Nations World Assembly on Ageing. Madrid, Spain, April, 2002. Disponível em: http://whqlibdoc.who.int/hq/2002/WHO_NMH_NPH_02.8.pdf.
5. Ernestus RI, Beldzinski P, Lanfermann H, Klug N. Chronic subdural hematoma: surgical treatment and outcome in 104 patients. Surg Neurol. 1997;48(3):220-5.
6. Yasuda CL, Morita ME, Nishimori FY, Yasuda AM, Alves HL. Hematoma subdural crônico: estudo de 161 pacientes operados e a relação com alterações no coagulograma. Arq Neuro-Psiquiatr. 2003;61(4):1011-4.
7. Pittella JEH, Duarte JE. Prevalência e padrão de distribuição das doenças cerebrovasculares em 242 idosos, procedentes de um Hospital Geral, necropsiados em Belo Horizonte, Minas Gerais, no período de 1976 a 1997. Arq Neuro-Psiquiatr. 2002;60(1):47-55.
8. Misra M, Salazar JL, Bloom DM. Subddural-peritoneal shunt: treatment for bilateral chronic subdural hematoma. Surg Neurol. 1996;46(4):378-83.
9. Rhode V, Graf G, Hassler W. Complications of burr-hole craniotomy and closed-system drainage for chronic subdural hematomas: a retrospective analysis of 376 patients. Neurosurg Rev. 2002;25(1-2):89-94.
10. Krupp WF, Jans PJ. Treatment of chronic subdurl haematoma with burr-hole craniostomy and closed drainage. Br J Neurosurg. 1995;9(5):619-27.
11. Adhiyaman V, Asghar M, Ganeshram KN, Bhowmick BK. Chronic subdural haematoma in the elderly. Postgrad Med J. 2002;78(916):71-5.
12. Weir B. The osmolality of subdural hematoma fluid. J Neurosurg. 1971;34(4):528-33.
13. Ito H, Yamamoto S, Saito K, Ikeda K, Hisada K. Quantitative estimation of hemorrhage in chronic subdural hematoma using the 51Cr erythrocyte labeling method. J Neurosurg. 1987;66(6):862-4.
14. Gelabert-González M, Fernández-Villa JM, López-García E, García-Allut A. Chronic subdural hematoma in patients over 80 years of age. Neurocirurgia. 2001;12(4):325-30.
15. Tsutsumi K, Maeda K, Iijima A, Usui M, Okada Y, Kirino T. The relationship of preoperative magnetic resonance imaging findings and closed system drainage in the recurrence of chronic subdural hematoma. J Neurosurg. 1997;87(6):870-5.
16. Ernestus RI, Beldzinski P, Lanfermann H, Klug N. Chronic subdural hematoma: surgical treatment and outcome in 104 patients. Surg Neurol. 1997;48(3):220-5.
17. Mellergård P, Wisten O. Operations and re-operations for chronic subdural haematomas during a 25-year period in a well defined population. Acta Neurochir. 1996;138(6):708-13.
18. Kurti X, Xhumari A, Petrela M. Bilateral chronica subdural haematomas: surgical or non-surgical treatment. Acta Neurochir. 1982;62(1-2):87-90.
19. Voelker JL. Nonoperative treatment of chronic subdural hematoma. Neurosurg Clin N Am. 2000;11(3):507-13.
20. Asano Y, Hasuo M, Takahashi I, Shimosawa S. Recurrent cases of chronic subdural hematoma—its clinical review and serial CT findings. No To Shinkei. 1992;44(9):827-31.
21. Fukuhara T, Gotoh M, Asari S, Ohmoto T, Akioka T. The relationship between brain surface elastance and brain reexpansion after evacuation of chronic subdural hematoma. Surg Neurol. 1996;45(6):570-4.
22. Oishi M, Toyama M, Tamatani S, Kitazawa T, Saito M. Clinical factors of recurrent chronic subdural hematoma. Neurol Med Chir. 2001;41(8):382-6.
23. Araújo JFM, Iafigliola MG, Balbo RJ. Hematoma subdural crônico: análise de 35 casos. Arq Neuro-Psiquiatr. 1996;54(1):71-4.
24. De Jesús O, Pacheco H, Negron B. Chronic and subacute hematoma in the adult population. The Puerto Rico experience. P R Health Sci. J. 1998;17(3):227-33.
25. Tagle P, Zamorano L, Villar S. Hematoma, subdural crónico: consideraciones terapéuticas y pronóstico. Rev chil neuro-psiquiatr. 1984;22(2):155-8.
26. Kwon TH, Park YK, Lim DJ, Cho TH, Chung YG, Chung HS, et al. Chronic subdural hematoma: evaluation of the clinical significance of postoperative drainage volume. J Neurosurg. 2000;93(5):796-9.
27. Tseng JH, Tseng MY, Liu AJ, Lin WH, Hu HY, Hsiao SH. Risk factors for chronic subdural hematoma after a minor head injury in the elderly: a population-based study. Biomed Res Int. 2014;2014:218646.
28. Jung YG, Jung NY, Kim E. Independent predictors for recurrence of chronic subdural hematoma. J Korean Neurosurg Soc. 2015;57(4):266-70.

Received: 18/02/2015
Accepted for publication: 10/05/2015
Conflict of interest: none.
Source of funding: none.

Mailing address:
João Luiz Vitorino Araujo
E-mail: vitorinomed@yahoo.com.br

DOI: 10.1590/0100-69912015005004

Correlation between the oropharyngo-laryngoscopic findings and the severity of obstructive sleep apnea

Correlação entre os achados orofaringolaringoscópicos e a gravidade da síndrome da apneia obstrutiva do sono

Priscila Sequeira Dias[1]; Maria Helena de Araujo-Melo[1]; Denise Duprat Neves[2]; Lucas Neves de Andrade Lemes[3]; Manuela Salvador Mosciaro[1]; Sandro Bedoya[4]

A B S T R A C T

Objective: To correlate anatomical and functional changes of the oral cavity, pharynx and larynx to the severity of obstructive sleep apnea syndrome (OSAS). **Methods**: We conducted a cross-sectional study of 66 patients of both genders, aged between 21 and 59 years old with complaints of snoring and / or apnea. All underwent full clinical evaluation, including physical examination, nasolarybgoscopy and polisonography. We classified individuals into groups by the value of the apnea-hypopnea index (AHI), calculated measures of association and analyzed differences by the Kruskal-Wallis and chi-square tests. **Results**: all patients with obesity type 2 had OSAS. We found a relationship between the uvula projection during nasoendoscopy and OSAS (OR: 4.9; p-value: 0.008; CI: 1.25-22.9). In addition, there was a major strength of association between the circular shape of the pharynx and the presence of moderate or severe OSAS (OR: 9.4, p-value: 0.002), although the CI was wide (1.80-53.13). The septal deviation and lower turbinate hypertrophy were the most frequent nasal alterations, however unrelated to gravity. Nasal obstruction was four times more common in patients without daytime sleepiness. The other craniofacial anatomical changes were not predictors for the occurrence of OSAS. **Conclusion**: oral, pharyngeal and laryngeal disorders participate in the pathophysiology of OSAS. The completion of the endoscopic examination is of great value to the evaluation of these patients.

Key words: Sleep Apnea, Obstructive. Snoring. Endoscopy. Polysomnography. Anatomic Variation. Airway Obstruction.

INTRODUCTION

Obstructive sleep apnea (OSAS) has impacts on quality of life and is a risk factor for heart, metabolic, neurological and perioperative diseases [1]. It is characterized by recurrent episodes of partial (hypopnea) or complete (apnea) obstruction of the upper airways (UA) produced during sleep despite respiratory efforts [2].

The pathophysiology of OSAS is multifactorial, however evidence shows that UA muscle control is the result of a delicate balance between different forces of intraluminal pressure during inspiration, which leads to a negative transpharyngeal pressure gradient, and the extraluminal pressure forces derived from muscle contractions that contribute to opening of the pharynx. Factors such as vasomotor tone and mucosal adhesive forces seem to collaborate with UA narrowing or collapse[3]. This reduction or intermittent cessation of airflow would cause oxyhemoglobin desaturation and nocturnal awakenings, with the consequent excessive daytime sleepiness (EDS), fatigue and cognitive changes[4].

OSAS is a common disease worldwide, found in both developed and developing countries[5-7]. The prevalence of this disease in adult men is approximately twice the prevalence in adult women[6,8,9]. It is speculated that this difference between genders is due to hormones, to body fat distribution, to UA anatomy and function, to neural breathing control mechanisms[5,10] and possibly to factors related to clinical presentation, which is less evident in women. On the other hand, there is an increased prevalence in people aged over 50, especially in elderly [11].

Studies have observed increased body weight and neck circumference as OSAS predictors[12-14]. Some craniofacial abnormalities such as hypoplasia of the maxillary or mandibular bone would also have a role in the cause of OSAS [15]. The increase in nasal resistance, on its turn, also needs to be investigated, although the direct relation with increased apnea-hypopnea index (AHI) and

1. Serviço de Otorrinolaringologia do Hospital Universitário Gaffrée e Guinle, Universidade Federal do Estado do Rio de Janeiro (UNIRIO), RJ, Brasil; 2. Serviço de Pneumologia do Hospital Universitário Gaffrée e Guinle, Universidade Federal do Estado do Rio de Janeiro (UNIRIO), RJ, Brasil; 3. Serviço de Otorrinolaringologia do Hospital Universitário Pedro Ernesto, Universidade do Estado do Rio de Janeiro (UNIRIO), RJ, Brasil; 4. Instituto Nacional de Infectologia, Fundação Oswaldo Cruz (Fiocruz), RJ, Brasil.

snoring is unclear[16]. It has been demonstrated that consumption of alcohol, smoking and gastroesophageal reflux predispose to OSAS[17,18].

This study aims to identify larynx and pharynx anatomical and functional changes visible through endoscopy in patients with varying degrees of OSAS and correlate them with their gravity.

METHODS

We prospectively and sequentially studied 66 adult patients with sleep-related disorders referred for evaluation of possible OSAS at the Universidade Federal do Estado do Rio de Janeiro in 2013. The study was approved by the institution Ethics and Research Committee, Opinion number 37/2011, and obtained financial support from the Rio de Janeiro state government (FAPERJ). All participants signed a free and informed consent form (ICF).

Initially, each patient underwent a detailed interview and general physical examination, including anthropometric body measurements (height, weight and body mass index – BMI – calculation). Secondly, there were orofacial, nasopharyngoscopic and polysomnographic assessments.

We excluded subjects with alterations that could seriously impair breathing, such as oral cavity, nasal and laryngeal tumors, facial middle third malformations and individuals with BMI greater than or equal to 40 kg/m^2, since they represent a high-risk group for OSAS.

Reliability of measurements

The evaluations were conducted by two researchers trained before the study so as to standardize the measurement techniques used. In case of disagreement, a third examiner was consulted. The intra and interobserver agreement was evaluated for BMI, neck circumference and Mallampati classification on a test pilot of 16 patients. The Spearman correlation analysis was used to confirm intra and interobserver reliability.

Nasopharyngoscopy and orofacial assessments

Oropharyngoscopy evaluated the Mallampati classification for the relationship between the tongue and the oral cavity[9] and the Brodsky[10] classification for tonsils. Video Nasolaryngoscopy was carried out with a zero degree flexible endoscope, without topical anesthesia or turbinates vasoconstriction, with the patient awake, sitting up straight, with the torso and head naturally positioned and looking forward. In this position we performed the following measurements: A) cervical circumference: measured by reference to a horizontal line at the half of the thyroid cartilage; B) Modified Mallampati score: during oropharyngoscopy, with the tongue inside the mouth in a relaxed position, classified as: Grade 1 - when the tonsillar pillars, soft palate and the uvula are visible; Grade 2 - when the soft palate and the uvula are visible; Grade 3 - where the soft palate and uvula base are visible and Grade 4 - where the soft palate is not visible; C) Brodsky classification: during oropharyngoscopy, observing the tonsils size and the degree of obstruction exercised by them in the oropharynx, classified as: Level 1 - the tonsils occupy 25% of the space between the tonsillar pillars; Grade 2 - they occupy 25% to 50%; Grade 3 - the tonsils occupy 50% to 70% of the space between the tonsillar pillars; and Grade 4 - they occupy 75% or more; D) Tonsilar Projection - considered positive when their posterior portion partially or completely occluded the pharyngeal lumen at endoscopy; E) Pharynx format - through nasoendoscopy we classified the pharynx format as if the anteroposterior diameter was the same as the laterolateral one, and elliptical if otherwise; F) Reflux Signs: we considered as indirect signs of reflux: edema and / or hyperemia of the arytenoids, and / or hyperemia of the interarytenoid region, and the presence of redundant mucosa in the interarytenoid region; G) Glossoepiglottic Complex Projection (GEC): During nasoendoscopy, the rear projection of the base of the tongue and / or epiglottis causes partial or complete obstruction of the larynx view; H) Uvula Projection: during nasoendoscopy, the uvula is prominent toward the pharynx lumen, whether touching the posterior pharyngeal wall or not.

Scales and protocols used

We used the Epworth Sleepiness Scale (ESS) to assess excessive daytime sleepiness (EDS), considering positive a score higher than 10 points, and the Stanford scale for snoring, classifying it as absent, mild, moderate and severe.

Polysomnography (PSG)

We used Polysomnography methods, instrumentation and analysis according to the criteria and definitions published by the American Academy of Sleep Medicine[19], as well as the classification of the OSAS severity with the apneas and hypopneas index (AHI): AHI <5 (primary snoring), AHI 5 to 14.9 (mild OSAS), AHI 15 to 29.9 (moderate OSAS) and AHIe"30 (severe OSAS).

Statistical analysis

Our statistical strategy was to determine which anthropometric orofacial variables could be correlated with OSAS and thus determine some kind of risk. The clinical variables of interest were gender, age, body mass index, neck circumference and the Epworth sleepiness scale. Different cut-off points were used in order to find some association with AHI in patients with OSAS (AHI > 5, > 10, > 15, and > 30). We calculated the frequency of nominal variables and the central and dispersion measures of continuous variables for the presentation of sample characteristics and the variables studied. Differences were evaluated by the Kruskal-Wallis test, and proportions, by

the chi-square test, considering values significant when p <0.05. The odds ratio (OR) and its confidence interval of 95% (95% CI) were calculated to assess the association between binary variables.

RESULTS

The questionnaire response rate on the individual characteristics and habits (gender, smoking, alcohol consumption, age) during the first consultation was 100% (Table 1). Of the 66 participants, 39 (59.1%) were male and 27 (40.9%) female. The average age was 41.97 years (21 59; SD 10.7). Ninety-five percent of people defined themselves racially as brown. As for BMI, 81.8% of participants were overweight or obese. All participants with BMI corresponding to obesity type 2 (BMI between 35 and 39.9) had OSAS.

Although a significant proportion of patients were smokers and drank alcohol, we found no significant differences between these variables and the presence or absence of OSAS.

Table 2 shows the results of the association between oro-pharyngo-laryngeal anatomical changes and OSAS. The format of the pharynx (circular and elliptical) was not significantly associated with OSAS. However, when we compare the two extremes of gravity, low-grade (none or mild OSAS) with the high grade (moderate and severe OSAS), we found an important strength of association (OR 9.4; p-value 0.002), although with a wide IC (1.80-53.13). This distribution shows a proportional increment as the disease intensity increases (Figure 1). The uvula projection during nasoendoscopy examination was associated with the presence of OSAS (OR 4.9; p-value 0.008; CI 1.25-22.9). The other craniofacial anatomical changes were not predictors for the occurrence of OSAS.

DISCUSSION

The narrowing of the upper airways is an important contributing factor to the closure of the pharynx during sleep in OSA[20]. Patients with OSAS may have a spectrum of orofacial abnormalities, of both skeletal anatomy and soft tissues. These abnormalities can act synergistically and participate in the complex OSAS cause. We believe that soft tissue and skeletal features may display variability between ethnic groups and contribute to the prevalence and severity of OSAS. This question was raised long ago by our group, considering that since the nineteenth and twentieth centuries Brazilian culture has been directed to racial integration and miscegenation, a fact proven by studies of genetic markers that show that people of Brazil are, in their majority, racially mixed[21].

Table 1 - Habits and socio-demographic characteristics of individuals with and without OSAS.

Variable		Without OSAS (18 cases) n (%)	With OSAS (48 cases) n (%)	Total n (%)
Sex				
	Male	7 (38.9)	32 (66.7)	39 (59.1)
	Female	11 (61.1)	16 (33.3)	27 (40.9)
BMI				
	Up to 24.9	6 (33.3)	6 (12.5)	12 (18.2)
	25-29.9	7 (38.9)	20 (41.7)	27 (40.9)
	30-34.9	5 (27.8)	16 (33.3)	21 (31.8)
	35-39.9	-	6 (12.5)	6 (9.1)
Smoking				
	Smoker	2 (11.1)	4 (8.3)	6 (9.1)
	No-smoker	14 (77.8)	37 (77.1)	51 (77.3)
	Ex-smoker	2 (11.1)	7 (14.6)	9 (13.6)
Age				
	20-35	10 (55.6)	11 (22.9)	21 (31.8)
	36-50	6 (33.3)	20 (41.7)	26 (39.4)
	≥50	2 (11.1)	17 (35.4)	19 (28.8)
Alcoholism				
	Don't drink	5 (27.8)	22 (47.8)	27 (42.2)
	< 300g/day	13 (72.2)	19 (41.3)	32 (50.0)
	>300g/ day	-	5 (10.9)	5 (7.8)

Source: medical records of patients with sleep disorders, Hospital Universitário Gaffrée e Guinle, Universidade Federal do Estado do Rio de Janeiro (2013).

Table 2 - Association between anatomical changes and OSAS. Odds Ratio adjusted by logistic regression, p-value and confidence interval.

Variable	Without OSA (18 cases) (n/%)	SOAs (48 cases) (n/%)	OR	p-value	IC 95%
Pharynx					
Circular	3 (16,7)	13 (27,1)	1,85	0,379	0,41-11,5
Elliptical	15 (83,3)	35 (72,9)			
Tonsillar Projection					
Yes	2 (11,1)	9 (18,8)	1,84	0,45	0,32-19,26
No	16 (88,9)	39 (81,3)			
Projection Uvula					
Yes	4 (22,2)	28 (58,3)	**4,9**	**0,008**	**1,25-22,9**
No	14 (77,8)	20 (41,7)			
CGE Projection					
Yes	2 (11,1)	13 (27,1)	2,9	0,16	0,55-29,7
No	16 (88,9)	35 (72,9)			
Mallampati score *					
Altered (classes 2, 3 and 4)	15 (83,3)	43 (89,6)	1,72	0,48	0,23-10,05
Normal (class 1)	3 (16,7)	5 (10,4)			
Brodsky rating **					
Classes 2, 3 and 4	6 (33,3)	16 (33,3)	1,00	1,0	0,28- 3,87
Classes 0 and 1	12 (66,7)	32 (66,7)			

Source: medical records of patients with sleep disorders, Hospital Universitário Gaffrée e Guinle, Universidade Federal do Estado do Rio de Janeiro (2013).

Although we have not explored in detail other possible risk factors in addition to gender, BMI and age, our hypothesis is that with a simple routine endoscopy examination, checking anatomical alterations and measuring orofacial soft tissue changes, one could identify groups at higher risk for OSAS. It is logical to expect that in the future, to accomplish this, we need to prepare studies with larger samples and better define the groups to be studied, including control ones.

Among the anatomical parameters evaluated in this study, the pharyngeal circular shape was associated with more severe clinical forms of OSAS, possibly accounting for a worse progression. We also found an association between the posterior projection of the uvula and OSAS. This leads to believe that some orofacial anatomic changes can be related to the severity and prognosis of OSAS. We know that the physiological shape of the pharynx is elliptical, with a wider laterolateral diameter. With the evolution of the disease the pharynx initially assumes a circular shape and, in later stages, once again becomes elliptical, but with a wider anteroposterior diameter due to hypertrophy of the pharyngeal lateral muscles. Unfortunately, however, we can not say that it is a true causal association, nor consider it a spurious one, mainly due to the small number of participants and the cofactors that were not considered in the analysis. Still, it is the starting point toward our hypotheses and this simple result leads to consider the possibility of defining high-risk groups for OSAS. Although the evaluated nasal parameters were the goal of another work conducted by our group, we can say that, in our findings, the septal deviation and lower turbinate hypertrophy were the most frequent nasal alterations, however unrelated to gravity. Nasal obstruction was four times more common in patients without daytime sleepiness.

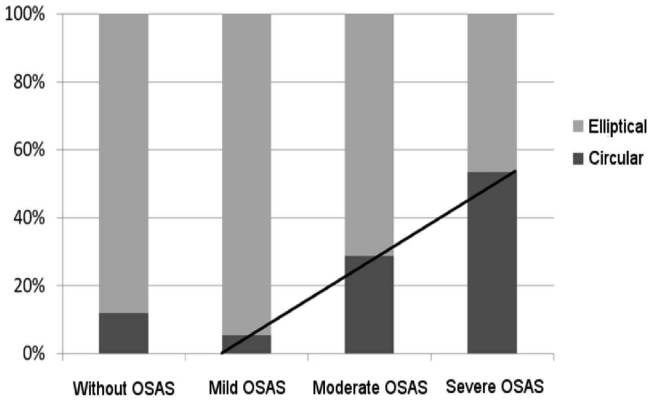

Figure 1 - *Distribution of the pharynx format (circular and elliptical) in patients with OSAS.*

We are aware of the limited scientific production when compared to studies in other countries, which hampers results comparisons. This is not proportionate to the impact of this condition. One study alarmingly showed that the prevalence of OSAS in São Paulo was around 30%[7]. Unfortunately, we did not find in the national literature more data on the prevalence of OSAS in other Brazil regions

to confirm these results. Some problems are related to the low amount of epidemiological studies on OSAS in Brazil, and perhaps the most important is the low supply of diagnostic services and specialized treatment, especially in the public system. Compared with data from foreign studies, Young *et al.*[8] found in the American population prevalence of OSAS is 4% in men and 2% in women.

Most people with OSAS seek medical attention mainly due to snoring and daytime sleepiness, but we know that this syndrome also causes other effects in the body. OSAS is one of the major causes of morbidity and mortality worldwide and is responsible for an important part for the loss of DALYs (Disability Adjusted Life-Years). The DALY is a health measure that extends the concept of potential years of life lost due to premature death to include equivalent years of "healthy living" in less healthy states of life, generally referred to as "disability"[19]. OSAS substantially increases health systems economic costs. People with OSAS often seek more health services than individuals without it because of its association with daytime sleepiness, poor concentration and neuropsychological dysfunction[22,23] and cardiovascular diseases (high blood pressure)[24], using more resources.

The behavior of OSAS in the different groups configures a challenge to be overcome. Being a multifactorial disease, we know that its prevalence suffer modifications depending on the population studied. It is known that the proportion of cases with OSAS is greater in men and postmenopausal women without hormone replacement therapy as compared with premenopausal women or postmenopausal women who take hormone replacement[11]. Similarly, this prevalence tends to increase in older and more obese people, and in individuals with greater neck circumference[14]. The great variability of anatomical features in populations and the participation of numerous risk factors acting synergistically in the pathophysiology of OSAS become an obstacle to obtain concrete and reliable data. Ancoli-Israel *et al.*[25] found a prevalence of OSAS in California of 24%, in a study population composed only of elderly, in contrast with the aforementioned 2-4% in the US general population[8]. On the other extreme, in studies in the pediatric population, this prevalence drops to 0.7-3% and is closely related to the presence of adenoid and tonsil hypertrophy[26]. With regard to ethnicity, Scharf .[27] showed that the prevalence and severity of OSAS in African and Asian populations are higher than in Caucasian ones.

All these discrepancies motivate the need to carry out studies detailed in terms of prevalence and associated risk factors, including analysis of anatomical features. We believe that the endoscopic examination is an important step in the evaluation of patients with OSAS that cannot be waived, which may be critical to defining OSAS risk groups.

R E S U M O

Objetivo: *correlacionar alterações anatômicas e funcionais de cavidade oral, faringe e laringe com a gravidade da síndrome da apneia obstrutiva do sono (SAOS).* ***Métodos:*** *estudo transversal com 66 pacientes de ambos os sexos, com idade entre 21 e 59 anos e queixas de roncos e/ou apneia. Todos passaram por avaliação clínica otorrinolaringológica completa incluindo exame físico, nasolaringofibroscopia epolissonografia noturna. Foram classificados em grupos pelo valor do índice de apneia-hipopneia (IAH), calculadas medidas de associação e analisadas diferenças pelo teste* Kruskal-Wallis *e do* c^2. ***Resultados:*** *todos os pacientes com obesidade tipo 2 avaliados eram portadores de SAOS. Foi observada relação entre a projeção de úvula durante o exame fibronasoendoscopico e a SAOS (OR:4,9; p-valor: 0.008; IC: 1.25-22.9). Além disso, notou-se uma importante força de associação entre o formato circular da faringe e a presença de SAOS moderado ou grave (OR: 9,4, p-valor: 0,002), embora o IC seja amplo (1.80-53.13).O desvio septal e a hipertrofia de concha inferior foram as alterações nasais mais frequentes, porém sem relação com a gravidade. A obstrução nasal foi quatro vezes mais comum nos pacientes sem sonolência diurna. As demais alterações anatômicas craniofaciais não se mostraram preditoras para a ocorrência de SAOS.* ***Conclusão:*** *concluímos que alterações orais, faríngeas e laríngeas participam da fisiopatologia da SAOS. A realização do exame endoscópico é de grande valia para a avaliação destes pacientes.*

Descritores*: Apneia do Sono Tipo Obstrutiva. Ronco. Endoscopia. Polissonografia. Variação Anatômica. Obstrução das Vias Respiratórias.*

REFERENCES

1. Park JG, Ramar K, Olson RJ. Updates on definition, consequences, and management of obstructive sleep apnea. Mayo Clin Proc. 2011;86(6):549-54; quiz 554-5.
2. Badr MS. Pathophysiology of upper airway obstruction during sleep. Clin Chest Med. 1998;19(1):21-32.
3. Haddad FL, Vidigal Tde A, Mello-Fujita L, Cintra FD, Gregório LC, Tufik S, et al. The influence of nasal abnormalities in adherence to continuous positive airway pressure device therapy in obstructive sleep apneia patients. Sleep Breath. 2013;17(4):1201-7.
4. Epstein LJ, Kristo D, Strollo PJ Jr, Friedman N, Malhotra A, Patil SP, et al. Clinical guideline for the evaluation, management and long-term care of obstructive sleep apnea in adults. J Clin Sleep Med. 2009;5(3):263-76.

5. Ip MS, Lam B, Tang LC, Lauder IJ, Ip TY, Lam WK. A community study of sleep-disordered breathing in middle-aged Chinese women in Hong Kong: prevalence and gender difference. Chest. 2004;125(1):127-34.
6. Udwadia ZF, Doshi AV, Lonkar SG, Singh CI. Prevalence of sleep-disordered breathing and sleep apnea in middle-aged urban Indian men. Am J Respir Crit Care Med. 2004;169(2):168-73.
7. Tufik S, Santos-Silva R, Taddei JA, Bittencourt LR. Obstructive sleep apnea syndrome in the São Paulo Epidemiologic Sleep Study. Sleep Med. 2010;11(5):441-6.
8. Young T, Palta M, Dempsey J, Skatrud J, Weber S, Badr S. The occurrence of sleep-disordered breathing among middle-aged adults. N Engl J Med. 1993;328(17):1230-5.
9. Kim J, In K, Kim J, You S, Kang K, Shim J, et al. Prevalence of sleep-disordered breathing in middle-aged Korean men and women. Am J Respir Crit Care Med. 2004;170(10):1108-13.
10. Young T, Hutton R, Finn L, Badr S, Palta M. The gender bias in sleep apnea diagnosis. Are women missed because they have different symptoms? Arch Intern Med. 1996;156(21):2445-51.
11. Bixler EO, Vgontzas AN, Ten Have T, Tyson K, Kales A. Effects of age on sleep apnea in men: I. Prevalence and severity. Am J Respir Crit Care Med. 1998;157(1):144-8.
12. Davies RJ, Ali NJ, Strading JR. Neck circumference and other clinical features in the diagnosis of the obstructive sleep apnea syndrome. Thorax. 1992;47(2):101-5.
13. Hoffstein V, Szalai JP. Preditive value of clinical features in diagnosing obstructive sleep apnea. Sleep. 1993;16(2):118-22.
14. Kushida CA, Efron B, Guilleminault C. A predictive morphometric model for the obstructive sleep apnea syndrome. Ann intern Med. 1997;127(8 Pt 1):581-7.
15. Tsai WH, Remmers JE, Brant R, Flemons WW, Davies J, Macarthur C. A decision rule for diagnosis testing in obstructive sleep apnea. Am J Respir Crit Care Med. 2003;167(10):1427-32.
16. Metes A, Cole P, Hoffstein V, Miljeteig H. Nasal airway dilation and obstructed breathing in sleep. Laryngoscope. 1992;102(9):1053-5.
17. Khoo SM, Tan WC, Ng TP, Ho CH. Risk factors associated with habitual snoring and sleep-disordered breathing in a multi-ethnic Asian population: a population-besed study. Respir Med. 2004;98(6):557-66.
18. Xiao YL, Liu FQ, Li J, Lv JT, Lin JK, Wen WP, et al. Gastroesophageal and laryngopharyngeal reflux profiles in patients with obstructive sleep apnea/hipopnea syndrome as determined by combined multichannel intraluminal impedance-pH monitoring. Neurogastroenterol Motil. 2012;24(6):e258-65.
19. Murray CJ. Quantifying the burden of disease: the technical basis for disability-adjusted life years. Bull World Health Organ. 1994;72(3):429-45.
20. Isono S, Remmers JE, Tanaka A, Sho Y, Sato J, Nishino T. Anatomy of pharynx in patients with obstructive sleep apnea and in normal subjects. J Appl Physiol. 1997;82(4):1319-26.
21. Santos RV, Maio MC. Race, genomics, identities and politics in contemporary Brazil. Crit Anthropol. 2004;24(4):347-78.
22. Engleman HM, Douglas NJ. Sleep. 4: Sleepiness, cognitive function, and quality of life in obstructive sleep apnoea/hypopnoea syndrome. Thorax. 2004;59(7):618-22.
23. Naëgelé B, Thouvard V, Pépin JL, Lévy P, Bonnet C, Perret JE, et al. Deficits of cognitive executive functions in patients with sleep apnea syndrome. Sleep. 1995;18(1):43-52.
24. Arzt M, Young T, Finn L, Skatrud JB, Bradley TD. Association of sleep-disordered breathing and the occurrence of stroke. Am J Respir Crit Care Med. 2005;172(11):1447-51.
25. Ancoli-Israel S, Kripke DF, Klauber MR, Mason WJ, Fell R, Kaplan O. Sleep-disordered breathing in community-dwelling elderly. Sleep. 1991;14(6):486-95.
26. Brunetti L, Rana S, Lospalluti ML, Pietrafesa A, Francavilla R, Fanelli M, et al. Prevalence of obstructive sleep apnea in a cohort of 1,207 children of southern Italy. Chest. 2001;120(6):1930-5.
27. Scharf SM, Seiden L, DeMore J, Carter-Pokras O. Racial differences in clinical presentation of patients with sleep-disordered breathing. Sleep Breath. 2004;8(4):173-83.

Received: 10/10/2014
Accepted for publication: 30/12/2014
Conflict of interest: none.
Source of funding: none.

Mailing address:
Priscilla Dias Sequeira
E-mail: prisdias@gmail.com

DOI: 10.1590/0100-69912015005005

Aplication of videothoracoscopy in trauma – experience of a service

Aplicação da videotoracoscopia no trauma – experiência de um serviço

Bruno Vaz de Melo, TCBC-RJ[1]; Felipe Guedes Siqueira[1] ; Thales Siqueira Di Tano[1]; Paulo Oliveira Silveira[1]; Mariama Barroso de Lima[1]

A B S T R A C T

Objective: To evaluate patients with chest trauma submitted to videothoracoscopy during hospitalization. In 2007, the Trauma Surgery Group was created in the General Surgery Department of the Hospital Municipal Lourenço Jorge of Rio de Janeiro-RJ, and started following all trauma victims who were admitted to the Hospital. **Methods**: We conducted a retrospective analysis of patients submitted to thoracoscopy from July 2007 to May 2015, based on a database started at the beginning of this period and on data collection from patients who underwent thoracoscopy. We evaluated the following parameters: procedure effectiveness, indication of the procedure, conversion rate, complications and mortality. We included patients who presented post-traumatic pleural collections, such as retained hemothorax and pleural empyema, and penetrating injury in the thoracoabdominal transition. All patients were hemodynamic stable and signed an informed consent. **Results:** In the analyzed period 53 patients were submitted to videothoracoscopy; 24 had penetrating trauma (45.3%) and 29, blunt (54.7%), with a predominance of males (75.5%). The procedure was performed in 26 cases of retained hemothorax (49%), 14 cases of empyema (26.5%) and in 13 patients for evaluation of injury in the thoracoabdominal transition (24.5%). The thoracoscopy was effective in resolution of 36 cases (80%), without need for further procedure. There was a conversion rate of 15.5% and 3 procedure complications related (6.6%). Mortality was nil. **Conclusion:** In this series, videothoracoscopy proved that this diagnostic and therapeutic procedure is safe and effective, if performed by a surgeon with appropriate training, especially when it is indicated in cases of retained hemothorax and evaluation of penetrating thoracoabdominal trauma.

Key words: Thoracoscopy. Thoracic Injuries. Thoracic Surgery, Video-Assisted. Hemothorax. Residual Volume.

INTRODUCTION

Thoracic trauma is present in approximately 30% of polytrauma patients. In most cases the injuries are treated conservatively or with simple procedures such as tube thoracostomy[1]. However, these cases are not exempted from complications and in some patients there is still need for additional procedures. The complications are related mainly to inadequate sterile techniques in emergency situations, incomplete evacuation of hemothorax, pain and displacement of chest tube[2].

Over the last decades videothoracoscopy has been used for selected cases in some trauma centers, especially in North America and Europe, with publications from other centers as well. The first articles appeared three decades ago. From this period to the present day thoracoscopy has been used in many clinical situations in trauma patients [3]. Videothoracoscopy is a potential resource for various situations in trauma patients. It has been used both in the acute phase and in complications, either for diagnosis or treatment of post traumatic pleural collections, such as empyema and retained hemothorax, bleeding control, especially when the source is the chest wall, intrathoracic foreign body assessment, evaluation of diaphragm injury, especially in penetrating trauma of the thoracoabdominal transition, pulmonary parechyma and pericardium injuries, and bronchopleural fistula[2,4,5].

The use of thoracoscopy in the acute phase is defended based on the possibility of diagnosing bleeding, pericardic and diaphragmatic injuries, which would not be detected if the trauma were treated with thoracostomy tube, and for the complete evacuation of the hemothorax, avoiding the most common complications[6]. Its early use may even reduce costs and radiation exposure, since it reduces observation time[7].

The approach by thoracoscopy of the thoracic trauma complications also has had promising results in the centers where it has been used.

In this article we evaluate the results of thoracoscopy for the evaluation of thoracoabdominal trauma and treatment of complications of chest trauma, especially pleural collections.

1. Serviço de Cirurgia Geral e do Trauma do Hospital Municipal Lourenço Jorge, Rio de Janeiro, RJ, Brasil.

METHODS

We conducted a retrospective analysis of cases in which thoracoscopy was used in victims of trauma. The study period was from July 2007 to May 2015. Data collection was performed on a database created at the beginning of the experiment and on assessment of patients' medical records. We assessed hospitalization time, complications, reoperations and death. All patients were followed on an outpatient basis after discharge; we recorded any sequelae and late complications. We considered the following variables: effectiveness of the method, indication of the procedure in our service, conversion rate to thoracotomy, complications and mortality associated with the procedure.

The inclusion criteria were: 1) patients sustaining penetrating thoracoabdominal injuries, who were hemodynamically stable, and previously submitted to thoracostomy with drainage in water seal, to assess the possibility of diaphragmatic injuries; 2) patients presenting with pleural complications of chest trauma: retained hemothorax, characterized by the presence of hemothorax and absence of lung expansion, over a period ranging from two days to four weeks, and patients with suspected pleural empyema or empyema unresolved by thoracostomy. All cases were documented with chest Computerized Tomography (CT).

All procedures were performed by the same surgical group. Most of them have experience in trauma surgery and laparoscopy, always trying to use the same technique, which was being standardized. Intubation was performed using a double-lumen endotracheal tube and positioning of the patient in the lateral position. In some situations, when for technical reasons selective intubation was not very effective, CO_2 was injected in the pleural cavity (similar to the pneumoperitoneum) with a low pressure, always monitored by the anesthesia staff. in general, we chose initially to put the first 10-mm trocar positioned at the previously made thoracostomy orifice and typically used two accessory trocars, preferably in the same intercostal space (anterior and posterior), the number of trocars being used as needed. We used only one monitor, which of course was positioned in the most ergonomic position for the surgeon and for a direct view. At the end of the procedure two chest tubes were positioned, one anteriorly and one posteriorly.

RESULTS

In this period, which was from July 2007 to May 2015, the Trauma Group followed 590 patients with thoracic trauma. We performed videothoracoscopy in 53 patients, all of them included in this analysis. Of this group, 42 patients were male (79%), with mean age of 27 years. Blunt trauma constituted 29 cases (54.7%), and penetrating, 24 (45.3%).

The time for the procedure was variable, ranging from two days to four weeks, with a median of five days.

Regarding indications, videothoracoscopy was performed in 13 patients with penetrating thoracoabdominal trauma (24.5%), 26 patients with retained hemothorax (49%) and 14 patients (26.4%) with pleural empyema .

In patients suffering from thoracoabdominal injuries subjected to thoracoscopy for evaluation of diaphragm integrity (n = 13) there was positive lesion diagnosis in 6 patients (42.8 %). In five cases, diaphragmatic suture was performed by laparoscopic surgery. In one case, due to technical reasons and to extensive damage (about 10 cm) a mini-thoracotomy was held to perform the diaphragm suture. Injuries to the diaphragm's costal portions are easier to view in our experience. In one patient we failed in properly evaluating the diaphragm (7%) due to the presence of strong lung adhesions.

In the cases of retained hemothorax (n = 26) there was resolution in 25 patients (96.1%). The one failure happened due to bleeding during the procedure, which led to conversion to thoracotomy. We observed a greater technical ease in patients for whom the same procedure was indicated earlier (< 5 days). The overall hospital stay after thoracoscopy averaged five days.

In cases with pleural empyema, the procedure was performed in 14 patients. Some of these cases were made later (transferred patients, patients returned to the hospital after discharge, ICU patients with multiple trauma in need of delaying intervention). In many cases the indication was delayed (four weeks for one patient). The worst results were obtained in this group, for which six conversions were necessary, mainly related to empyema in stage III with pulmonary incarceration and technical impossibility of safe thoracoscopy, leading to conversion in a number considered high (42.8%).

The procedure was effective in 86.7% (n = 53) of patients and the best results were obtained in patients in whom it was performed earlier (< 5 days) (Table 1).

The conversion rate was 13.2%, predominantly in cases of empyema and late indications. There were complications in three (5.6%) patients: one bleeding of lung parenchymal injury in the passage of the trocar, one postoperative broncho-pleural fistula and one iatrogenic injury to the diaphragm. (Table 2). Mortality was nil.

DISCUSSION

In most cases of chest trauma that require any intervention, thoracostomy with water seal drain is enough. But in cases where this does not happen, the procedures that are usually adopted are invasive and increase

Table 1 - Efficacy of thoracoscopy in trauma.

	Total	Resolution (%)
Retained Haemothorax	26	25 (96.1)
Empyema	14	8 (57.1)
Thoracoabdominal Injury	13	11 (84.6)
TOTAL	53	44 (83)

Source: General Surgery and Trauma of Hospital Municipal Lourenço Jorge (07 / 2007-05 / 2015).

significantly the length of hospital stay and treatment costs. In the literature these cases can reach 20%[1,8]. Videothoracoscopy has been used as an option in this scenario, proving to be applicable both as a diagnostic and as a therapeutic approach[4], as in most cases in our series. Although little used by surgeons in trauma, in our reality it is a procedure that, with proper training, can be widely used, presenting no great implementation complexity.

The cases of retained hemothorax appear as a great indication of videothoracoscopy. Our series, despite being small, reaffirms what has already been shown by the medical literature in the last decades. In most cases there is resolution, reduced hospital stay and consequently lower treatment costs. The early approach, in the first 3-7 days, provides better results according to a study on the subject[9], although some authors indicate the fifth day of evolution as the cutoff point to significant worsening of results[8]. In the cases reviewed in our service there were similar results. The extended period of evolution leads to loculation of collections and lung entrapment, bringing additional technical difficulty to the procedure and reducing its effectiveness. The thoracoscopy for thoracic trauma with retained hemothorax displays 10% of failure in published works[2].

In penetrating injuries of the thoracoabdominal transition, the diaphragm evaluation is difficult when using non-invasive methods, chest X-ray and CT, and other described methods do not have acceptable accuracy, sometimes reaching levels below 50%[6]. Early diagnosis of diaphragmatic injuries is an important prognostic factor. Thoracoscopy allows accurate diagnosis of such lesions when properly performed and also allows the correction to be carried out without additional intervention. Martinez *et al*. presented a case series of 52 patients with penetrating thoracoabdominal trauma, with diaphragm injuries diagnosis in 67.3%[10]. Divisi *et al*. point at lesions larger than 3 cm as the single therapeutic limit[6]. Despite the lower incidence of diaphragmatic injury in our study, there was success in repair by thoracoscopy in most diagnosed cases, the lesion size being the limiting factor found. We believe that thoracoscopy is a safe and effective method for the diagnosis and treatment of lesions of the diaphragm.

The empyema is a complication mostly associated with retained hemothorax. Karmy-Jones *et al.* showed a higher incidence of empyema in patients undergoing thoracostomy with retained hemothorax over those without hemothorax[2]. Other factors associated with the development of empyema are inadequate aseptic technique in emergency situations and lung infections associated with hospital stay[1,2]. The most commonly identified agent was *Staphylococcus aureus*. The treatment of pleural empyema consists in evacuating the chest secretion and decortication in some cases[11]. Thoracoscopy in these cases shows bad results. Despite being a minimally invasive technique, less traumatic than thoracotomy, it has high failure and conversion rates, especially when performed in later stages. However, thoracoscopy was superior than the treatment with thoracic drainage associated with antibiotics; therefore, it is a valid surgical option before considering thoracotomy[9]. Our experience, although small, has results similar to the literature, with high conversion rates, especially when the indication is late. In the early stages, we had good results and the procedure was technically simpler. Patients with empyema at later stages seem to be a group with higher chances of failure. Early indications for the procedure, as demonstrated in several series of literature and in ours, is an important factor for treatment success of and for the best results obtained with this technique.

We conclude, despite the small number of this series, that thoracoscopy is a feasible procedure with multiple indications and applications in trauma patients, and in our series there was a low rate of complications and no mortality.

Table 2 - Conversion rate to thoracotomy.

	N	Conversions (%)	Conversion rate (%)
Retained Haemothorax	26	1 (3.9)	1 (3.9)
Empyema	14	6 (42.8)	2 (14.2)
Thoracoabdominal INJURY	13	1 (7.6)	1 (7.6)
TOTAL	53	8 (15)	4 (7.5)

Source: General Surgery and Trauma of Hospital Municipal Lourenço Jorge (07 / 2007-05 / 2015).

RESUMO

Objetivo: *avaliar os resultados obtidos com o emprego da videotoracoscopia na avaliação dos traumas toracoabdominais e no tratamento das complicações do trauma torácico.* ***Métodos:*** *análise retrospectiva dos pacientes submetidos à videotoracoscopia no período de julho de 2007 a maio de 2015, com base em banco de dados criado no início deste período e na coleta dos dados dos pacientes submetidos à videotoracoscopia. Foram avaliados: a eficácia e as indicações do procedimento, a taxa de conversão, as complicações e mortalidade. Foram incluídos os pacientes que apresentavam coleções pleurais pós-traumáticas, como hemotórax retido e empiema pleural, e lesões penetrantes na transição toracoabdominal. Todos os pacientes submetidos apresentavam estabilidade hemodinâmica e consentimento informado do procedimento.* ***Resultados:*** *no período analisado, 53 pacientes foram submetidos à toracoscopia, dentre estes, 24 traumas penetrantes (45,3%) e 29 contusos (54,7%) com predominância do sexo masculino (75,5%). O procedimento foi realizado em 26 casos de hemotórax retido (49%), 14 empiemas (26,5%) e em 13 pacientes para avaliação de lesões da transição toracoabdominal (24,5%). A toracoscopia foi eficaz na resolução de 36 casos (80%) sem necessidade de novo procedimento. Houve uma a taxa de conversão de 15,5% e três complicações relacionadas ao procedimento (6,6%). A mortalidade foi nula.* ***Conclusão:*** *apesar da série ainda ser pequena, a videotoracoscopia é um procedimento factível, com várias indicações e aplicações em pacientes traumatizados e, na nossa série, a mortalidade foi nula e a incidência de complicações, pequena.*

Descritores: *Toracoscopia. Traumatismos Torácicos. Cirurgia Torácica Videoassistida. Hemotórax. Volume Residual.*

REFERENCES

1. Smith JW, Franklin GA, Harbrecht BG, Richardson JD. Early VATS for blunt chest trauma: a management technique underutilized by acute care surgeons. J Trauma. 2011;71(1):102-5; discussion 105-7.
2. Karmy-Jones R, Holevar M, Sullivan RJ, Fleisig A, Jurkovich GJ. Residual hemothorax after chest tube placement correlates with increased risk of empyema following traumatic injury. Can Respir J. 2008;15(5):255-8.
3. Dorgan Neto V, Saad Júnior R, Rasslan S. Videotoracoscopia no trauma de tórax. Rev Col Bras Cir. 2001;28(1):3-8.
4. Schermer CR, Matteson BD, Demarest GB 3rd, Albrecht RM, Davis VH. A prospective evaluation of video-assisted thoracic surgery for persistent air leak due to trauma. Am J Surg. 1999;177(6):480-4.
5. Rasslan S, Rodrigues FCM, Soldá SC, Saad Júnior R. Corpo estranho intratorácico tratado por videocirurgia. Rev Col Bras Cir. 1994;21(1):42-4.
6. Divisi D, Battaglia C, De Berardis B, Vaccarili M, Di Francescantonio W, Salvemini S, et al. Video-assisted thoracoscopy in thoracic injury: early or delayed indication? Acta Biomed. 2004;75(3):158-63.
7. Ahmed N, Chung R. Role of early thoracoscopy for management of penetrating wounds of the chest. Am Surg. 2010;76(11):1236-9.
8. Morales Uribe CH, Villegas Lanau MI, Petro Sanchez RD. Best timing for thoracoscopic evacuation of retained post-traumatic hemothorax. Surg Endosc. 2008;22(1):91-5.
9. Mowery NT, Gunter OL, Collier BR, Diaz JJ Jr, Haut E, Hildreth A, et al. Practice management guidelines for management of hemothorax and occult pneumothorax. J Trauma. 2011;70(2):510-8.
10. Martinez M, Briz JE, Carillo EH. Video thoracoscopy expedites the diagnosis and treatment of penetrating diaphragmatic injuries. Surg Endosc. 2001;15(1):28-32; discussion 33.
11. Aguilar MM, Battistella FD, Owings JT, Su T. Posttraumatic empyema. Risk factor analysis. Arch Surg. 1997;132(6):647-50; discussion 650-1.

Received: 08/12/2014
Accepted for publication: 25/02/2015
Conflict of interest: none.
Source of funding: none.

Mailing address:
Felipe Guedes Siqueira
E-mail: felipeguedess87@gmail.com

DOI: 10.1590/0100-69912015005006 Original Article

Esophagectomy with gastroplasty in advanced megaesophagus: late results of omeprazole use

Esofagectomia com gastroplastia no megaesôfago avançado: análise tardia da importância do uso do omeprazol

Celso de Castro Pochini, TCBC-SP[1]; Danilo Gagliardi,TCBC-SP[1]; Roberto Saad Júnior, TCBC-SP[1]; Ruy França de Almeida, TCBC-SP[1]; Paulo Roberto Corsi, TCBC-SP[1]

A B S T R A C T

Objective: To analyze the late results of advanced Chagasic megaesophagus treatment by esophagectomy associated with the use of proton pump inhibitor (omeprazole) as for the incidence of esophagitis and Barrett's esophagus in the remaining stump. **Methods**: We studied patients with advanced megaesophagus undergoing esophagectomy and transmediastinal esophagogastroplasty. Patients were divided into three groups: A (20) with esophageal replacement by full stomach, without the use of omeprazole; B (20) with esophageal replacement by full stomach, with omeprazole 40 mg/day introduced after the first postoperative endoscopy and maintained for six years; and C (30) with esophageal replacement by gastric tube with use of omeprazole. Dysphagia, weight loss and BMI were clinical parameters we analyzed. Upper gastrointestinal endoscopy was performed in all patients, and determined the height of the anastomosis, the aspect of the mucosa, with special attention to possible injuries arising from gastroesophageal reflux, and the patency of the esophagogastric anastomosis. **Results**: We studied 50 patients, 28 males (56%) and 22 (44%) females. All underwent endoscopy every year. In the first endoscopy, erosive esophagitis was present in nine patients (18%) and Barrett's esophagus, in four (8%); in the last endoscopy, erosive esophagitis was present in five patients (8%) and Barrett's esophagus in one (2%). When comparing groups B and C, there was no evidence that the manufacturing of a gastric tube reduced esophagitis and Barrett's esophagus. However, when comparing groups A and C, omeprazole use was correlated with reduction of reflux complications such as esophagitis and Barrett's esophagus ($p < 0.005$). **Conclusion**: The use of omeprazole (40 mg/day) reduced the onset of erosive esophagitis and Barrett's esophagus during the late postoperative period.

Key words: Chagas Disease. Esophagitis. Barrett Esophagus. Esophagectomy. Omeprazole.

INTRODUCTION

The esophagus is the organ most commonly affected by Chagas disease in the digestive tract. The resulting condition is the megaesophagus, characterized by dilation and lengthening of the organ body, progressive, functional dysphagia, the pathological substrate being the damage to the intermuscular plexus by the *Trypanosoma cruzi*[1,2].

Chagas is one of the most common parasitic diseases in Latin America, with a commitment of 670,000 lives / year and annual cost of morbidity and death estimated at more than eight billion dollars in 2000. Chagas disease affects eight million people in America Latin[3,4]. The first proposal for the surgical treatment of achalasia was made by Gottstein, which indicated cardiomyotomy[5]. However, it was Heller who consecrated the procedure, with section of the muscles in the anterior and posterior aspects of the esophagus[6]. Later, others came to perform it only in the anterior asppect[7]. However, achalasia in its most advanced stage (grade IV), requires a larger surgical procedure, the treatment of choice being the removal of the diseased organ, ie, esophagectomy [8-11].

In Brazil, around 1960, Câmara Lopes and Ferreira Santos successfully performed the first subtotal esophagectomy by right thoracotomy, followed by gastroplasty in two and one times, respectively[12,13].

From the 1970s on, the cervico-abdomino-mediastinal route gained preference in the treatment of Chagas megaesophagus. Eugenio Ferreira et al. spread the technique in our country, 28 patients underwent subtotal esophagectomy through esophagus extraction[14]. Subsequently, Pinotti et al. advocated section of the diaphragm from the hiatal ring to the xiphoid process, providing more security and improving the procedure results[15-18].

1. Departamento de Cirurgia da Faculdade de Ciências Médicas da Santa Casa de São Paulo, SP, Brasil.

Aquino *et al.* caused surprised by performing esophagectomy through esophageal mucosal resection (removal only of the mucosal cylinder), with low complications rate[19-21].

Although not appreciated by many surgeons, Rocha *et al.*, following 48 patients undergoing esophagectomy and gastroplasty with cervical anastomosis, found severe chronic gastritis, as well as the presence of a "bile lake" in the gastric antrum, with endoscopic appearance similar to alkaline reflux gastritis[22]. Four years later, studying 48 patients who underwent subtotal esophagectomy with esophagogastroplasty, they found Barrett's esophagus in four patients, the latest one at 18 months after the operation[23].

The reflux of gastric juice and bile fluid are important factors in the genesis of Barrett's esophagus, there being a direct correlation between the metaplastic segment and the time the esophagus is exposed to pH < 4[24].

Rocha *et al.* Studied 101 patients who underwent transmediastinal esophagectomy with gastroplasty, having found 70% erosive esophagitis and 57% columnar epithelialization, besides two cases of cancer in the remaining esophageal stump[25].

Oberg proved that despite truncal vagotomy, there was no long-term suppression of acid reflux. Corroborating this statement, Rocha et al. described erosive esophagitis and Barrett's esophagus in patients undergoing esophagectomy with gastroplasty. They suggested that long-term treatment with proton pump inhibitor could avoid such complications[26].

Prophylactic treatment done with the restoration of transit through a gastric tube with proton pump inhibitor (PPI) and annual endoscopic follow-up has been the guidance of experts to reduce reflux complications[26-28].

This research aims to analyze the late results of advanced Chagasic megaesophagus treatment by esophagectomy associated with PPIs (omeprazole), targeted at the incidences of esophagitis and Barrett's esophagus in the remaining stump.

METHODS

We studied 50 patients with megaesophagus treated at the clinic of the Esophagus Group of the Departamento de Cirurgia da Faculdade de Ciências Médicas da Santa Casa de São Paulo, in the period from April 26, 1990 to January 08, 2011. They were 22 (44%) women and 28 (56%) men. The age ranged from 24 to 79 years, the average being 49.

The diagnosis was made clinically, by serological test for Chagas disease, by radiological examinations and by esophageal eletromanometry. Barium swallow was performed with Philips-Challenge N 800 HF apparatus after the ingestion of 100 ml of barium sulphate diluted in 200ml of water at three positions 180 cm distant from the bulb with films at ten seconds, five minutes and 30 minutes. The eletromanometry was made with a six channel computerized polygraph (Synectics – Sweden), EMC-R catheter under pneumo-hydraulic capillary infusion, with flow of 0.6 ml/min/channel. Patients with impaired esophageal body contraction were characterized as having megaesophagus.

Patients underwent Machado-Guerreiro complement fixation test and indirect hemagglutination or immunoenzymatic reaction (ELISA) for the confirmation of Chagas disease[29-31].

We included patients with achalasia with organ dilation largest than 10cm (grade IV) at the esophagus radiological contrast examination; patients with achalasia with electromanometry revealing absence of lower esophageal sphincter relaxation and synchronous contractions of low amplitude of the esophageal body (< 15 mmHg).

We have carried out two types of operations: resection of the esophagus by esophageal extraction and resection by trans-hiatal dissection. The restoration of the transit was made with the full stomach in 20 patients and with a gastric tube of greater curvature in 30 patients (Figures 1 and 2). The cervical esophagogastric anastomosis was manual, by left lateral cervicotomy positioned at the level of the sternal notch, about 15 cm from the upper dental arch or 4 cm from the cricopharyngeal muscle (pharyngo-esophageal transition). Truncal vagotomy and pyloroplasty were performed in all patients.

Dysphagia, weight loss and body mass index were clinical parameters analyzed. Upper gastrointestinal endoscopy was performed in all patients. We determined the height of the anastomosis, the aspect of the mucosa, with special attention to possible injuries arising from

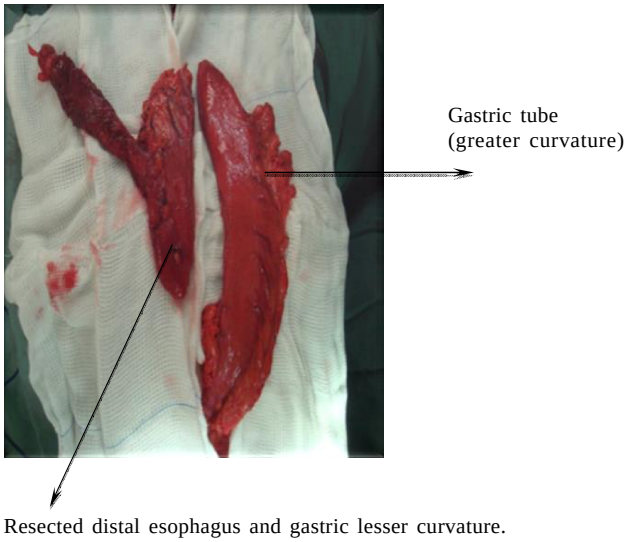

Figure 1 - *Gastric tube with resection of lesser curvature.*

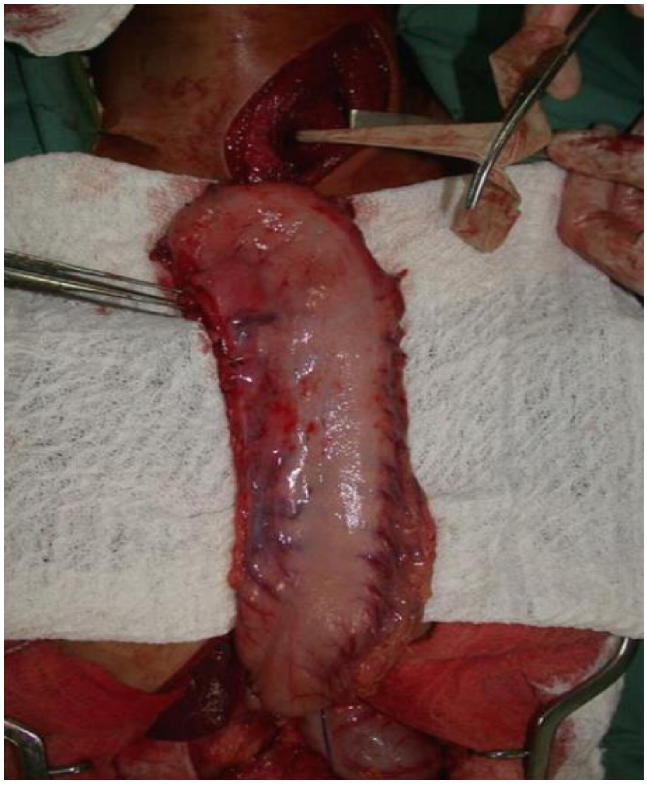

Figure 2 - *Reconstitution of transit post-esophagectomy. Total stomach.*

gastroesophageal reflux, and the patency of the esophagogastric anastomosis.

We harvested three fragments from the esophagus and three from the stomach two cm above and two below the anastomosis, after prior staining with methylene blue. The fragments were fixed in 3.7% formalin and stained with hematoxylin-eosin for subsequent histological analysis.

The use of proton pump inhibitor was done at a dose of 40 mg/day for all patients undergoing esophagectomy operated from 2006 on. Since 2006, the transit reconstitution of all patients comprised an enlarged proximal gastrectomy (gastric tube). Three groups were formed: Group A - Operated from 1990 to 2006 with full stomach esophageal replacement, without the use of omeprazole during this period, and the first postoperative endoscopy performed in 2006; Group B - operated from 1990 to 2006 with esophageal replacement through full stomach, without the use of omeprazole during that period, and after the first postoperative endoscopy in 2006, intiaintg omeprazole use, which lasted six years until 2011; Group C - operated between 2006 and 2011 with esophageal replacement with gastric tube (enlarged proximal gastrectomy), with use of omeprazole during this period, and the first endoscopy performed in 2006.

For the descriptive analysis, we used position measurements for continuous variables and frequency for categorical variables. For comparison groups and times of endoscopy results we used the GEE model (Generalized Estimating Equation Model). To compare weight loss between groups we used analysis of variance (ANOVA). To compare dysphagia and heartburn between groups we used the Chi-square test and, when necessary, the Fisher's exact test. We deemed significant a p value ≤ 0.05.

RESULTS

We found no patient with severe dysphagia; 13 (26%) patients had dysphagia (mild), of whom 92% had no aspiration or weight loss. As for the remaining 37 (74%), they did not have such complaint after esophagectomy.

The records of the current weight and height allow us to state that 39 (78%) patients were healthy (normal weight). As for the other 11: 16% were overweight and 6% were malnourished after esophagectomy. Ten patients (21%) had heartburn after the surgical procedure.

The first endoscopy was performed in 2006 and the last in 2011. In the first endoscopy erosive esophagitis was present in nine (18%) patients and Barrett's esophagus in four (8%); during the last endoscopy we observed erosive esophagitis in four (8%) patients and Barrett's esophagus in one (2%) (Table 1).

There was a statistically significant difference ($p = 0.002$) between groups A and C in relation to the results of digestive endoscopy (Table 2). There was no statistically significant difference ($p = 0.416$) between groups B and C regarding the outcome of digestive endoscopy (Table 3).

DISCUSSION

Considering our findings regarding the clinical aspects – dysphagia, heartburn, aspiration, weight loss and nutritional status –, we can say that esophagectomy in advanced megaesophagus provides good quality of life in

Table 1 - Distribution of patients according to treatment with PPI after esophagectomy.

Total Group	50 patients	
	N	%
Endoscopy (First)-2006		
Absent	37	74
Erosive Esophagitis	9	18
Barrett	4	8
Endoscopy (Last)-2011		
Absent	45	90
Erosive Esophagitis	4	8
Barrett	1	2

Source: Santa Casa de Misericórdia de São Paulo (1990 to 2011).

Table 2 - Distribution of Endoscopies' results (First and Last) after esophagectomy for groups A and C.

Group	A	C	*p*
Endoscopy (First)			
Absent	10	27	0.002
Erosive Esophagitis	6	3	
Barrett	4	0	
Endoscopy (Last)			
Absent	10	29	
Erosive Esophagitis	6	1	
Barrett	4	0	

Source: Santa Casa de Misericórdia de São Paulo (1990 to 2011).

Table 3 - Distribution of Endoscopies' results (First and Last) after esophagectomy for groups B and C.

Group	B	C	*p*
Endoscopy (First)			
Absent	16	27	0.416
Erosive Esophagitis	3	3	
Barrett	1	0	
Endoscopy (Last)			
Absent	16	29	0.143
Erosive Esophagitis	3	1	
Barrett	1	0	

Source: Santa Casa de Misericórdia de São Paulo (1990 to 2011).

the short and medium term, especially as for the nutritional aspect[11,20,21,28,32].

It is worth remembering that 80% of patients were asymptomatic and did not complain of heartburn. In the long-term monitoring, the presence of erosive esophagitis and Barrett's esophagus brought reflections.

It was believed that truncal vagotomy associated to pyloroplasty and the use of the entire stomach in the transit reconstitution was sufficient to reduce gastric acidity, minimizing reflux. Considering that in these patients, basal and stimulated acid secretion is lower than that found in normal subjects, and the right colon may be affected by the disease, reconstitution with the stomach initially appeared to be a great option. However, the follow-up of patients submitted to esophagectomy with this type of reconstitution and without the use of proton pump inhibitor (PPI) may show disastrous complications, such as Barrett's esophagus and esophageal stump cancer[25,33-35].

From the first year after surgery, the pepsinogen levels and acid secretion, both at baseline and under stimulus, increase despite truncal vagotomy and pyloroplasty. As a consequence, there has been found up to 20% esophagitis in the cervical esophageal stump during the first year after surgery, and approximately 70% in the seventh year, and the presence of Barrett's esophagus in the cervical stump in up to 27.7% of cases, which is more serious[26,34]. Of course, the destruction of reflux containment mechanisms (loss of inferior esophageal sphincter mechanism, cardia and pylorus), promote mixed reflux (acid and bile), extremely harmful to the esophageal mucosa[36,37].

In an attempt to reduce acid reflux, an option has been made for the resection of the lesser curvature of the stomach, reducing the population of acid-producing parietal cells, and manufacturing of a gastric tube[25,28]. Results have not improved, though.

When more specifically considering complications arising from the duodenogastric reflux (esophagitis and Barrett's esophagus), we found no statistically significant correlation ($p = 0.143$) between groups B and C. We remember that both received PPIs (omeprazole) at the same dosage, but differed in that Group B had the reconstitution with full stomach and Group C had the gastric tube. Thus, we cannot say with certainty that the enlarged proximal gastrectomy contributed to the reduction of esophagitis and Barrett in our patients. Other authors also found the occurrence of esophagitis and Barrett's esophagus in the esophageal stump of patients with gastric tube, since its vertical position is maintained, facilitating rapid gastric emptying, as well as duodenogastric reflux[34,35,38,39].

We conducted esophagectomy with enlarged proximal gastrectomy (gastric tube) and yearly endoscopy, as experts recommend. We noted that Group A, which was devoid of PPI, showed a greater number of complications due to acid and bile reflux[25,27,28,40]. In addition, our statistical calculations emphasize the use of omeprazole (Group C) as the most significant independent variable correlated with reduced complications of mixed reflux (erosive esophagitis and Barrett's esophagus – Group A) in the univariate analysis, showing a statistically significant difference (Table 2).

We understand that the use of PPIs in continuous monitoring of patients submitted to esophagectomy is essential, and that a dosage of 40 mg/day can reduce the appearance of erosive esophagitis and Barrett in the remaining stump.

We stress the utmost importance of the clinical follow-up and annual endoscopic exam of patients undergoing esophagogastroplasty, combined with the continued use of proton pump inhibitors, beginning in the early postoperative period in an attempt to decrease tumor development in the remaining esophageal stump[26,33,35,40-43].

The results obtained in this study, with 50 Chagas megaesophagus patients, support the conclusion that the use of omeprazole (40 mg/day) reduced the onset of erosive esophagitis and Barrett's esophagus during the late postoperative period.

RESUMO

***Objetivo**: analisar os resultados tardios do tratamento do megaesôfago chagásico avançado através da esofagectomia associada ao IBP (omeprazol), com vistas à incidência de esofagite e esôfago de Barrett do coto esofagiano remanescente. **Métodos**: foram estudados pacientes com megaesôfago avançado submetidos à esofagectomia e à esofagogastroplastia transmediastinal posterior. Os pacientes foram distribuídos em três grupos: A (20) com substituição esofagiana por meio do estômago total, sem o uso do omeprazol; B (20) com substituição esofagiana por meio do estômago total, sem o uso do omeprazol durante este período; após a primeira endoscopia, realizada no pós-operatório, foi introduzido IBP (omeprazol 40mg/dia) e mantido por seis anos; e C (30) com substituição esofagiana por meio do tubo gástrico com uso do omeprazol. A disfagia, a perda ponderal e o IMC foram os parâmetros clínicos analisados. A endoscopia digestiva alta foi realizada em todos os pacientes. Foi determinada a altura da anastomose, a aparência do aspecto da mucosa, com especial atenção para possíveis lesões oriundas de refluxo gastresofágico, a patência da anastomose esofagogástrica. **Resultados**: na primeira endoscopia, a esofagite erosiva esteve presente em nove pacientes (18%) e o esôfago Barrett, em quatro (8%); na última endoscopia, a esofagite erosiva esteve presente em quatro pacientes (8%) e o esôfago de Barrett em um (2%). Comparando-se os grupos B e C, não houve redução da esofagite e do esôfago de Barrett. Porém, comparando-se os grupos A e C, houve redução de complicações do refluxo, como esofagite e o esôfago de Barrett ($p<0,005$). **Conclusão**: os resultados obtidos permitem concluir que o uso de omeprazol (40mg/dia) reduziu o aparecimento de esofagite erosiva e esôfago de Barrett no decorrer do pós-operatório tardio.*

***Descritores:** Doença de Chagas. Esofagite. Esôfago de Barrett. Esofagectomia. Omeprazol.*

REFERENCES

1. Köberle F. Chagas' disease and Chagas' syndromes: the pathology of American trypanosomiasis. Adv Parasitol. 1968;6:63-116.
2. Coura JR, Borges-Pereira J. Chagas disease: 100 years after its discovery. Acta Trop. 2010;115(1-2):5-13.
3. Rassi A Jr, Rassi A, Marin-Neto JA. Chagas disease. Lancet. 2010;375(9723):1388-402.
4. Lescure FX, Le Loup G, Freilij H, Develoux M, Paris L, Brutus L, et al. Chagas disease: changes in knowledge and management. Lancet. 2010;10(8):556-70.
5. Gottstein G Technik und Klinik der Oesophagoskopie. Mitt Grenzgeb Med Chir. 1901;8:57-152.
6. Heller E. Extramuköse cardioplastik beim chronischen cardiospasmus mit dilatation des oesophagus, Mitt Grenzgeb Med Chir. 1914;27:141-9.
7. Ellenbogen G. Megaesôfago não avançado. Tratamento pela cardiomiotomia associada à esofagogastrofundopexia. Avaliação clínica, morfológica e funcional dos seus resultados [tese]. São Paulo: Universidade de São Paulo, Faculdade de Medicina; 1979.
8. Orringer MB, Marshall B, Chang AC, Lee J, Pickens A, Lau CL. Two thousand transhiatal esophagectomies: changing trends, lessons learned. Ann Surg. 2007;246(3):363-72; discussion 372-4.
9. Crema E, Cruvinel LAF, Werneck AM, Oliveira RM, Silva AA. Correlação manométrico-radiológica e sua importância no tratamento cirúrgico do megaesôfago chagásico. Rev Soc Bras Med Trop. 2003;36(6):665-9.
10. Herbella FA, Aquino JL, Stefani-Nakano S, Artifon EL, Sakai P, Crema E, et al. Treatment of achalasia: lessons learned with Chagas' disease. Dis Esophagus. 2008;21(5):461-7.
11. Orringer MB. Marshall B, Iannettoni MD. Tranhiatal esophagectomy: clinical experience and refinements. Ann Surg. 1999;230(3):392-400; discussion 400-3.
12. Câmara-Lopes LH. Transposição retroesternal do estômago para anastomose esôfago-gástrica cervical, após esofagectomia subtotal [nota prévia]. Centro Médico de Ribeirão Preto; 1955.
13. Ferreira-Santos R. Tratamento cirúrgico da aperistalse esofágica (megaesôfago) [dissertação]. Ribeirão Preto: Universidade de São Paulo, Faculdade de Medicina de Ribeirão Preto; 1965.
14. Ferreira EAB, Paula RA, Branco PD, Raia AA. Esophagectomy followed by esofagogastroplasty through the posterior mediastinum without toracotomy. Chir Gastroent. 1976;10:347-50.
15. Pinotti HW. Novas perspectives da execução de esofagectomias evitando as toracotomias. Arq Gastroenterol. 1977;14(2):93-8.
16. Pinotti HW, Zilberstein B, Pollara W, Raia A. Esophagectomy without thoracotomy. Surg Gynecol Obstet. 1981;152(3):344-6.
17. Pinotti HW, Cecconello I, da Rocha JM, Zilberstein B. Resection for achalasia of the esophagus. Hepatogastroenterol. 1991;38(6):470-3.
18. Pinotti HW, Habr-Gama A, Cecconello I, Felix VN, Zilberstein B. The surgical treatment of megaesophagus and megacolon. Dig Dis. 1993;11(4-5):206-15.
19. Aquino JLB. Tratamento do megaeôfago pela mucosectomia com conservação da túnica muscular esofágica por via cervicoabdominal [tese]. Campinas: Universidade de Campinas, Faculdade de Ciências Médicas; 1996.
20. Aquino JLB, Reis Neto JA, Muraro CLPM, Camargo JGT. Mucosectomia esofágica no tratamento do megaesôfago avançado: análise de 60 casos. Rev Col Bras Cir. 2000;27(2):107-13.
21. Aquino JLB, Tarufi MJ, Martins RE, Castilho MV. Avaliação tardia da mucosectomia esofágica: análise de 42 pacientes com megaesôfago avançado. Rev Col Bras Cir. 2005;32(Supl):77.
22. Rocha JM, Cecconello I, Ishioka S, Zilberstein B, Gama-Rodrigues JJ, Pinotti HW. Gastrite de refluxo alcalino em gastroplastia. ABCD Arq Bras Cir Dig. 1987;2(2):64-7.
23. Rocha JRM, Cecconello I, Zilberstein B, Sallum RAA, Saika P, Ishioka S, et al. Esôfago de Barrett no coto esofagiano após esofagectomia subtotal com esofagogastroplastia cervical. Rev Hosp Clin Fac Med Univ São Paulo. 1992;47(2):69-70.
24. Oberg S, Johansson J, Wenner J, Walther B. Metaplastic columnar mucosa in the cervical esophagus after esophagectomy. Ann Surg. 2002;235(3):338-45.
25. da Rocha JR, Ribeiro U Jr, Sallum RA, Szachnowicz S, Cecconello I. Barrett's esophagus (BE) and carcinoma in the esophageal stump (ES) after esophagectomy with gastric pull-up in achalasia patients: a study based on 10 years follow-up. Ann Surg Oncol. 2008;15(10):2903-9.
26. da Rocha JR, Ribeiro U, Cecconello I, Sallum RA, Takeda F, Nasi A, et al. Gastric secretory and hormonal patterns in end-stage chagasic achalasia. Dis Esophagus. 2009;22(7):606-10.
27. Okuyama M, Motoyama S, Maruyama K, Sasaki K, Sato Y, Ogawa J. Proton pump inhibitors relieve and prevent symptoms related to gastric acidity after esophagectomy. World J Surg. 2008;32(2):246-54.

28. Terra Júnior JA, Terra GA, Silva AA, Crema E. Evaluation of anatomical and functional changes esophageal stump of patients with advanced megaesophagus submitted to subtotal laparoscopic esophagectomy. Acta Cir Bras. 2012;27(9):650-8.
29. Ministério da Saúde. Secretaria de Vigilância em Saúde. Consenso brasileiro em doença de chagas. Rev Soc Bras Med Trop. 2005;38 Suppl 3:7-29.
30. Gomes YM, Lorena VMB, Luquetti AO. Diagnosis of Chagas disease: what has been achieved? What remains to be done with regard to diagnosis and follow up studies? Mem Inst Oswaldo Cruz. 2009;104(Suppl 1):115-21.
31. Britto CC. Usefulness of PCR-based assays to assess drug efficacy in Chagas disease chemotherapy: value and limitations.(Mem Inst Oswaldo Cruz. 2009;104 (Suppl 1):122-35.
32. Batista Neto J, Fontan AJ, Nepomuceno MC, Lourenço LG, Ribeiro LT, Ramos CP. Esofagectomia trans-hiatal no tratamento do megaesôfago chagásico avançado. Rev Col Bras Cir. 2003;30(3):230-7.
33. Abate E, DeMeester SR, Zehetner J, Oezcelik A, Ayazi S, Costales J, et al. Recurrence after esophagectomy for adenocarcinoma: defining optimal follow-up intervals and testing. J Am Coll Surg. 2010;210(4):428-35.
34. da Rocha JR, Cecconello I, Ribeiro U Jr, Baba ER, Safatle-Ribeiro AV, Iriya K, et al. preoperative gastric acid secretion and the risk to develop Barrett's esophagus after esophagectomy for chagasic achalasia. J Gastrointest Surg. 2009;13(11):1893-8; discussion 1898-9.
35. Yamamoto S, Makuuchi H, Shimada H, Chino O, Nishi T, Kise Y, et al. Clinical analysis of reflux esophagitis following esophagectomy with gastric tube reconstruction. J Gastroenterol. 2007;42(5):342-5.
36. Yuasa N, Sasaki E, Ikeyama T, Miyake H, Nimura Y. Acid and duodenogastroesophageal reflux after esophagectomy with gastric tube reconstruction. Am J Gastroenterol. 2005;100(5):1021-7.
37. Park CH, Lee JI, Choi S, Ko KP. A flow visualization model of duodenogastric reflux after esophagectomy with gastric interposition. J Cardiothoracic Surg. 2013;8:192.
38. Hölscher AH, Voit H, Buttermann G, Siewert JR. Function of the intrathoracic stomach as esophageal replacement. World J Surg. 1988;12(6):835-44.
39. Gutschow CA, Collard JM, Romagnoli R, Michel JM, Salizzoni M, Hölscher AH. Bile exposure of the denervated stomach as an esophageal substitute. Ann Thorac Surg. 2001;71(6):1786-91.
40. Shibuya S, Fukudo S, Shineha R, Miyasaki S, Miyata G, Sugawara K, et al. High incidence of reflux esopagitis observed by routine endoscopic examination after gastric pull-up esophagectomy. World J Surg. 2003;27(5):580-3.
41. Sharma P, McQuaid K, Dent J, Fennerty MB, Sampliner R, Spechler S, et al. A critical review of the diagnosis and management of Barrett's esophagus: the AGA Chicago Workshop. Gastroenterology. 2004;127(1):310-30.
42. Sharma P. Barrett's esophagus. N Eng J Med. 2009;361:2548-56.
43. Gutschow CA, Vallböhmer D, Stolte M, Oh D, Danemberg K, Danenberg P, et al. Adenocarcinoma developing in de novo Barrett's mucosa in the remnant esophagus after esophagectomy: clinical and molecular assessment. Dis Esophagus. 2008;21(3):E6-8.

Received on: 15/11/2014
Accepted for publication: 20/01/15
Conflict of interest: none.
Source of funding: none.

Mailing address:
Celso de Castro Pochini
E-mail: celsopochini@gmail.com

DOI: 10.1590/0100-69912015005007 Original Article

Impact of Roux-en-Y gastric bypass on lipid and inflammatory profiles

Impacto da derivação gástrica em Y-de-Roux no perfil inflamatório e lipídico

Cleiton da Silva Oliveira[1]; Bruna Teles Soares Beserra[2]; Raphael Salles Granato Cunha[1]; Ana Gabriela Estevam Brito[3]; Rafaella Cristina Dimbarre de Miranda[1]; Lúcia Andréia Zanette Ramos Zeni[4]; Everson Araújo Nunes[5]; Erasmo Benicio Santos de Moraes Trindade[5]

ABSTRACT

Objective: To evaluate the behavior of acute phase proteins and lipid profile in patients undergoing Roux-en-Y gastric bypass. **Methods**: We conducted a prospective study, consisting of three moments: M1 - preoperative (24 hours before surgery); M2 – 30 days after surgery; and M3 – 180 days after surgery. We carried measured height and BMI, as well as determined the concentrations of acute phase proteins (C-reactive protein (CRP), albumin and Alpha-1-acid glycoprotein) and total cholesterol, LDL-c, HDL-c and triacylglycerol. **Results**: participants comprised 25 individuals, with a mean age of 39.28 ± 8.07, 72% female. At all times of the study there was statistically significant difference as for weight loss and BMI. We found a significant decrease in CRP concentrations between the moments M1 and M3 (p = 0.041) and between M2 and M3 (p = 0.018). There was decrease in Alpha-1-GA concentrations between M1 and M2 (p = 0.023) and between M1 and M3 (p = 0.028). The albumin values increased, but did not differ between times. Total cholesterol and triacylglycerol decreased significantly ay all times. LDL-c concentrations decreased and differed between M1 and M2 (p = 0.001) and between M1 and M3 (p = 0.001). HDL-c values increased, however only differing between M1 and M2 (p = 0.050). **Conclusion**: Roux-en-Y gastric bypass promoted a decrease in plasma concentrations of CRP and Alpha-1-acid glycoprotein, improving lipid and inflammatory profiles.

Key words: Gastric Bypass. Obesity. Inflammation Mediators. Weight Loss.

INTRODUCTION

Obesity is defined as abnormal or excessive fat accumulation and can harm one's health[1]. It is a non-communicable chronic disease[2]. Considered worldwide a public health problem, it continues to increase in prevalence, both in developed countries, as in developing ones[3 5]. In Brazil, the prevalence of obesity in men and women aged 20 years or older is 12.5% and 16.9%, respectively. The country Southern Region has a higher prevalence of obesity when compared to other regions[6].

The treatment of obesity is complex and multidisciplinary. There are different kinds of treatments, which are non-pharmacological, pharmacological and surgical. These treatments seek a lasting reduction and maintenance of body weight up to levels considered clinically satisfactory, with beneficial effects on possible associated diseases as type 2 diabetes, hypertension and dyslipidemia[7].

Regarding surgical treatment, Roux en Y gastric bypass (RYGB) reduces the stomach capacity and concomitantly alters the production of hormone responsible for regulating hunger and satiety[8]. Currently, this operation has been the most frequently performed in Brazil, corresponding to 75% of total operations employed for the treatment of obesity[9].

It is worth mentioning that the obese individual is considered a having a chronic low-grade inflammatory condition[10]. In this scenario are present the acute phase proteins (APP), defined as those whose plasma concentration range at least 25% when an inflammatory response ensues, and can be categorized as negative when normal values are reduced during inflammation, and positive, wherein normal values are increased within inflammation[11,12]. Produced mainly by hepatocytes, APP may also be synthesized on immune cells, epithelial cells and adipocytes[11].

Given the above, this study aims to evaluate the behavior of APP (C-reactive protein, Alpha-1-acid glycoprotein and albumin) and lipid profile in patients undergoing RYGB.

1. Departamento de Nutrição / Universidade Federal de Santa Catarina; 2. Programa de Pós-Graduação em Nutrição / Universidade Federal de Santa Catarina; 3. Hospital Universitário Professor Polydoro Ernani de São Thiago / Universidade Federal de Santa Catarina; 4. Departamento de Fisiologia / Universidade Federal de Santa Catarina; 5. Programa de Pós-Graduação em Nutrição / Universidade Federal de Santa Catarina.

METHODS

We conducted a prospective study in a public hospital that is reference for bariatric surgery. We evaluated patients undergoing Roux-en-Y gastric bypass. The study was approved by the Ethics in Human Research Committee under number 2422/2011. In addition, this survey was conducted in accordance with the resolution of the National Health Council no 466 of 12/12/2012. All individuals involved in this study were informed and signed an Informed Consent form. There were no conflicts of interest.

The study consisted of three moments: M1 – preoperative time (24 hours before surgery); M2 – 30 days after surgery; and M3 – 180 days after surgery. The times were chosen according to the outpatient treatment protocol for patients undergoing bariatric surgery in that hospital. Clinical and epidemiological variables recorded were age, gender, use of drugs, associated diseases and smoking. All these data were collected through interviews.

For the assessment of nutritional status we carried out anthropometric measurements of weight and height. The nutritional status was classified by body mass index (BMI) using the cutoff points defined by the World Health Organization (WHO) [13].

Regarding the laboratory variables, the examinations related to this study were collected in the proposed times. Study participants were asked to follow an overnight fast of 12 hours. Blood samples were collected by venipuncture in the ulnar region of the forearm, using vacuum tubes. Then the blood was centrifuged and processed in the hospital Clinical Analysis Service. Laboratory parameters included measurement of C-reactive protein (CRP), alpha 1-acid glycoprotein (Alpha 1-AG), albumin and lipid profile. CRP was determined by immunonephelometry method [14] (DadeBehring Siemens Inc., Newark, DE, USA), alpha 1 AG, also by immunonephelometry [15] (DadeBehring Siemens Inc., Newark, DE, USA) and albumin, by the automated colorimetric method (Siemens Healthcare Diagnostics Inc., Newark, DE, USA) employing bromcresol purple as color reagent[14]. Total cholesterol[16], HDL-cholesterol[17] and triglycerides[17] were determined by enzymatic method. LDL-cholesterol was determined using the Friedewald equation[18] (LDL-c = Total cholesterol - HDL-c - Triglycerides / 5) wherein triglycerides / 5 represents the VLDL c.

The reference value used in that hospital for CRP is < 3.3 mg/L, and alpha-1-GA, distinguishing as to gender, are: Women: 40-120 mg/dL; men: 50-130 mg/dL. The reference adopted for albumin is 3.4 to 5.0 g/dL. Reference values for total cholesterol: Desirable: < 200 mg/dL; borderline: 200-239 mg/dL; High: ≥240mg/dL. Reference values for HDL-c: low: < 40 mg/dL; high: > 60 mg / dL. Reference values for LDL-c: good: < 100 mg/dL; desirable: between 100 and 129 mg/dL; borderline: between 130 and 159 mg/dL; high: between 160 and 189 mg/dL; too high: ≥190 mg/dL. Reference values for triacylglycerol: good: < 150 mg/dL; borderline: 150-200 mg/dL; High: 201-499 mg/dL; too high: ≥500 mg/dL. The adopted classification values for complications risk were: no risk: <0.4; low risk: 0.4-1.2; medium risk: 1.2-2.0; high risk: >2.0[19].

The sample consisted of patients aged between 18 and 60 years undergoing RYGB. The study included individuals of both genders in the preoperative phase of bariatric surgery at the hospital. We did not include individuals with inability to perform the biochemical and anthropometric measurements and who did not sign the informed consent.

To evaluate the symmetry of variables we considered the coefficient of variation and the Shapiro-Wilk test (p values <0.05 are considered asymmetrical variables). Data were presented as mean and standard deviation for symmetrical variables and median and interquartile range for asymmetric variables. The paired t test and the Wilcoxon test for paired data were used to test the differences between the different moments of the study, considering p <0.05 for statistical significance.

RESULTS

The study included 25 patients with a mean age of 39.2 (± 8.07) years. Most participants were female (72%) and with comorbidities related to obesity, such as hypertension (44%), type 2 diabetes mellitus (23.5%) and dyslipidemia (5.9%). All patients were taking some kind of medication, among which stand out hydrochlorothiazide (11.5%), metformin hydrochloride (11.5%) and losartan (9.6%). During follow-up there were participants losses, 13 at 30 days and 14 at 180 days; absence to appointments was the main reason for losses.

We observed an average percentage weight loss of 14.14% at 30 days and the same average of 28.74% at 180 days. In all stages of the study there was a significant reduction in weight, BMI, triglyceride and total cholesterol (p <0.05) (Table 1). LDL-c concentrations decreased and differ between M1 and M2 (p = 0.001) and M1 and M3 (p = 0.001), while the HDL-c values increased with statistically significant difference only between M1 and M2 (p = 0.049) (Figure 1). The acute phase protein alpha-1-GA also had its serum concentrations reduced (p = 0.028). Albumin concentrations, on their turn, showed an increase, but without significant differences (Table 1). CRP showed an inverse behavior in the two study periods, that is, increased between M1 and M2 (p <0.05) and significantly decreased between M2 and M3 (p <0.05). The CRP / Albumin ratio showed a change of behavior in the relationship of these proteins, in which participants had the degree of complication shifted from high risk to low risk (Figure 1).

Table 1- Anthropometric and biochemical parameters of the study participants.

Variables	Moment 1(n=25) Mean ± DP	Moment 2 (n=12) Mean ± DP	Moment 3 (n=11) Mean ± DP
Weight *	121.52 ± 23.74[a]	105.42 ± 18.41[b]	86.56 ± 17.06[c]
BMI*	49.71 ± 7.66[a]	41.57 ± 5.47[b]	33.43 ± 5.29[c]
Total cholesterol*	201.20 ± 43.21[a]	173.90 ± 29.76[b]	149.67 ± 40.55[c]
HDL-cholesterol*	36.88 ± 10.17[a]	31.54 ± 7.93[b]	41.67 ± 10.97[a-b]
LDL cholesterol*	136.76 ± 35.62[a]	112.27 ± 22.83[b]	93.30 ± 28.65[b]
Triacylglycerol** †	144 (110 - 187)[a]	117 (105 - 131)[b]	74.00(54.50 – 91.50)[c]
Alpha-1-GA ** †	104.99 (86.2 - 116)[a]	127 (122 - 168)[b]	69.90 (58.2-91.3)[b]
Albumin*	3.64 ± 0.25	3.70 ± 0.20	3.72 ± 0.22

*Alpha-1-GA – Alpha-1-acid glycoprotein; CRP - C-reactive protein; Data that do not share the same letter within a horizontal row are significantly different (p <0.05). * Paired t test, ** Wilcoxon test for paired data. † Results are expressed as median and interquartile range.*

DISCUSSION

In this study, the average age and the high prevalence of females are similar to other studies that analyzed the inflammatory profile in patients undergoing surgical treatment of obesity[20-22]. The predominance of women may be justified by a higher obesity prevalence when compared to men in the world [4].

Overweight and obesity are associated with increased risk of developing certain metabolic abnormalities such as type 2 diabetes mellitus, dyslipidemia and cardiovascular diseases such as hypertension. The origin of these comorbidities was initially attributed to hyperinsulinemia or insulin resistance. However, chronic elevations in the concentration of adipokines, such as tumor necrosis factor (TNF), play an important role in the development of metabolic complications associated with obesity [10]. According to a meta-analysis by Guh *et al*. [23], the risks of developing type 2 diabetes and hypertension, are respectively 12.41 (95% CI 9.03-17.06) and 2.42 (95% CI 1.59-3.67) times higher among women who are obese than among those who are not, rendering obesity as an aggravating factor of such diseases in women. In another meta-analysis[24] that analyzed the effectiveness and adverse surgical treatment of obesity events, the prevalence of individuals preoperatively diagnosed with type 2 diabetes mellitus who showed improvement or resolution of symptoms after surgery ranged from 64% to 100% (median 100%). When hypertension was analyzed by studies, 38% (ranging from 16% to 83%) of patients had hypertension preoperatively, of whom 25% to 100% (median 89%) showed improvement or resolution of this condition, resulting in improvement range of 95% to 100% (median 100%). In studies on dyslipidemia, 32% (range 3% to 65%) of subjects had this comorbidity preoperatively, of whom 60% to 100% (median 88%) reported improvement or resolution of dyslipidemia in moments subsequent to the surgical procedure [24].

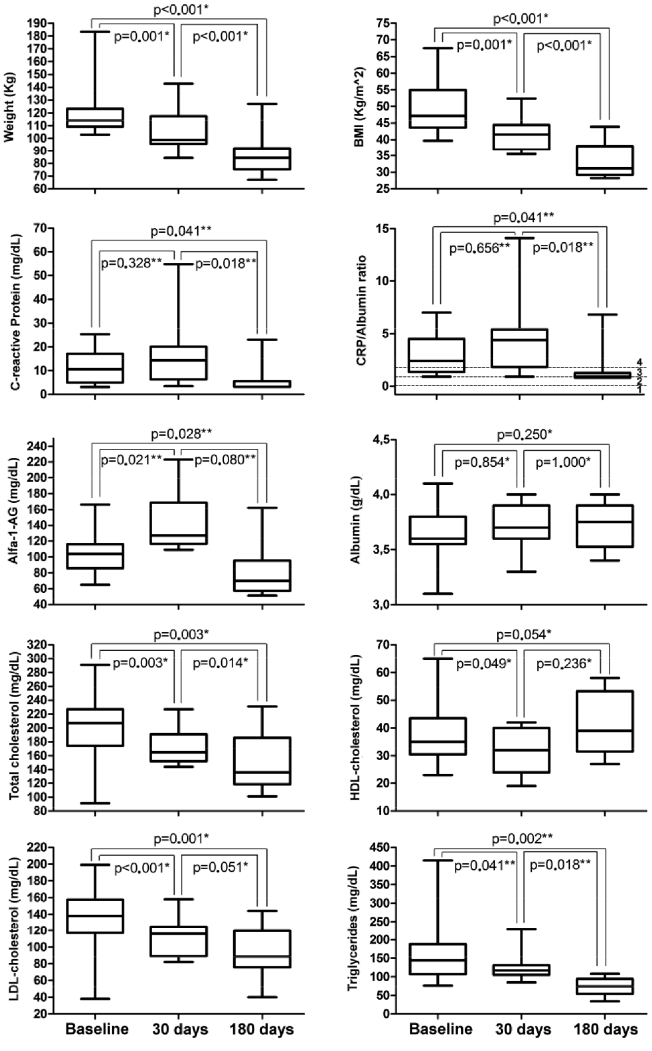

Figure 1 *- Distribution of weight, BMI, CRP acute phase protein and its relationship with albumin, Alpha-1-GA, albumin, total cholesterol and HDL-cholesterol in the different moments of the study.*

** Wilcoxon test for paired data. Categories: 1- without risk; 2 low risk; 3- medium risk; 4-high risk. Significant difference: p <0.05.*

During the time of the study, weight and BMI decreased significantly, achieving both a reduction > 20% at 180 days, which corroborates the findings of other studies that analyzed the impact of surgical obesity treatment on these variables[20,22] and demonstrates the effectiveness of this procedure as to loss of body weight. The reduction in body weight also seems to improve the inflammatory condition in the obese individual, specifically reducing pro-inflammatory markers (CRP, TNF-α, IL-6 and leptin) and increasing an anti-inflammatory marker (adiponectin), as concluded Forsythe et al. in a review[25]. Moreover, the same review reports that the largest and most consistent improvements are observed in those studies in which the subjects had at least a 10% weight loss[25], which occurred in the present study from the 30th postoperative day on.

Weight reduction in obese subjects and its relation with the decrease of serum cholesterol render it difficult to estimate the reduction of the latter is primarily due to the reduced synthesis or lower absorption, since a metabolic pathway or another will result in compensatory measures to maintain cholesterol homeostasis[26]. Similar to the present study, in which Total Cholesterol (TC), Triglycerides (TG) and LDL-c were reduced with statistical difference after 180 days of operation, the study by Pedrosa *et al.* [27], who analyzed the lipid profile of patients undergoing Roux-en-Y gastric bypass, showed that after one year postoperatively there was a significant decrease in serum concentrations of TC, LDL-c and TG, and increased HDL-c . However, in this study, HDL c was increased at 180 days compared with the preoperative period, but without significant differences. Possibly, the determining factor was the time of analysis; if the study continued longer than 180 days, perhaps it would display a difference. Thus, the loss of weight after RYGB appears to limit the absorption of cholesterol[26], with consequent negative equilibrium of the same and reduction in total cholesterol and LDL-c. This low absorption and decrease in total cholesterol synthesis in the body may contribute to the postoperative reduction of cardiovascular risk[26].

The CRP synthesis in the liver occurs primarily by the action interleukin-6 (IL-6), the adipocytes being responsible for producing about 30% of circulating IL-6 of non-inflammatory origin. The weight loss and consequent reduction of the fatty tissue caused by RYGB results in lower serum IL-6 concentrations, reduced CRP hepatic synthesis and consequent reduction in the deleterious biological effects of this protein[21,22]. Some studies confirm this theory by showing that 180 days after surgery, in addition to significant weight loss, there is also reduction in CRP[20,22,28,29]. In a systematic review, Selvin *et al.*.[30] showed that each kilogram of body weight lost through modification of diet and lifestyle corresponded to a 0.13mg/L reduction in CRP concentration; however, weight loss induced by bariatric surgery provoked a higher decrease, of 0.16mg/L by Kg lost, indicating more effectiveness of the surgical treatment on reducing inflammatory markers compared with weight loss through diet and lifestyle changes.

For Alpha 1-AG, it is known to be an indicator of tissue injury of inflammatory or infectious character, and its hepatic synthesis is stimulated by cytokines such as IL-1, IL-6, leptin and TNF-α, which are mostly secreted by adipocytes[21]. In the study of John Cabrera *et al.* [21], Alpha 1-AG was positively correlated with CRP in the RYGB pre- and postoperative periods. The authors believe that the loss of adipose tissue and consequent reduction in the synthesis of cytokines may explain the positive correlation found, suggesting that this protein may be used as a marker of inflammation in obesity. As in this study, Anty *et al.*[31] and Iannelli *et al.*[32] also observed a significant reduction of Alpha 1-AG after weight loss induced by surgical treatment, with a reduction in the inflammatory profile of the individual.

Albumin is considered a negative APP. The reduction in the synthesis of APP is believed to occur by increased need for amino acid for synthesis of positive APP and other inflammatory mediators[11]. Also, during the inflammatory process, some changes occur in vascular permeability resulting in loss of albumin to extravascular medium and consequent rapid drop in plasma concentrations[33]. In the present study there was no significant difference in the concentration of albumin in the analyzed moments. Similarly, other studies have also found non-impressive results. Farias *et al.*[34] analyzed the serum albumin of women undergoing RYGBand observed a low percentage of individuals with hypoalbuminaemia (12.5%; n = 1) after eight months. Nicoletti *et al.*[35] reported a reduction in serum albumin just 12 months after surgery, there being no difference in times three and six months, and suggested that serum albumin cannot be an effective indicator of the protein profile in post bariatric surgery time.

The median CRP / Albumin ratio, which indicates the of risk of inflammatory stress complications[19], was at its highest degree in the preoperative moment (M1) and 30 days after surgery (M2). However, at 180 days (M3) the median of this ratio was ranked among medium and low risk for complications. This variation can be attributed to the possible inflammatory state caused by the surgical procedure, which tends to regress not earlier than three months after surgery[22].

It is noteworthy that the study sample sustained a large loss of patients during follow-up, for reasons expected as sample characteristics studied, making the sample small. The 180-day follow-up period, while being the most critical period and of major changes for patients undergoing RYGB, is still a short period when it comes to a major surgical procedure. Such factors can be considered as limitations of the study.

Thus, we conclude that in the sample studied RYGB induced weight loss and reduction of BMI, total cholesterol and triacylglycerol, also causing a decrease in concentrations of CRP and Alpha-1-acid glycoprotein, and consequently improving lipid and inflammatory profile.

R E S U M O

Objetivo: *avaliar o comportamento das proteínas de fase aguda e o perfil lipídico em pacientes submetidos à derivação gástrica em Y-de-*Roux. ***Métodos:*** *estudo prospectivo, constituído por três momentos: M1 – pré-cirúrgico (24 horas antes do procedimento cirúrgico); M2 – 30 dias pós-cirúrgico; e M3 – 180 dias pós-cirúrgico. Foram realizadas aferição antropométrica de peso, altura e IMC, como também determinação das concentrações das proteínas de fase aguda (proteína c reativa (PCR), albumina e alfa-1-glicoproteína-ácida) e de colesterol total, LDL-c, HDL-c e triacilglicerol.* ***Resultados:*** *participaram desse estudo 25 indivíduos, com média de idade de 39,28±8,07, sendo 72% do sexo feminino. Em todos os momentos do estudo observou-se diferença estatística significativa quanto à redução de peso e IMC. Verificou-se diminuição com diferença nas concentrações da PCR entre os momentos M1 e M3 (p=0,041); M2 e M3 (p=0,018). As concentrações da a1-GA reduziram e foram diferentes entre os momentos M1 e M2 (p=0,023); M1 e M3 (p=0,028). Os valores de albumina aumentaram, mas não diferiram entre os momentos. O colesterol total e o triacilglicerol diminuíram com diferença entre todos os momentos. As concentrações de LDL-c diminuíram e diferiram entre os momentos M1 e M2 (p=0,001); M1 e M3 (p=0,001). Os valores de HDL-c aumentaram, entretanto apenas diferiram entre os momentos M1 e M2 (p=0,050).* ***Conclusão:*** *a derivação gástrica em Y-de-*Roux *promoveu diminuição nas concentrações plasmáticas da PCR e alfa-1-glicoproteína ácida, melhorando o perfil inflamatório e lipídico.*

Descritores: *Derivação Gástrica. Obesidade. Mediadores da Inflamação. Perda de Peso.*

REFERENCES

1. World Health Organization [homepage na internet]. Fact sheet nº 311: Facts about overweight and obesity. Acessado em: 15 mar 2013. Disponível em: http://www.who.int/mediacentre/factsheets/fs311/en/
2. Francischi RPP, Pereira LO, Freitas CS, Klopfer M, Santos RC, Vieira P, et al. Obesidade: atualização sobre sua etiologia, morbidade e tratamento. Rev Nutr. 2000;13(1):17-28.
3. Pinheiro ARO, Freitas SFT, Corso ACT. Uma abordagem epidemiológica da obesidade. Rev Nutr. 2004;17(4):523-33.
4. World Health Organization. Obesity: prevention and management of the global epidemic. Reportof a WHO Consultation on Obesity. Geneva: WHO. 1998.
5. Abrantes MM, Lamounier JA, Colosimo EA. Prevalência de sobrepeso e obesidade nas regiões Nordeste e Sudeste do Brasil. Rev Assoc Med Bras. 2003;49(2):162-6.
6. Instituto Brasileiro de Geografia e Estatística. Pesquisa de orçamentos familiares 2008-2009. Antropometria e Estado Nutricional de Crianças, adolescentes e adultos no Brasil. Rio de Janeiro: IBGE, 2010.
7. Associação Brasileira para o Estudo da Obesidade e da Síndrome Metabólica. Diretrizes Brasileiras de Obesidade 2009/2010 / ABESO – Associação Brasileira para o Estudo da obesidade e da Síndrome Metabólica. 3ª ed. Itapevi, SP: AC Farmacêutica, 2009.
8. Brasil. Conselho Federal de Medicina. Resolução CFM nº 1.942/2010. Normas seguras para o tratamento cirúrgico da obesidade mórbida, definindo indicações, procedimentos e equipe. Diário Oficial da União, 12 fev 2010; Seção I, p. 72.
9. Sociedade Brasileira de Cirurgia Bariátrica e Metabólica [homepage na internet]. Técnicas Cirúrgicas. Acessado em: 27 fev 2013. Disponível em: http://www.sbcbm.org.br/wordpress/tratamento-cirurgico/cirurgia-laparoscopica/
10. Bulló M, Casas-Agustench P, Amigó-Correig P, Aranceta J, Salas-Salvadó J. Inflammation, obesity and comorbidities: the role of diet. Public Health Nutr. 2007;10(10A):1164-72.
11. Gabay C, Kushner I. Acute-phase proteins and other systemic responses to inflammation. N Engl J Med. 1999;340(6):448-54.
12. Morley JJ, Kushner I. Serum C-reactive protein levels in disease. Ann N Y Acad Sci. 1982;389:406-18.
13. World Health Organization [homepage na internet]. BMI classification, Geneve, Switzerland: World Health Organization, 2008 [acesso em 16 mar 2013]. Disponível em: http://apps.who.int/bmi/index.jsp?introPage=intro_3.html
14. Lasky FD, Li ZM, Shaver DD, Savory J, Sarvory MG, Willey DG, et al. Evaluation of a bromocresol purple method for the determination of albumin adapted to the DuPont aca discrete clinical analyzer. Clin Biochem. 1985;18(5):290-6.
15. Ledue TB, Weiner DL, Sipe JD, Poulin SE, Collins MF, Rifai N. Analytical evaluation of particle-enhanced immunonephelometric assays for C-reactive protein, serum amyloid A and mannose-binding protein in human serum. Ann Clin Biochem. 1998;35 (Pt 6):745-53.
16. Rautela GS, Liedtke RJ. Automated enzymic measurement of total cholesterol in serum. Clin Chem. 1978;24(1):108-14.
17. Rifai N, Russell Warnick G, Dominiczak MH. Handbook of Lipoprotein Testing. Washington, DC: AACC; 1997.
18. Friedewald WT, Levy RI, Fredrickson DS. Estimation of the concentration of low-density lipoprotein cholesterol in plasma, without use of the preparative ultracentrifuge. Clin Chem. 1972;18(6):499-502.
19. Correa CR, Angeleli AYO, Camargo NR, Barbosa L, Burini RC. Comparação entre a relação PCR/albumina e o índice de prognóstico inflamatório nutricional (IPIN). J Bras Patol Med Lab. 2002;38(3):183-90.
20. Holdstock C, Lind L, Engstrom BE, Ohrvall M, Sundbom M, Larsson A, et al. CRP reduction following gastric bypass surgery is most pronounced in insulin-sensitive subjects. Int J Obes. 2005;29(10):1275-80.
21. João Cabrera E, Valezi AC, Delfino VD, Lavado EL, Barbosa DS. Reduction in plasma levels of inflammatory and oxidative stress indicators after Roux-en-Y gastric bypass. Obes Surg. 2010;20(1):42-9.
22. Miller GD, Nicklas BJ, Fernandez A. Serial changes in inflammatory biomarkers after Roux-en-Y gastric bypass surgery. Surg Obes Relat Dis. 2011;7(5):618-24.
23. Guh DP, Zhang W, Bansback N, Amarsi Z, Birmingham CL, Anis AH. The incidence of co-morbidities related to obesity and overweight: a systematic review and meta-analysis. BMC Public Health. 2009;9:88.
24. Maggard MA, Shugarman LR, Suttorp M, Maglione M, Sugerman HJ, Livingston EH, et al. Meta-analysis: surgical treatment of obesity. Ann Intern Med. 2005;142(7):547-59.
25. Forsythe LK, Wallace JM, Livingstone MB. Obesity and inflammation: the effects of weight loss. Nutr Res Rev. 2008;21(2):117-33.
26. Pihlajamäki J, Grönlund S, Simonen M, Käkelä P, Moilanen L, Pääkkönen M, et al. Cholesterol absorption decreases after Roux-en-Y gastric bypass but not after gastric banding. Metabolism. 2010;59(6):866-72.
27. Pedrosa IV, Burgos MGPA, Souza NC, Morais CN. Aspectos nutricionais em obesos antes e após a cirurgia bariátrica. Rev Col Bras Cir. 2009;36(4):316-22.

28. Pardina E, Ferrer R, Baena-Fustegueras JA, Rivero J, Lecube A, Fort JM, et al. Only C-reactive protein, but not TNF-á or IL6, reflects the improvement in inflammation after bariatric surgery. Obes Surg. 2012;22(1):131-9.
29. Rojas P, Carrasco F, Codoceo J, Inostroza J, Basfi-fer K, Papapietro K, et al. Trace element status and inflammation parameters after 6 months of Roux-en-Y gastric bypass. Obes Surg. 2011;21(5):561-8.
30. Selvin E, Paynter NP, Erlinger TP. The effect of weight loss on C-reactive protein: a systematic review. Arch Intern Med. 2007;167(1):31-9.
31. Anty R, Dahman M, Iannelli A, Gual P, Staccini-Myx A, Amor IB, et al. Bariatric surgery can correct iron depletion in morbidly obese women: a link with chronic inflammation. Obes Surg. 2008;18(6):709-14.
32. Iannelli A, Anty R, Piche T, Dahman M, Gual P, Tran A, et al. Impact of laparoscopic Roux-en-Y gastric bypass on metabolic syndrome, inflammation, and insulin resistance in super versus morbidly obese women. Obes Surg. 2009;19(5):577-82.
33. Santos NSJ, Draibe SA, Kamimura MA, Cuppari L. Albumina sérica como marcador nutricional de pacientes em hemodiálise. Rev Nutr. 2004;17(3):339-49.
34. Farias LM, Coêlho MPSS, Barbosa RF, Santos GS, Marreiro DN. Aspectos nutricionais em mulheres obesas submetidas à gastroplastia vertical com derivação gastro-jejunal em Y-de- Roux. Rev Bras Nutr Clin. 2006;21(2):98-103.
35. Nicoletti CF, Morandi Junqueira-Franco MV, dos Santos JE, Marchini JS, Salgado W Jr, Nonino CB. Protein and amino acid status before and after bariatric surgery: a 12-month follow-up study. Surg Obes Relat Dis. 2013;9(6):1008-12.

Received at: 25/10/2014
Accepted for publication: 10/01/2015
Conflict of interest: none.
Source of funding: none.

Mailing address:
Erasmo Benício Santos Moraes Trindade
E-mail: erasmotrindade@gmail.com

DOI: 10.1590/0100-69912015005008

Predictors of "occult" intra-abdominal injuries in blunt trauma patients

Indicadores de lesões intra-abdominais "ocultas" em pacientes vítimas de trauma fechado admitidas sem dor abdominal ou alterações no exame físico do abdome

José Gustavo Parreira, TCBC-SP[1]; Juliano Mangini Dias Malpaga[2]; Camilla Bilac Olliari[2]; Jacqueline A. G. Perlingeiro, TCBC-SP[1]; Silvia C. Soldá, TCBC-SP[1]; José Cesar Assef, TCBC-SP[1]

A B S T R A C T

Objective: to assess predictors of intra-abdominal injuries in blunt trauma patients admitted without abdominal pain or abnormalities on the abdomen physical examination. **Methods:** We conducted a retrospective analysis of trauma registry data, including adult blunt trauma patients admitted from 2008 to 2010 who sustained no abdominal pain or abnormalities on physical examination of the abdomen at admission and were submitted to computed tomography of the abdomen and/or exploratory laparotomy. Patients were assigned into: Group 1 (with intra-abdominal injuries) or Group 2 (without intra-abdominal injuries). Variables were compared between groups to identify those significantly associated with the presence of intra-abdominal injuries, adopting p<0.05 as significant. Subsequently, the variables with p<0.20 on bivariate analysis were selected to create a logistic regression model using the forward stepwise method. **Results:** A total of 268 cases met the inclusion criteria. Patients in Group I were characterized as having significantly (p<0.05) lower mean AIS score for the head segment (1.0±1.4 vs. 1.8±1.9), as well as higher mean AIS thorax score (1.6±1.7 vs. 0.9±1.5) and ISS (25.7±14.5 vs. 17,1±13,1). The rate of abdominal injuries was significantly higher in run-over pedestrians (37.3%) and in motorcyclists (36.0%) (p<0.001). The resultant logistic regression model provided 73.5% accuracy for identifying abdominal injuries. The variables included were: motorcyclist accident as trauma mechanism (p<0.001 – OR 5.51; 95%CI 2.40-12.64), presence of rib fractures (p<0.003 – OR 3.00; 95%CI 1.47-6.14), run-over pedestrian as trauma mechanism (p=0.008 – OR 2.85; 95%CI 1.13-6.22) and abnormal neurological physical exam at admission (p=0.015 – OR 0.44; 95%CI 0.22-0.85). **Conclusion** Intra-abdominal injuries were predominantly associated with trauma mechanism and presence of chest injuries.

Key words: Diagnosis. Delayed Diagnosis. External Causes. Multiple Trauma. Abdominal Injuries.

INTRODUCTION

Blunt trauma is commonly seen in large urban centers, largely due to road traffic accidents, falls and interpersonal violence. The frequency of abdominal injuries varies according to sample analyzed[1,2]. In studies including minor trauma the rate of these injuries is typically less than 10%[1,2]. A number of different factors can add to the difficulty in diagnosing intra-abdominal injuries, including changes in level of consciousness, distracting injuries, sedation and use of analgesics[1-4].

These injuries are not initially diagnosed in a substantial proportion of patients. Delayed diagnosis can have serious consequences and may even lead to "preventable" deaths[5-8]. Therefore, several diagnostic modalities have evolved in the past three decades: diagnostic peritoneal lavage, ultrasound, computed tomography (CT) and videolaparoscopy, each having inherent advantages, disadvantages and complications[9].

The most accurate imaging exam is computed tomography, being able to identify most injuries[10]. Some authors advocate liberal use of CT in blunt trauma patients[11]. However, the exam poses some risks to the patient such as anaphylactic reactions due to administration of contrast and cancers resulting from radiation exposure[12,13]. Missed abdominal injuries can occur despite adherence to strict evaluation protocols and are often associated with the absence of abdominal pain or of abnormalities on the abdomen physical examination[4].

We believe it is possible to identify variables that characterize patients in whom the presence of intra-abdominal injuries is statistically more likely. The literature refers to these variables as predictors of abdominal injuries[14]. Previous studies have suggested a range of predictors, such

1. Departamento de Cirurgia da Faculdade de Ciências Médicas da Santa Casa de São Paulo, Brasil; 2. Faculdade de Ciências Médicas da Santa Casa de São Paulo, Brasil.

as the presence of arterial hypotension, metabolic acidosis, severe injuries to the thoracic segment, as well as fractures to the pelvis, long bones and lumbar spine[1,14-16]. However, we found no specific studies assessing these predictors in trauma patients admitted without abdominal pain or changes on physical examination of the abdomen – in whom the risk of diagnostic failure is high. The objective of this study was to identify predictors of abdominal injuries in this specific group of trauma patients.

METHODS

This study was submitted to the Ethics in Research Committee of the institution and approved under number 443.723.

We conducted a retrospective study of information from medical charts and trauma registry, including blunt trauma patients over the age of 13 years admitted to the Emergency Room of the Irmandade da Santa Casa de Misericórdia de São Paulo between 2008 and 2010. Prospective data collection was performed over this period for all trauma patients over the age of 13 admitted to the emergency room. The data collected was held in a Microsoft Access database.

We assessed data on identification, trauma mechanism, pre-hospital care, vital signs at admission, trauma scores, complementary exams ordered, associated diseases, injuries diagnosed and treatment. This information was routinely collected for all trauma patients admitted to the trauma room, and recorded on standard forms and patient medical charts.

The abdominal assessment protocol for imaging exams routinely employed at the our service entails selective use of Focused Assessment with Sonography for Trauma (FAST), complete abdominal ultrasound (US) and computed tomography (CT) according to the abdominal injury risk assessment by the attending physician. In addition to imaging exams, laboratory assays such as leukocyte count, amylase level and arterial blood gases were performed to screen for possible abdominal injuries. Leukocytosis, elevated amylase and metabolic acidosis are suggestive of injuries that may have been missed by imaging exams.

This study included all blunt trauma patients aged over 13 who underwent computed tomography of the abdomen and/or exploratory laparotomy and that had no abdominal pain or abnormalities on physical examination of the abdomen at admission.

Severity of the sample was stratified using the following trauma measures: Glasgow Coma Scale (GCS)[17], Revised Trauma Score (RTS)[18], Abbreviated Injury Scale (AIS)[19], Organ Injury Scale[20], and the Injury Severity Score (ISS)[21]. Injuries with an AIS score $\geq$ 3 were considered severe. Patients presenting with free intraperitoneal fluid, retroperitoneal hematomas (with or without spinal fractures) and/or injuries to the abdominal wall, but without injuries to specific intra-abdominal anatomic structures, were defined as without intra-abdominal injury (IAI).

Patients were categorized into two groups: Group 1: with intra-abdominal injuries; Group 2: without intra-abdominal injuries. Variables for the two groups were compared to identify those significantly associated with the presence of intra-abdominal injuries, using the software *Statistical Package for Social Sciences®*. We first carried out a Bivariate analysis comparing the variables between groups. The Chi-square and Fisher´s tests were employed for nominal variables, whereas the Student´s *t*-test was used for quantitative variables. A value of $p<0.05$ was considered significant. Subsequently, the most important variables for diagnosing intra-abdominal injuries in the emergency room (except those depending on performance of abdominal ultrasound) with $p<0.20$ on bivariate analysis were selected to create a logistic regression model using the forward stepwise method.

RESULTS

During the study period, a total of 5,785 blunt trauma patients were attended, of which 5,202 (89.9%) presented no abdominal pain or abnormalities on physical examination of the abdomen at admission. Of these, 268 (5.1%) were submitted to computed tomography scan and/or exploratory laparotomy. In this group, age ranged from 14 to 98 years (mean 38.1±16.1) and 219 (81.7%) were male. Mean systolic arterial pressure, Glasgow coma scale, respiration rate and heart rate at admission were, respectively, 119.7±36.4 mmHg, 11.4±4.4, 17.0±9.0 ipm and 92.2±21.6 bpm. Mean RTS and ISS calculated for the sample were 6.64±1.8 and 19.5±14.0, respectively.

The most common trauma mechanisms were run-over pedestrians in 90 (33.6%) cases, accidents involving motorcyclists in 61 (22.8%), falls from height in 56 (20.9%), automobile accidents involving occupants of four-wheeled vehicles in 31 (11.6%), assault in 16 (6.0%) and fall from the standing height in 7 (2.6%). The remaining 7 (2.6%) cases had either multiple trauma mechanisms or could not be categorized into any of the above-mentioned groups.

Injuries to the head segment were identified in 131 (48.8%) cases, thorax in 91 (34.0%), abdomen in 75 (28.0%) and extremities in 133 (53.4%). Thirty-seven patients (13.8%) had pelvic fractures. Severe injuries (AIS $\geq$ 3) were detected in the head segment, thorax, abdomen, and extremities in 96 (35.8%), 75 (28.0%), 50 (18.7%) and 107 (39.9%), respectively.

FAST was performed in 69 of the 75 patients with intra-abdominal injuries, proving positive in 21 cases (30.4%). Complete abdominal ultrasound was performed in 38 of the 75 patients with intra-abdominal injuries, disclosing positive results in 34 (89.5%) cases. Abdominal computed tomography scans were performed in 66 of the

75 patients with intra-abdominal injuries, disclosing positive results in 64 (89.5%) cases.

The most frequent abdominal injuries were: splenic in 34 (12.7%) patients; hepatic in 33 (12.3%); and renal in 9 (3.3%). Injuries to the small intestine and colon were seen in 4 patients, representing 1.4% of the overall sample (Table 1). A total of 31 (11.6%) exploratory laparotomies were carried out, 15 (48.0%) of which were non-therapeutic. Abdominal surgical procedures performed were: splenectomy (8), diaphragm suture (3), enterorrhaphy (3), bladder suture (1), renal suture (1), enterectomy/ anastomosis (1), ligation of the common iliac vein (1) and revascularization of the common iliac artery (1).

Comparison of the numerical variables between groups revealed that patients with abdominal injuries (Group I) exhibited significantly lower mean AIS score for the head segment (1.0±1.4 vs. 1.8±1.9) and higher mean AIS thorax score (1.6±1.7 vs. 0.9±1.5) and ISS (25.7±14.5 vs. 17.1±13.1) than Group II (Table 2). We observed no significant difference between the groups as for mean systolic arterial pressure at admission, respiratory rate at admission, Glasgow coma scale score at admission, heart rate at admission, RTS, age or AIS in extremities.

A significant difference in trauma mechanism between the groups was detected (p<0.001). The rate of abdominal injuries was significantly greater in individuals run over by road vehicles (37.3%) and among motorcyclists (36.0%), compared to those suffering falls from height (13.3%), automobile accidents (9.3%), assault (1.3%) and falls from standing height (1.3%).

A significant difference was found (p<0.05) between groups as for frequency of chest drainage at admission (25.3% vs. 10.4%), abnormal pelvic radiograph (24.0% vs. 11.4%), brain swelling (0.7% vs. 6.7%), traumatic subarachnoid hemorrhage (6.7% vs. 12.4%), skull fracture (0.7% vs. 7.1%), hemothorax (24.0% vs. 14.0%), pneumothorax (25.3% vs. 9.3%), rib fractures (37.3% vs. 17.6%), flail chest (20.0% vs. 6.3%), lung contusion (28.0% vs. 11.4%), chest drainage (33.3% vs. 15.0%), and pelvic fractures (26.7% vs. 8.8%) (Table 3). Thirty-three (12.3%) patients died, but there was no difference in lethality between groups (10.7% vs. 13.0%).

Table 1 - Intra-abdominal injuries detected in 75 blunt trauma patients admitted without abdominal pain or changes on physical examination of the abdomen (Group 1), according to AAST-OIS grade.

	I	II	III	IV	V	Total
Spleen	8	10	8	5	3	34 (45.3%)
Liver	7	13	9	3	1	33 (44.0%)
Kidneys	1	3	3	0	2	9 (12.0%)
Small intestine/colon	0	2	1	1	0	4 (5.3%)
Diaphragm	0	0	3	0	0	3 (4.0%)
Bladder	0	1	1	0	0	2 (2.6%)
Abdominal vessels	0	0	0	1	0	1 (1.3%)

Source: records and trauma registry of the Pronto Socorro Central da Irmandade da Santa Casa de Misericórdia de São Paulo (2008/2010).

Table 2 - Comparison of numerical variables between groups.

Variables	p	Group I N=75		Group II N=193	
		Mean	Standard Deviation	Mean	Standard Deviation
Age (years)	0.593	37.2	38.4	38.4	16.3
SAP at admission(mmHg)	0.111	113.9	122.1	122.1	35.5
Respiratory rate	0.139	18.4	9.7	16.4	8.6
Heart rate (bpm)	0.566	93.5	91.7	91.7	22.9
Glasgow Coma Scale	0.120	12.3	10.9	10.9	4.5
AIS in head	<0.001	1.0	1.4	1.8	1.9
AIS in thorax	0.001	1.6	1.7	0.9	1.5
AIS in extremities	0.869	1.7	1.6	1.6	1.8
ISS	<0.001	25.7	14.5	17.1	13.1
RTS	0.730	6.7	6.6	6.6	1.8
TRISS	0.598	0.97	0.9	0.95	0.1

Source: records and trauma registry of the Pronto Socorro Central da Irmandade da Santa Casa de Misericórdia de São Paulo (2008/2010). SAP: Systolic arterial pressure; AIS: Abbreviated Injury Scale; ISS: Injury Severity Score; RTS: Revised Trauma Score; TRISS: Trauma And Injury Severity Score.

Similarly, no significant difference was found between the groups in terms of frequency of orotracheal intubation at admission, extradural hematoma, subdural hematoma, brain contusion, diffuse axonal injury, skull base fracture, spinal cord trauma, upper and lower limb fractures, or open fractures of the upper and lower limbs (Table 3).

The following variables were input to the logistic regression model: systolic arterial pressure at admission, respiratory rate at admission, Glasgow coma scale score at admission, abnormal neurological physical exam, abnormal physical exam of the thoracic region, rib fractures, abnormal pelvic radiograph, abnormal chest radiograph and trauma mechanisms (run-over pedestrian, motorcyclist, fall from height, fall from standing height, occupant of four-wheeled automobile and assault). The model built using logistic regression yielded 73.5% accuracy for identifying abdominal injuries. The variables included were: motorcyclist as trauma mechanism (p<0.001 – OR 5.51; 95%CI 2.40-12.64), presence of rib fractures (p<0.003 – OR 3.00; 95%CI 1.47-6.14), run-over pedestrian as trauma mechanism (0.008 – OR 2.85; 95%CI 1.13-6.22) and abnormal neurological physical exam at admission (p=0.015 – OR 0.44; 95%CI 0.22-0.85).

DISCUSSION

The devising of a definitive protocol for diagnosing intra-abdominal injuries in blunt trauma patients remains a challenge, since potentially lethal injuries often go undetected on physical, laboratory and imaging exams[4]. Use of the most accurate exam, computed tomography, is becoming increasingly limited, mainly owing to its association with the genesis of malignant tumors[12,13].

The results of this study in a sample of blunt trauma patients without abdominal pain or altered physical

Table 3 - Comparison of categorical variables between groups.

Variable	Group I (%) N=75	Group II (%) N=193	p
Orotracheal intubation	21.3	31.6	0.095
Chest drainage at admission	25.3	10.4	0.007
Abnormal neurological physical exam	41.3	56.5	0.025
Abnormal thorax physical exam	38.7	21.2	0.004
Abnormal chest radiograph	54.7	28.0	<0.001
Abnormal pelvic radiograph	24.0	11.4	0.033
Extradural hematoma	5.3	11.4	0.363
Subdural hematoma	4.0	11.4	0.097
Traumatic subarachnoid hemorrhage	6.7	12.4	0.044
Brain contusion	5.3	7.8	0.124
Diffuse axonal injury	0.7	6.7	0.343
Brain Swelling	0.7	7.1	0.046
Skull fracture	0.7	4.9	0.036
Skull base fracture	2.7	6.4	0.157
Spinal cord trauma	5.3	8.3	0.294
Hemothorax	24.0	14.0	0.035
Pneumothorax	25.3	9.3	0.003
Rib fracture	37.3	17.6	0.001
Flail chest	20.0	6.3	0.001
Lung contusion	28.0	11.4	0.003
Chest drainage	33.3	15.0	0.003
Pelvic fracture	26.7	8.8	<0.001
Upper limb fracture	17.3	14.0	0.304
Lower limb fracture	17.3	13.5	0.702
Open upper limb fracture	4.0	4.1	0.630
Open lower limb fracture	5.3	7.8	0.343
Severe injury in head segment	22.7	40.9	0.005
Severe injury in thorax segment	45.3	21.2	<0.001
Severe injuries in extremities	40.0	39.9	0.988

Source: records and trauma registry of the Pronto Socorro Central da Irmandade da Santa Casa de Misericórdia de São Paulo (2008/2010).

exam of the abdomen showed that several clinical variables were significantly associated with the presence of intra-abdominal injuries, such as trauma mechanism and presence of thoracic injuries.

It is important to emphasize that the sample investigated in this study represented only a fraction (5.1%) of the total blunt trauma patients seen at that service during the study period. The trauma scores RTS (6.64±1.8) and ISS (19.5±14.0) revealed a more severe group, selected for CT or exploratory laparotomy. The rate of intra-abdominal injuries (28.0%) was also higher than that observed in other series[1,2,9]. However, in clinical practice most diagnostic doubts about intra-abdominal injuries arise in the situations represented by the sample.

One of the most widely recognized factors hampering diagnosis in blunt trauma patients is impaired consciousness secondary to head trauma or use of sedatives, particularly among subjects submitted to orotracheal intubation at admission[22]. In our study, those patients presenting with abdominal injuries had greater mean GCS score at admission and lower mean AIS score in the head segment. Multivariate analysis of the present sample showed that the presence of abnormal neurological physical exam at admission was inversely correlated with presence of intra-abdominal injuries (OR 0.44; 95%CI 0.22-0.85).

However, this finding does not preclude the need for objective abdominal evaluation in severe trauma patients with reduced level of consciousness. It is noteworthy that a previous study involving a sample of unselected blunt trauma patients found greater head trauma severity in patients with intra-abdominal injuries[22]. Comparison against this data reveals that the present study sample contained patients that were more severe with a higher rate of intra-abdominal injuries, possibly explaining the logistic regression results.

Mean thorax AIS, as well as frequencies of hemothorax, pneumothorax, rib fractures and flail chest, were higher in patients with intra-abdominal injuries. This finding was described in previous reports directly associating severity of thoracic trauma with the presence of intra-abdominal injuries[14,15,16]. This marker also held true for the present group of trauma patients, admitted without abdominal pain or altered abdomen physical examination. On the multivariate analysis, the presence of rib fractures was significantly associated with intra-abdominal injuries (OR 3.00; 95%CI 1.47-6.14).

It is believed that associated injuries in other body segments, particularly severe injuries, can "mask" the presence of intra-abdominal injuries[3]. In this group of "asymptomatic" patients, both AIS in extremities and the rate of upper and lower limb fractures were not statistically associated with higher frequency of intra-abdominal injuries. The selection of patients apparently influences this finding. In the 2004 study of Gonzales *et al.*[2], intra-abdominal injuries were found in only 1.2% of blunt trauma patients with extra-abdominal injuries requiring surgery. By contrast, a high percentage of cases had severe intra-abdominal injuries requiring surgical treatment in our sample. This highlights the need for objective investigation of the abdomen even in asymptomatic cases.

Notably, the rate of pelvic fractures was higher in patients with intra-abdominal injuries, corroborating the findings of other studies[15,16,22]. Pelvic fractures appear to be a marker of severity in trauma, and intra-abdominal injuries should always be actively investigated in these cases. On multivariate analysis however, we detected no significant association between abnormal radiographs of the pelvis and abdominal injuries, most likely owing to sample selection.

We found no difference between groups for vital signs data at admission. In other studies, arterial hypotension was identified as a marker of the presence of intra-abdominal injuries in blunt trauma patients[14,16,22]. When analyzing unselected blunt trauma patients, Glasgow Coma Scale score, heart and respiratory rates and RTS have been shown to be significantly associated with the presence of intra-abdominal injuries[22]. This is perhaps the most important finding in the present study. In the cases with absence of abdominal pain and normal abdominal physical exam, vital signs data did not serve as a discriminating parameter for the detection of intra-abdominal injuries in this selected sample of severe patients with a high frequency of associated injuries.

Trauma mechanism was also a variable included in the multivariate analysis using logistic regression. Both motorcyclists involved in accidents (OR 5.51; 95%CI 2.40-12.64) and run-over pedestrians (OR 2.85; 95%CI 1.13-6.22) had a higher likelihood of sustaining intra-abdominal injuries. In an earlier study involving unselected blunt trauma patients, a significant association was found between motorcyclists and severe intra-abdominal injuries[23].

Some authors have proposed a combination of variables to determine risk scores for intra-abdominal injuries[1,15,24,25], indicating the use of complementary exams. Specific scores were proposed for children and adults, with optimized areas under the ROC curve. Studies validating these scores in a homogeneous population are currently lacking. We found no similar proposals for blunt trauma patients without abdominal pain or altered abdomen exam.

A retrospective analysis such as this has some limitations. In order to ensure a "true negative" as a basis for comparison, we chose to include only individuals submitted to exploratory laparotomy and/or computed tomography of the abdomen and pelvis. This would decrease the "false negative" rate. However, both procedures depend on subjective analysis. Despite the common understanding that patients sustaining diffuse peritonitis, uncontrolled abdominal hemorrhage, diaphragmatic hernias or intraperitoneal bladder rupture should be best treated with surgical exploration, other situations could raise discussion about the best option. The same is observed in the CT protocols for abdominal assessment. There are several options and many depend

on personal interpretation. From a population of 5,202 blunt trauma patients, only 5% were included and, certainly, this sample does not represent the entire population of blunt trauma victims.

A consequence of this selection was the possibility of non-inclusion in the sample of some patients whose intra-abdominal injury was not diagnosed for not having undergone CT or exploratory laparotomy. There were no reports, however, of readmissions to the hospital for complications of undetected intra-abdominal injuries during the study period. Nonetheless, this does not rule out the possibility of minor injuries which did not manifest clinically.

The standardization of the physical exam of the abdomen may also draw criticism. However, not only resident doctors admitted the patients but also attending physicians from the service. The inclusion of trauma patients with impaired consciousness and/or arterial hypotension in this study may also raise questions, since these are high-risk patients for suspected intra-abdominal injuries despite a normal abdominal physical exam. Nevertheless, even in this specific group of patients there is a risk of undiagnosed injuries, with subsequent serious consequences. Inclusion of these cases was therefore deemed important.

A final analysis of the data clearly evidences the association of trauma mechanisms and chest injuries with the presence of intra-abdominal injuries in this group of blunt trauma patients admitted without abdominal pain or abnormalities on physical examination of the abdomen. Other classic predictors of intra-abdominal injuries described in unselected blunt trauma patients, such as systolic arterial pressure at admission and presence of severe injuries to the extremities, among others, were not associated with intra-abdominal injuries in the sample studied. This absence of association might be explained by the anatomical and physiological severity of the patients selected for this study.

R E S U M O

Objetivo: *avaliar os indicadores de lesões intra-abdominais em vítimas de trauma fechado admitidas sem dor abdominal ou alterações no exame físico do abdome.* ***Método:*** *estudo retrospectivo das vítimas de trauma fechado com idade superior a 13 anos, admitidas no período de 2008-2010. Selecionamos para estudo todos que foram submetidos à tomografia computadorizada de abdome e/ou laparotomia exploradora e que, à admissão, não apresentavam dor abdominal ou alterações ao exame físico do abdome. Os doentes foram separados em: Grupo 1 (com lesões intra-abdominais) e Grupo 2 (sem lesões intra-abdominais). As variáveis foram comparadas entre os grupos, considerando p<0,05 como significativo. Em um segundo passo, selecionamos as variáveis com p<0,20 na análise bivariada para criar modelo de regressão logística pelo método* forward stepwise. ***Resultados:*** *foram incluídos 268 casos. Os doentes com lesão abdominal caracterizaram-se por apresentar, significativamente (p<0,05), menor média de AIS em segmento cefálico (1,0 ± 1,4* vs. *1,8 ± 1,9), bem como, maior média de AIS em tórax (1,6 ± 1,7* vs. *0,9 ± 1,5) e de ISS (25,7 ± 14,5* vs. *17,1 ± 13,1). A frequência de lesões abdominais foi significativamente maior nas vítimas de atropelamentos (37,3%) e motociclistas (36%) (p<0,001). A regressão logística construiu um modelo utilizando as seguintes variáveis: motociclista como mecanismo de trauma (p<0,001- OR=5,51; IC95% 2,40-12,64), presença de fraturas de costelas (p<0,003 – OR=3,00; IC95% 1,47-6,14), atropelamento como mecanismo de trauma (p=0,008 – OR=2,85; IC95% 1,13-6,22) e exame físico neurológico anormal a admissão (p=0,015 – OR=0,44; IC95% 0,22-0,85).* ***Conclusão:*** *as lesões intra-abdominais foram relacionadas principalmente com o mecanismo de trauma e a presença de lesões torácicas.*

Descritores: *Diagnóstico. Diagnóstico Tardio. Causas Externas. Traumatismo Múltiplo. Traumatismos Abdominais.*

REFERENCES

1. Poletti PA, Mirvis SE, Shanmuganathan K, Takada T, Killeen KL, Perlmutter D, et al. Blunt abdominal trauma patients: can organ injury be excluded without performing computed tomography? J Trauma. 2004;57(5):1072-81.
2. Gonzalez RP, Han M, Turk B, Luterman A. Screening for abdominal injury prior to emergent extra-abdominal trauma surgery: a prospective study. J Trauma. 2004;57(4):739-41.
3. Ferrera PC, Verdile VP, Bartfield JM, Snyder HS, Salluzzo RF. Injuries distracting from intraabdominal injuries after blunt trauma. Am J Emerg Med. 1998;16(2):145-9.
4. Jones EL, Stovall RT, Jones TS, Bensard DD, Burlew CC, Johnson JL, et al. Intra-abdominal injury following blunt trauma becomes clinically apparent within 9 hours. J Trauma Acute Care Surg. 2014;76(4):1020-3.
5. Sung CK, Kim KH. Missed Injuries in abdominal trauma. J Trauma. 1996;41(2):276-82.
6. Crookes BA, Shackford SR, Gratton J, Khaleel M, Ratliff J, Osler T. "Never be wrong": the morbidity of negative and delayed laparotomies after blunt trauma. J Trauma. 2010;69(6):1386-91; discussion 1391-2.
7. Eren B, Türkmen N, Gündo mu ÜN. Delayed spleen rupture after blunt abdominal trauma (case report). Georgian Med News. 2012;(206):22-4.
8. Ertugrul G, Coskun M, Sevinc M, Ertugrul F, Toydemir T. Delayed presentation of a sigmoid colon injury following blunt abdominal trauma: a case report. J Med Case Rep. 2012;6:247.
9. Nishijima DK, Simel DL, Wisner DH, Holmes JF. Does this adult patient have a blunt intra-abdominal injury? JAMA. 2012;307(14):1517-27.
10. Sise MJ, Kahl JE, Calvo RY, Sise CB, Morgan JA, Shackford SR, et al. Back to the future: reducing reliance on torso computed tomography in the initial evaluation of blunt trauma. J Trauma Acute Care Surg. 2013;74(1):92-7; discussion 97-9.

11. Deunk J, Brink M, Dekker HM, Kool DR, van Kuijk C, Blickman JG, et al. Routine versus selective computed tomography of the abdomen, pelvis, and lumbar spine in blunt trauma: a prospective evaluation. J Trauma. 2009;66(4):1108-17.
12. Zallman L, Woolhandler S, Himmelstein D, Bor DH, McCormick D. Computed tomography associated cancers and cancer deaths following visits to U.S. emergency departments. Int J Health Serv. 2012;42(4):591-605.
13. Printz C. Computed tomography scans and cancer risk: the latest findings. Cancer. 2013;119(4):701-2.
14. Mackersie RC, Tiwary AD, Shackford SR, Hoyt DB. Intra-abdominal injury following blunt trauma. Identifying the high-risk patient using objective risk factors. Arch Surg. 1989;124(7):809-13.
15. Deunk J, Brink M, Dekker HM, Kool DR, Blickman JG, van Vugt AB, et al. Predictors for the selection of patients for abdominal CT after blunt trauma: a proposal for a diagnostic algorithm. Ann Surg. 2010;251(3):512-20.
16. Beck D, Marley R, Salvator A, Muakkassa F. Prospective study of the clinical predictors of a positive abdominal computed tomography in blunt trauma patients. J Trauma. 2004;57(2):296-300.
17. Teasdale G, Jennet B. Assessment of coma and impaired consciousness: a pratical scale. Lancet. 1974;2(7872):81-4.
18. Champion HR, Sacco WJ, Copes WS, Gann DS, Gennarelli TA, Flanagan ME. A revision of the Trauma Score. J Trauma. 1989;29(5):623-9.
19. Association for the Advancement of Automotive Medicine (USA), Committee on Injury Scaling. The abbreviated injury scale-1990 Revision (AIS-90). Des Plaines, IL: Association for the Advancement of Automotive Medicine, 1990.
20. Moore EE, Moore FA. American Association for the Surgery of Trauma Organ Injury Scaling: 50th anniversary review article of the Journal of Trauma. J Trauma. 2010;69(6):1600-1.
21. Baker SP, O'Neill B, Haddon W Jr, Long WB. The injury severity score: a method for describing patients with multiple injuries and evaluating emergency care. J Trauma. 1974;14(3):187-96.
22. Farrath S, Parreira JG, Perlingeiro JAG, Soldá SC, Assef JC. Fatores preditores de lesões abdominais em vítimas de trauma fechado. Rev Col Bras Cir. 2012;39(4):295-301.
23. Farrath S, Parreira JG, Olliari CB, Silva MA, Perlingeiro JAG, Soldá SC, et al. Identificação de lesões abdominais graves na avaliação inicial das vítimas de trauma fechado. Rev Col Bras Cir. 2013;40(4):305-11.
24. Holmes JF, Wisner DH, McGahan JP, Mower WR, Kuppermann N. Clinical prediction rules for identifying adults at very low risk for intra-abdominal injuries after blunt trauma. Ann Emerg Med. 2009;54(4):575-84.
25. Shojaee M, Faridaalaee G, Yousefifard M, Yaseri M, Arhami Dolatabadi A, Sabzghabaei A, et al. New scoring system for intra-abdominal injury diagnosis after blunt trauma. Chin J Traumatol. 2014;17(1):19-24.

Received at: 15/12/2014
Accepted for publication: 13/02/2015
Conflict of interest: none.
Source of funding: none.

Mailing address:
José Gustavo Parreira.
E-mail: jgparreira@uol.com.br.

DOI: 10.1590/0100-69912015005009

Video assisted resections. Increasing access to minimally invasive liver surgery?

Ressecções videoassistidas. Ampliação do acesso à cirurgia hepática minimamente invasiva?

Fabricio Ferreira Coelho, TCBC-SP[1]; Marcos Vinícius Perini[1,2]; Jaime Arthur Pirola Kruger[1,2]; Renato Micelli Lupinacci[1,3]; Fábio Ferrari Makdissi[2]; Luiz Augusto Carneiro D'Albuquerque, TCBC-SP[4]; Ivan Cecconello, TCBC-SP[5]; Paulo Herman, TCBC-SP[6]

A B S T R A C T

Objective: To evaluate perioperative outcomes, safety and feasibility of video-assisted resection for primary and secondary liver lesions. **Methods**: From a prospective database, we analyzed the perioperative results (up to 90 days) of 25 consecutive patients undergoing video-assisted resections in the period between June 2007 and June 2013. **Results**: The mean age was 53.4 years (23-73) and 16 (64%) patients were female. Of the total, 84% were suffering from malignant diseases. We performed 33 resections (1 to 4 nodules per patient). The procedures performed were non-anatomical resections (n = 26), segmentectomy (n = 1), 2/3 bisegmentectomy (n = 1), 6/7 bisegmentectomy (n = 1), left hepatectomy (n = 2) and right hepatectomy (n = 2). The procedures contemplated postero-superior segments in 66.7%, requiring multiple or larger resections. The average operating time was 226 minutes (80-420), and anesthesia time, 360 minutes (200-630). The average size of resected nodes was 3.2 cm (0.8 to 10) and the surgical margins were free in all the analyzed specimens. Eight percent of patients needed blood transfusion and no case was converted to open surgery. The length of stay was 6.5 days (3-16). Postoperative complications occurred in 20% of patients, with no perioperative mortality. **Conclusion**: The video-assisted liver resection is feasible and safe and should be part of the liver surgeon armamentarium for resection of primary and secondary liver lesions.

Key words: Liver Neoplasms. Hepatectomy. Laparoscopy. Video-Assisted Surgery.

INTRODUCTION

Hepatic resection is one of the last frontiers transposed by minimally invasive surgery. Initial suspicions that had to be overcome for its development were the theoretical risk of air embolism, of uncontrollable intraoperative bleeding, uncertainties about getting adequate surgical margins, risk of tumor dissemination in the cases of malignancies and the need for large incorporation of technology (energy sources, vascular staplers, laparoscopic transducers to perform the intraoperative ultrasound and specific retractors to liver mobilization)[1,2]. In addition, the method's learning curve is steep, requiring surgeons with experience in liver surgery and advanced laparoscopic surgery training[2-4].

Driven by good initial results, different series have shown that laparoscopic liver resections (LLR) are feasible, safe and provide benefits over the conventional approach. Among the advantages of LLR are less bleeding, lower incidence of perioperative complications, less postoperative pain, shorter hospital stay and lower incisional hernias rates[4,5].

The best candidates for the method are those with lesions in the antero-lateral liver segments (segments 2, 3, 4b, 5 and 6), also referred to as "laparoscopic segments"[1,5,6]. Currently, LLR in these segments, and the left side sectionectomy (bisegmentectomy 2 3), have been considered as the gold standard in centers specialized[7]. Challenges to laparoscopy are still the resection of multiple and bilateral lesions, nodules in the superior, posterior or central locations (segments 1, 4a, 7 and 8) and major hepatectomy (e" three segments)[1,2,5,6]. However, with increasing experience with the method, the advent of new technologies and the development of alternative modalities within the minimally invasive liver surgery (MILS), the technical difficulties inherent to these resections could be overcome, enabling the successful realization of larger LLR, such as the left and right hepatectomy or even trisectionectomy[8]. More recently, LLR has been also applied for removing living donor liver grafts[9].

1. Serviço de Cirurgia do Fígado e Hipertensão Portal do HCFMUSP, São Paulo, Brasil; 2. Instituto do Câncer do Estado de São Paulo (ICESP), São Paulo, Brasil; 3. Assistant Spécialiste, Service de Chirurgie Générale, Viscérale et Endocrinienne; Hôpital Pitié Salpetrière, Paris, France; 4. Disciplina de Transplantes de Órgãos do Aparelho Digestivo, FMUSP, São Paulo, Brasil; 5. Departamento de Gastroenterologia da FMUSP, São Paulo, Brasil; 6. Disciplina de Cirurgia do Aparelho Digestivo, FMUSP, São Paulo, Brasil.

The modalities most commonly employed within the are purely (or fully) laparoscopic operation, the one with hand assistance and the video-assisted operation (hybrid). The purely laparoscopic is preferable in most services; in this mode the whole procedure is performed laparoscopically and an incision is performed at the end of the procedure for withdrawal of the specimen[10,11].

Hand-assisted and video-assisted resections emerged in order to overcome some of the limitations of the totally laparoscopic approach and thus broaden MILS access and indications[1,10,11]. These modalities allow handling closer to conventional hepatectomy and return the tactile sensation partially lost in laparoscopy, facilitating palpation and lesions identification, and allows the compression of the parenchyma during liver transection, providing greater safety[1,12,13].

The hand-assisted approach has been used for resection of lesions located in the liver posterior-superior segments and major hepatectomy[9,12,14]. The major disadvantages of the method are fatigue by a non ergonomic position in prolonged operations, loss of gas through the hand portal and the high cost, since the hand insertion device device does not obviate the need for energy sources and vascular staplers for section of the hepatic parenchyma[1,14].

Video-assisted or hybrid liver surgery, on its turn, is not widely used, but has potential that can spread its use. In this modality, the procedure is started via total laparoscopy or hand-assisted, with the performance of the complete liver mobilization; after that, a programmed minilaparotomy is carried, with section of the parenchyma by conventional means[10,11,14]. This mode has some of the advantages presented by the hand-assisted resection, the possibility of using the tactile perception for identification of deep lesions and aid in parenchymal section. The approach by the auxiliary incision allows maneuvers similar to conventional surgery such as liver compression and manual (or clamp) control of the vascular pedicle. The closeness with the conventional procedure can reduce the learning curve and the direct costs of the operation[13,15].

The purpose of this paper is to present the results and evaluate safety and feasibility of video-assisted resection for primary and secondary liver injuries.

METHODS

From June 2007 to June 2013 155 LLR were held in the Sevice of Liver Surgery and Portal Hypertension of the Hospital das Clínicas da Faculdade de Medicina da Universidade de São Paulo (HCFMUSP). Of these we studied 25 consecutive patients undergoing video-assisted liver resection from a prospective database. The study was approved by the Ethics in Research Committee of the institution under number 14260.

We defined hybrid resection as the procedure initiated totally laparoscopically or hand-assisted for mobilization liver (whether with dissection of the vascular pedicles and hepatic veins or not). After this, through elective minilaparotomy, dissection of the pedicles and hepatic veins was carried out (if not previously done) and the section of the parenchyma. Cases converted by intraoperative complications were excluded.

We included patients with primary and secondary liver lesions with liver resection indication according to their etiology (Table 1). Patients with hepatic adenomas underwent resection if symptomatic or if with lesions larger than 5 cm. Patients with liver metastases of colorectal cancer and other types of cancer were operated within a context of control of the primary tumor and appropriate chemotherapy. Patients with liver cirrhosis and hepatocellular carcinoma (HCC) were candidates for surgery with preserved liver function (Child-Pugh A and Model for End-satge Liver disease [MELD] <10) and lesions considered resectable (preservation of at least 40-50% of liver parenchyma). Patients with liver cirrhosis and portal hypertension had selective indication, being considered eligible for surgery those with fine caliber esophageal varices and platelets > 100,000/ml.

The indication for surgical treatment, as well as the access rout, was made after discussion in a multidisciplinary meeting. The video-assisted mode was considered in patients that anticipated preoperatively technical difficulties arising from the location, size or multinodularity, in particular when requiring major resections and resection of postero-lateral superior segments (1, 4a, 7 and 8).

We studied the following preoperative characteristics: age, gender, preoperative diagnosis, size and location of the lesions, previous surgeries, in addition to Child-Pugh and MELD scores in cirrhotic patients. Regarding the intra-operative period, the information of interest were: type of procedure, duration of surgery and anesthesia, need for blood transfusion, as well as intraoperative complications and the need for conversion.

Table 1 - Indications of the video-assisted liver resections.

Indication	n
CRCHM	11
HCC	8
Hepatocellular adenoma	4
Anal canal SCC metastasis	1
Metastatic neuroendocrine tumor	1
Total	25

Source: Medical records, Service of Liver Surgery and Portal Hypertension (HCFMUSP-2007/2013).
CRCHM: liver metastasis of colorectal cancer, HCC: hepatocellular carcinoma, SCC: squamous cell carcinoma.

In the postoperative period we studied the length of stay in ICU and hospital, clinical and surgical complications and early mortality (up to 90 days after the procedure). Complications were stratified according to the Dindo-Clavien classification[16].

Operative Technique

The surgical technique was standardized, all patients were placed in Lloyd-Davis position with the surgeon standing between the patient's legs. For the right resections we placed a cushion under the right shoulder blade and an arc to accommodate the right upper limb, in addition to the use of the left lateral position (45°) to facilitate the exposure of the posterior right hepatic sector. For the left resections we used only a slight inclination. The pneumoperitoneum was performed by open technique, maintaining the intra-abdominal pressure between 12 and 14 mmHg. Central venous pressure was kept below 5 mmHg to minimize the risk of bleeding during the section of the hepatic parenchyma.

In right hepatectomies or resections of segments of the right hepatic lobe, we used four or five portals, as depicted in Figure 1A. We instilled the pneumoperitoneum in the periumbilical region and placed a 10 mm trocar for introduction of a 30° endoscope. Under direct vision we placed two working trocars in the right hypochondrium, 8 to 10 cm apart from each other (Figure 1A). One of the assistants used the 5 mm subxiphoid trocar to retraction of the right hepatic lobe. In some cases we used an additional portal on the right flank between the middle and anterior axillary line to approach the ligaments of the right lobe (Figure 1A). We began the procedure in totally laparoscopic approach with the release of the round and falciform ligaments. After this, we divided the right triangular and coronary ligaments, guaranteeing the full mobilization of the right lobe. Thus, even lesions in posterior segments could be shifted to the left and addressed by the auxiliary incision. One could also, depending on the type of procedure and surgeon's skill, perform the dissection of the vascular pedicle and right hepatic vein at this operative time. After this, we performed a minilaparotomy in the right upper quadrant, joining the working portals, or a 8-10 cm supraumbilical midline incision (Figure 1A). In the case of malignant disease or anatomical doubt, at this time we performed intraoperative ultrasound with a conventional transducer by the auxiliary incision. Finally, we completed the procedure by conventional surgery with dissection and ligation of the pedicle (where necessary) and the section of liver parenchyma (Figure 2). We did not use vascular stapling devices in any case.

For the resections of lesions located in the left hepatic lobe we used three or four trocars positioned as depicted in Figure 1B. We placed the endoscope in the periumbilical region, the surgeon's working trocars to the right and left upper quadrant, and an additional trocar in some cases in the subxiphoid region to aid in the presentation of the liver (Figure 1B). We released the left triangular ligament to the right until the left hepatic vein, which we did not routinely isolate and dissect. After total hepatic liberation, we made a 8-10 cm supraumbilical midline incision and finished the procedure conventionally.

We selectively used the Pringle and hemi-Pringle maneuvers, when necessary[17]. We removed the surgical specimen through the auxiliary incision with a protective bag. The drainage of the surgical bed was not routine; when indicated, we used a closed system chest tube.

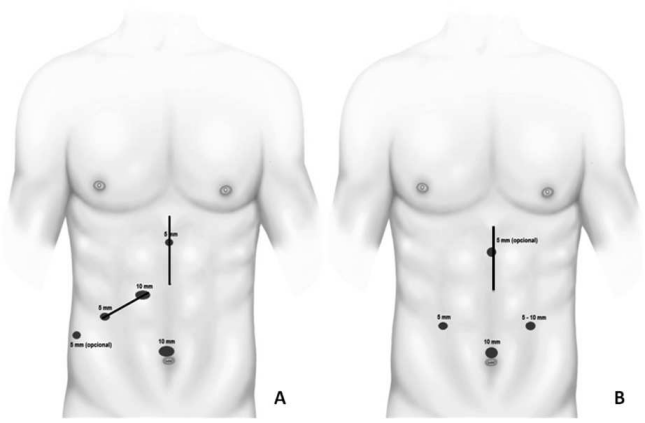

Figure 1 - *A) placing of the portals for resections of lesions in the right lobe. Note the placement of working portals in the right hypochondrium in a more cranial position situated 8 to 10 cm from each other. The auxiliary incision can be made in the right upper quadrant joining the incisions of the working trocars or in the midline. B) Placing of portals for left lobe resections. The auxiliary incision is made in the midline, in a span of 8 to 10 cm.*

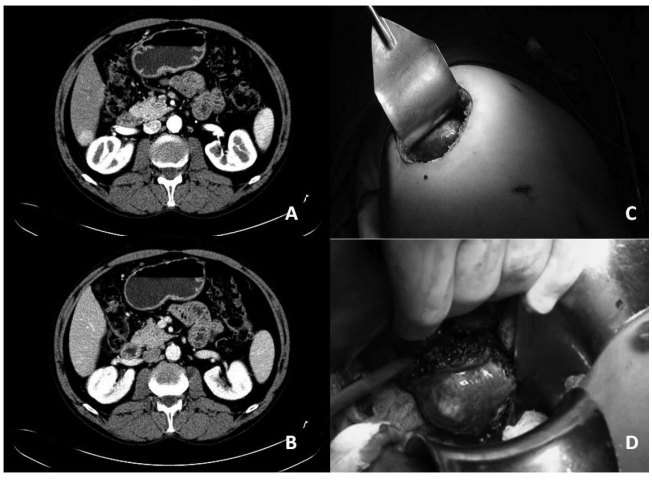

Figure 2 - *Patient with chronic liver disease due to hepatitis C virus and hepatocellular carcinoma (HCC). A and B) 2.5 cm lesion with wash-out in the segment 7. C) Auxiliary incision (10cm) detail in the right upper quadrant. D) after the liver liberation, the right lobe can be shifted to the left, the lesion exteriorized through the incision, and the section of the hepatic parenchyma carried out with conventional techniques.*

RESULTS

From June 2007 to June 2013 we held 155 LLR, 25 (16.1%) being video-assisted hepatectomies. Of the 25 operated patients, 16 (64%) were female. The average age was 53.4 years (range 23-73). Thirteen patients (52%) had previous abdominal surgery. Of the total, 21 (84%) patients had primary or secondary malignancies of the liver. The eight patients with HCC were Child-Pugh A, with functional MELD ranging between 6 and 8, four (50%) having signs of portal hypertension at endoscopy or tomography.

We performed a total of 33 resection, being extirpated from one to four nodules per patient (21 showed a single lesion, one patient two lesions, two patients three lesions and one patient four lesions). The average size of the resected nodules was 3.2 cm (0.8 to 10). Twenty lesions were located in the right lobe and 13 in the left lobe.

We initiated all procedures by the totally laparoscopic approach, with an auxiliary right subcostal incision in 14 cases and a median supraumbilical one in 11. The procedures performed are listed in Table 2. Of the total, 22 (66.7%) operated on postero-lateral superior segments, requiring multiple or larger resections. The mean duration of surgery was 226 minutes (80-420) and 360 minutes of anesthesia time (200-630). Surgical margins were free in all the analyzed specimens.

Two patients (8%) had controlled bleeding during the procedure, requiring transfusion (1-2 units of packed red blood cells). No cases were converted. We referred 16 patients (64%) to the ICU postoperatively, the average stay being 1.1 days (1 to 3). The mean hospital stay was 6.5 days (3-16).

Postoperative complications occurred in five patients (20%) and are listed in Table 3. We managed most of the complications conservatively, with the need for elective repair of one incisional hernia and guided puncture and antibiotic therapy in one patient with a collection in the hepatic resection bed. There were no deaths related to the procedure.

DISCUSSION

Since the first report of performing peripheral LLR by Reich et al., The MILS underwent a major breakthrough[18]. Anatomical resections (bisegmentectomy 2-3) and later more complex resections were described as feasible and safe. The initial MILS experience developed primarily with a purely laparoscopic method, which is preferred by most services. A review of LLR literature published until 2008 showed that 75.1% of cases had been fully operated by laparoscopy, 16.5% by the hand-assisted approach and only 2.1% by the hybrid technique[10]. In our service, there is also a predilection for the pure laparoscopic mode when possible. During the study period 79.4% (136/155) of LLR were made by this technique, this being the method of choice for antero-lateral resections and left lateral sectionectomy.

Despite the experience gain with the purely laparoscopy route, there are limitations inherent in the method that hinder its spread, among which we can mention the high direct cost for the need of large technological resources, the high level of technical proficiency required and the steep learning curve[2,5,6]. In one study addressing this question, Vigano et al.[3] identified the need of 60 operated cases before reaching the maturity in terms of complications and results with the method. From a technical point of view, the main limitations are the difficulty of mobilizing and retracting the liver, the two-dimensional view, difficult access to higher and higher liver segments, difficulty in dissecting the hepatic veins, as well as difficulty in performing vascular and biliary sutures. For this reason, the resection of lesions located in the posteri-or-superior liver segments, multiple bilobar resections and major hepatectomy, although achievable, are still challenging, being indicated in selected cases[1,6,8].

In this context arose the video-assisted surgery, aiming to overcome some of the limitations of the totally laparoscopic mode, thus expanding access and enhancing LLR security[12,14,19]. The first hybrid resections were reported by Huscher et al.[20], who applied the method for larger right resections. Although not widely used, video-assisted

Table 2 - Types of video-assisted procedures performed.

Procedure	n (%)
Non-anatomical resections	26 (78.8%)
Segmentectomy	1 (3%)
Bisegmentectomy 2-3	1 (3%)
Bisegmentectomy 6-7	1 (3%)
Left hepatectomy	2 (6.1%)
Right hepatectomy	2 (6.1%)
Total	33

Source: Medical records, Service of Liver Surgery and Portal Hypertension (HCFMUSP-2007/2013).

Table 3 - Frequency and classification of postoperative complications.

Complication	n (%)	Classification*
Incisional Hernia	1 (4%)	dIIIB
Intra-abdominal fluid collection	1 (4%)	IIIA
Hepatic Encephalopathy	1 (4%)	II
Ileus	1 (4%)	I
Ascites	1 (4%)	I
Total	5 (20%)	-

Source: Medical records, Service of Liver Surgery and Portal Hypertension (HCFMUSP-2007/2013).
** Stratification according to the Dindo-Clavien Classification[16].*

hepatectomy has potential benefits that can justify its spread. First, this technique can attach the benefits of laparoscopy for liver mobilization, without the need of large incisions to access the liver, with "security" of the conventional resection, particularly in times of increased risk, such as during parenchymal section[13,15,19]. By being closer to the conventional method, it requires less learning curve and can be used by surgeons with less experience in advanced laparoscopic surgery. For this reason, it's the choice (even for simple resections) on services which are starting their experience in MILS. The technical standardization and training obtained from the liver release can serve as a basis for conducting more complex, entirely laparoscopic resections[14].

It is difficult for most centers to have all the necessary resources to fully carry out laparoscopic procedures. In this situation, the hybrid technique can also be an attractive option, since it enables the performance of LLR without the use of specific energy sources and vascular stapling to the section of the parenchyma and without the use of laparoscopic transducers to perform the intraoperative ultrasonography in malignant diseases, which considerably reduces the procedure's direct costs[15,21].

The video-assisted approach can be used for any type of LLR; however, its best indication occurs when there is foreseen technical difficulty in locating or resecting a lesion, being an extremely useful option for those located in the segments of difficult laparoscopic access, for multiple resections and for major hepatectomy[21,22]. In this series, these conditions were present in 66.7% of the indications.

In a multicenter study of 210 major hepatectomies, Dagher et al. reported that only 43.3% of the procedures were performed by the totally laparoscopic technique[23]. In a recent publication, Nitta et al. showed that in Japanese centers 88.7% of major hepatectomies are carried out by the hybrid technique, versus only 7.5% for the pure laparoscopic technique and 3.8% with hand assistance[24]. Consistent with these data, a systematic review comparing the modalities purely laparoscopic, hand-assisted and hybrid for larger resections showed that video-assisted technique has its greatest applicability in lesion resections in difficult places, patients predicted to pose technical difficulties (such as in patients with chronic liver disease and HCC) and resections requiring delicate hilar dissection, such as living donors hepatectomy[8]. In the latter subgroup a hybrid approach has wide applicability, being the preferred technique in many transplant centers, with superior results and complication rates similar to conventional hepatectomy[25].

The hybrid mode may also be useful in cases of resection for malignant disease, which is currently the dominant indication in most series, as well as in ours (84%)[10,26]. Intraoperative ultrasound is essential in these cases, because even with modern imaging methods it may change the surgical approach in as much as 25% of cases[27]. However, laparoscopic transducers are still difficult to access for most services. In addition, one of the great obstacles of laparoscopy is loss of tactile sensation, which can impair the finding of non-superficial lesions and thus hamper the achievement of adequate oncological margins[19]. With the hybrid approach these problems can be overcome; the Union between tactile palpation and ultrasound (performed with conventional equipment) may explain the high rate of free margins in our series.

Potential disadvantages of this method are inadequate exposure of the liver to manipulation by the auxiliary incisions and doubt regarding the possible loss of benefits of laparoscopy. One of the fundamental points in the video-assisted surgery is complete liver mobilization, thus it is essential that for lesions on the right side the triangular and coronary ligaments are fully released, as well as the round and falciform ligaments. Additionally, the positioning of the patient in sharp left lateral position is important, ensuring that even posterior lesions can be displayed and manipulated through small incisions in the anterior abdominal wall. In left resections the ligaments' release is usually enough to liver mobilization, a sharp decubitus not being generally necessary. The choice of the incision site is also important for technical success; we prefer a right subcostal incision for the access to lesions in the posterior region, however, there are authors who perform the procedure with a median incision with good results[19,22]. On the left or bilobar resections a median incision allows access to all segments, being the one of choice.

Regarding the results of hybrid resections, some authors have demonstrated its feasibility and safety[28-30]. We observed no intraoperative complications, transfusion being required in 8% of patients, similar to that reported by other authors[14,15,28-30]. The conversion rate was zero, reaching 7% in the literature[13,14,26,30]. The frequency of 20% of postoperative complications found in this study is in agreement with other series, which report rates ranging from 5.7 to 24%[13,14,21,26], noting that most resections performed were complex and complications were of low gravity, with no complications comprising organ dysfunction or readmission to the ICU.

Comparative studies show that the hybrid resections maintain the safety of conventional ones, with no increase in complications, causing less postoperative pain and shorter hospital stay[15,31]. Johnson et al. compared the results of conventional and hybrid surgery (125 conventional versus 88 hybrid) and found similar complication rates (10.5% conventional versus 6.8% hybrid, p = 0.59) with a reduction in hospital stay in the video-assisted group[31]. Koffron et al.[13,14] reported the maintenance of laparoscopy benefits with hybrid surgery, demonstrating that except for a higher surgical time, it displays results similar to other minimally invasive modalities, and better than the conventional on as for blood loss, transfusion requirements and complication rates[14].

The good results, together with the security achieved with the method, caused the interest in its use to

grow in recent years, especially in Asian centers[15,21,22,24]. A recent survey in 124 Japanese centers showed that, currently, 32.7% of LLR are held by the hybrid technique[26], higher than the number reported in our series (16.1%) and denoting the growth potential of the method compared to the 2.1% initially reported [11].

This study represents the largest Brazilian experience on the video-assisted liver resection and, despite its non-comparative character, attests the good results of the method, with low immediate mortality, high complete resection rate of injuries and low frequency of complications. We believe that the method may have great impact on the development of MILS and may be indicated at the beginning of experience in centers for training as an alternative technique for lesions in "non-laparoscopic segments" and in cases of technical difficulties, or even where there is no availability of some high-cost items such as staplers and transducers. However, more prospective and comparative studies are still needed to consolidate its real indications, advantages, and the best candidates to the method.

We can conclude from the above that the video-assisted liver resection is feasible and safe and should be part of the liver surgeon armamentarium for resection of primary and secondary liver lesions.

Acknowledgements

We thank the artist Marcos Retzer for his help with the illustrations of this work.

R E S U M O

Objetivo: *avaliar os resultados perioperatórios, segurança e exequibilidade das ressecções videoassistidas para lesões hepáticas primárias e secundárias.* ***Métodos:*** *a partir de um banco de dados prospectivo, foram analisados os resultados perioperatórios (até 90 dias) de 25 pacientes consecutivos submetidos à ressecções videoassistidas, no período entre junho de 2007 e junho de 2013.* ***Resultados:*** *a média de idade foi 53,4 anos (23 a 73 anos), sendo 16 (64%) pacientes do sexo feminino. Do total, 84% eram portadores de patologias malignas. Foram realizadas 33 ressecções (1 a 4 nódulos por paciente). Os procedimentos realizados foram: ressecções não regradas (n=26), segmentectomia (n=1), bissegmentectomia 2/3 (n=1), bissegmentectomia 6/7 (n=1), hepatectomia esquerda (n=2), hepatectomia direita (n=2). Do total, 66,7% dos procedimentos foram em segmentos póstero-superiores, necessitaram de resecções múltiplas ou ressecções maiores. O tempo médio de operação foi 226 minutos (80-420 min) e o tempo de anestesia de 360 minutos (200-630 min). O tamanho médio dos nódulos ressecados foi 3,2cm (0,8 a 10 cm) e as margens cirúrgicas foram livres em todos os espécimes analisados. Foram transfundidos 8% dos pacientes e nenhum caso foi convertido. O tempo de internação foi 6,5 dias (3 a 16 dias). Complicações pós-operatórias ocorreram em 20% dos pacientes, não havendo mortalidade perioperatória.* ***Conclusão:*** *a ressecção hepática videoassistida é exequível e segura, devendo fazer parte do armamentário do cirurgião de fígado para ressecções de lesões hepáticas primárias e secundárias.*

Descritores: *Neoplasias Hepáticas. Hepatectomia. Laparoscopia. Cirurgia Videoassistida.*

REFERENCES

1. Viganò L, Tayar C, Laurent A, Cherqui D. Laparoscopic liver resection: a systematic review. J Hepatobiliary Pancret Surg. 2009;16(4):410-21.
2. Herman P, Coelho FF, Lupinacci RM, Perini MV, Machado MAC, D'Albuquerque LAC, e al. Ressecções hepáticas por videolaparoscopia. ABCD, arq bras cir dig. 2009;22(4):226-32.
3. Vigano L, Laurent A, Tayar C, Tomatis M, Ponti A, Cherqui D. The learning curve in laparoscopic liver resection: improved feasibility and reproducibility. Ann Surg. 2009;250(5):772-82.
4. Mirnezami R, Mirnezami AH, Chandrakumaran K, Abu Hilal M, Pearce NW, Primrose JN, et al. Short- and long-term outcomes after laparoscopic and open hepatic resection: systematic review and meta-analysis. HPB. 2011;13(5):295-308.
5. Rao A, Rao G, Ahmed I. Laparoscopic or open liver resection? Let systematic review decide it. Am J Surg. 2012;204(2):222-31.
6. Nguyen KT, Geller DA. Laparoscopic liver resection--current update. Surg Clin North Am. 2010;90(4):749-60.
7. Rao A, Rao G, Ahmed I. Laparoscopic left lateral liver resection should be a standard operation. Surg Endosc. 2011;25(5):1603-10.
8. Lin NC, Nitta H, Wakabayashi G. Laparoscopic major hepatectomy: a systematic literature review and comparison of 3 techniques. Ann Surg. 2013;257(2):205-13.
9. Koffron AJ, Kung R, Baker T, Fryer J, Clark L, Abecassis M. Laparoscopic-assisted right lobe donor hepatectomy. Am J Transplant. 2006;6(10):2522-5.
10. Nguyen KT, Gamblin TC, Geller DA. World review of laparoscopic liver resection-2,804 patients. Ann Surg. 2009;250(5):831-41.
11. Buell JF, Cherqui D, Geller DA, O'Rourke N, Iannitti D, Dagher I, et al. The international position on laparoscopic liver surgery: The Louisville Statement, 2008. Ann Surg. 2009;250(5):825-30.
12. Herman P, Krüger JA, Perini MV, Coelho FF, Lupinacci RM. Laparoscopic hepatic posterior sectionectomy: a hand-assisted approach. Ann Surg Oncol. 2013;20(4):1266.
13. Koffron AJ, Kung RD, Auffenberg GB, Abecassis MM. Laparoscopic liver surgery for everyone: the hybrid method. Surgery. 2007;142(4):463-8; discussion 468.e1-2. Erratum in: Surgery. 2008;143(2):301.
14. Koffron AJ, Auffenberg G, Kung R, Abecassis M. Evaluation of 300 minimally invasive liver resections at a single institution: less is more. Ann Surg. 2007;246(3):385-92; discussion 392-4.
15. Nanashima A, Sumida Y, Oikawa M, Nonaka T, Abo T, Takeshita H, et al. Usefulness and limitation of laparoscopic assisted hepatic resections: a preliminary report. Hepatogastroenterology. 2009;56(90):447-51.
16. Dindo D, Demartines N, Clavien PA. Classification of surgical complications: a new proposal with evaluation in a cohort of 6336 patients and results of a survey. Ann Surg. 2004;240(2):205-13.

17. Herman P, Perini MV, Coelho F, Saad W, D'Albuquerque LA. Half-Pringle maneuver: a useful tool in laparoscopic liver resection. J Laparoendosc Adv Surg Tech A. 2010;20(1):35-7.
18. Reich H, McGlynn F, DeCaprio J, Budin R. Laparoscopic excision of benign liver lesions. Obstet Gynecol. 1991;78(5 Pt 2):956-8.
19. Oida T, Mimatsu K, Kano H, Kawasaki A, Kuboi Y, Fukino N, et al. Minimal incision based on measurement of the to-be-resected specimen in laparoscopic hepatectomy. Hepatogastroenterology. 2012;59(120):2598-601.
20. Hüscher CG, Lirici MM, Chiodini S, Recher A. Current position of advanced laparoscopic surgery of the liver. J R Coll Surg Edinb. 1997;42(4):219-25.
21. Nitta H, Sasaki A, Fujita T, Itabashi H, Hoshikawa K, Takahara T, et al. Laparoscopy-assisted major liver resections employing a hanging technique: the original procedure. Ann Surg. 2010;251(3):450-3.
22. Soyama A, Takatsuki M, Adachi T, Kitasato A, Torashima Y, Natsuda K, et al. A hybrid method of laparoscopic-assisted open liver resection through a short upper midline laparotomy can be applied for all types of hepatectomies. Surg Endosc. 2014;28(1):203-11.
23. Dagher I, O'Rourke N, Geller DA, Cherqui D, Belli G, Gamblin TC, et al. Laparoscopic major hepatectomy: an evolution in standard of care. Ann Surg. 2009;250(5):856-60.
24. Nitta H, Sasaki A, Otsuka Y, Tsuchiya M, Kaneko H, Wakabayashi G. Impact of hybrid techniques on laparoscopic major hepatectomies. J Hepatobiliary Pancreat Sci. 2013;20(2):111-3.
25. Zhang X, Yang J, Yan L, Li B, Wen T, Xu M, et al. Comparison of laparoscopy-assisted and open donor right hepatectomy: a prospective case-matched study from China. J Gastrointest Surg. 2014;18(4):744-50.
26. Imura S, Shimada M, Utsunomiya T, Morine Y, Wakabayashi G, Kaneko H. Current status of laparoscopic liver surgery in Japan: results of a multicenter Japanese experience. Surg Today. 2014;44(7):1214-9.
27. Ferrero A, Langella S, Giuliante F, Viganò L, Vellone M, Zimmitti G, et al. Intraoperative liver ultrasound still affects surgical strategy for patients with colorectal metastases in the modern era. World J Surg. 2013;37(11):2655-63.
28. Cho A, Asano T, Yamamoto H, Nagata M, Takiguchi N, Kainuma O, et al. Laparoscopy-assisted hepatic lobectomy using hilar Glissonean pedicle transection. Surg Endosc. 2007;21(8):1466-8.
29. Tang CN, Li MK. Laparoscopic-assisted liver resection. J Hepatobiliary Pancreat Surg. 2002;9(1):105-10.
30. Itano O, Chiba N, Maeda S, Matsui H, Oshima G, Wada T, et al. Laparoscopic-assisted limited liver resection: technique, indications and results. J Hepatobiliary Pancreat Surg. 2009;16(6):711-9.
31. Johnson LB, Graham JA, Weiner DA, Smirniotopoulos J. How does laparoscopic-assisted hepatic resection compare with the conventional open surgical approach? J Am Coll Surg. 2012;214(4):717-23; discussion 723-5.

Received at: 06/10/2014
Accepted for publication: 03/01/2015
Conflict of interest: none.
Source of funding: none.

Mailing address:
Fabricio Ferreira Coelho
E-mail: ff_coelho@hotmail.com or fabricio.coelho@hc.fm.usp.br

DOI: 10.1590/0100-69912015005010

Severity assessment of acute pancreatitis: applying Marshall scoring system

Avaliação da gravidade da pancreatite aguda: aplicando o sistema de pontuação de Marshall

André Lanza Carioca[1]; Debora Rodrigues Jozala[1]; Lucas Oliveira de Bem[1]; Jose Mauro da Silva Rodrigues, TCBC-SP[1]

A B S T R A C T

Objective: To analyze the effectiveness of the Marshall scoring system to evaluate the severity of acute pancreatitis (AP). **Methods**: We performed a prospective, observational study in 39 patients with AP evaluated by the Marshall scoring system and the Ranson criteria (admission and 48 hours). We assessed the progression of the disease for seven days and compared the data of the two criteria. **Results**: Seven patients died during the observation period and one died afterwards. All deaths had shown failure of at least one system by the Marshall method. **Conclusion**: The Marshall scoring system may be used as an effective and simplified application method to assess the severity of acute pancreatitis.

Key words: Pancreatitis. Multiple Organ Failure. Organ Dysfunction Scores. Pancreatitis, Acute Necrotizing.

INTRODUCTION

Acute pancreatitis (AP) is defined as an acute inflammatory process of the pancreas, which can also involve peripancreatic areas or more distant organs, being most commonly caused by gallstones and chronic alcohol consumption[1]. Its clinical presentation involves abdominal pain in the epigastric and periumbilical region, with referral, for example, to the lumbar region. Nausea, vomiting and fever often accompany the clinical setting and hypotension may be present due to liquid sequestration[2].

The clinical course of AP is variable, since there are cases of complete resolution and those of occurrence of multiple organ failure, which can be lethal. The determination of AP's severity is essential in view of the prognosis and proper treatment selection[3]. Accordingly, various classifications have been proposed to determine the severity of each clinical situation, the one of Atlanta[4] being the most used.

Currently, it is assumed that the number of affected organs, the start time and duration of organ dysfunction influence AP's evolution, which diverges from the Atlanta classification, which includes only the presence or absence of such condition[5-7].

Regarding severe AP, the Atlanta classification establishes the Ranson[8] or APACHE II[9] criteria for characterization of severity. These methods, however, have limitations reported by other studies[10-15]. In 2008, the review of the Atlanta classifivcation[16] defined the severity of acute pancreatitis, at least in the first week, is based on clinical components and suggested that the persistence of a systemic inflammatory response syndrome and / or organ failure should be considered.

The dysfunction or organ failure is recognized as the most important determinant of prognosis in the early stage[17] and is possibly related to bacterial and endotoxin translocation that favor the evolution of the clinical picture for sepsis and for multiple organ failure syndrome. Moreover, there are claims that, in severe AP, there is activation of reflex anti-inflammatory response and reduced immune capacity, which predisposes to organ failure and secondary infections[2,18].

For the definition of organ failure, the revision of the Atlanta classification suggested the Marshall scoring system[19], establishing a score ≥ 2 to determine the failure of an organ. It uses pO_2 / FiO_2 as parameters for the respiratory system, serum creatinine in mmol / L or mg / dL for renal evaluation and systolic blood pressure in mmHg for the cardiovascular system. This system has been chosen by some authors 11,16,20 due to its convenience.

This paper aims to examine the effectiveness of the Marshall scoring system in evaluating AP severity.

METHODS

We conducted a prospective, observational study, with 39 consecutive patients with AP diagnosis admitted to

1. Departamento de Cirurgia Faculdade de Ciências Médicas e da Saúde (FCMS) – PUCSP, SP, Brasil.

the Conjunto Hospitalar de Sorocaba. Sociodemographic, clinical, laboratory and radiological data were collected daily by consulting their medical records for up to seven days for all cases. The Ranson and Marshall scoring systems were applied in all patients and compared using the McNemar chi-square test. The research project number 14260 was approved by the Ethics in Human Research Committee of the Faculdade de Ciências Médicas e da Saúde at PUC-SP.

RESULTS

The patients' ages ranged from 20 to 88 years, 17 were men, and 22, women. The Ranson score mode at admission was zero, and at 48 hours, one (Figure 1). The Marshall system mode was zero (Figure 2).

Of the 39 patients observed, 11 were classified with severe acute pancreatitis by the Marshall system (score $\geq$2) and eight patients by the Ranson score (score $\geq$3), with agreement between the two scoring systems in seven cases. When applying the McNemar chi-square test, we found $\chi^2 = 1.8$ with $p = 0.1797$, there hence being agreement between the results presented by both systems ($p > 0.05$).

Seven patients died in one week and one died after this. Of those who died in seven days, all had some type of organ failure by the Marshall scoring system. Nine patients developed respiratory failure, seven cardiovascular failure and six, kidney failure (Table 1).

Among the patients who died in seven days, three had Ranson score $\geq$3 at admission and four showed score $\geq$3 in 48 hours. Among those who died, four had high Marshall and Ranson scores, with disagreement only in three cases, in which there were low Ranson scores, but high Marshall ones.

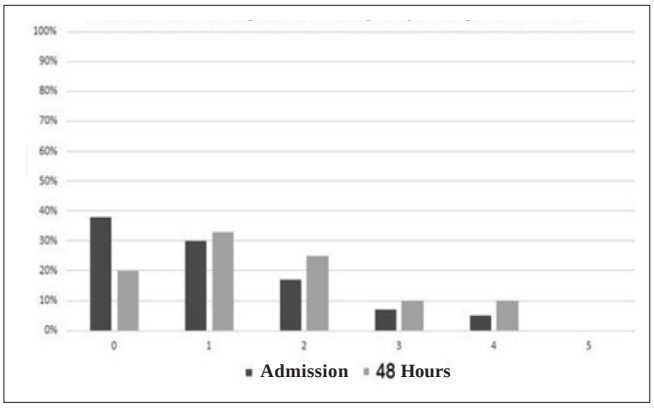

Figure 1 - *Distribution of cases according to the Ranson score.*

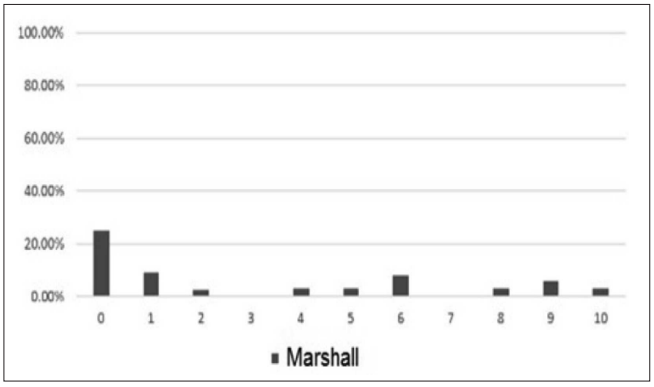

Figure 2 - *Distribution of cases according to the Marshall score.*

Table 1 - Failure of specific organs according to the Marshall scoring system.

System	Frequency	
	%	n
Respiratory	23	9
Cardiovascular	18	7
Renal	15	6
None	72	28

Source: medical records of Conjunto Hospitalar de Sorocaba.

DISCUSSION

Several classifications are presented in the literature in an attempt to determine AP severity. The Atlant classification [4] was introduced in 1992 and defined the categories of mild and severe AP. The latter was defined as pancreatitis associated with organ failure or local complications. Organ failure, according to this system, is defined by shock, respiratory failure, renal failure and gastrointestinal bleeding (more than 500 ml / 24 hours). Necrosis, abscess, pseudocyst are among the possible local complications.

The definition for severe AP proposed by the review of the Atlanta classification[16] includes persistent systemic inflammatory response and / or development of organ failure. We observed seven patients with organ failure among the dead in a week of hospitalization. However, despite its use established in the Atlanta classification[4], it is a method that requires 48 hours to complete the evaluation, hampering the analysis within the first 24 hours, which is important in view of the prevention of possible adverse events[10-12].

Besides the Ranson scoring system, the Atlanta classification also proposes the APACHE II score[9], which can be used before 24 hours and correlates better with prognosis. However, it is complex, it requires more time for execution, and does not properly diagnose necrotizing pancreatitis at admission[13-15].

Already pointed out and used in other studies as a way to assess AP severity, the Marshall scoring system emerged in the literature as a better applicability proposal

due to its ease of use[16,20,21]. Moreover, its specificity is greater than 90% for predicting AP severity at 24 and 48 hours[21].

We also found correlation of high Ranson scores with high Marshall scores. Thus, considering that the determination of gravity is essential to the proposed treatment and that this, in turn, is critical for prognosis, it is necessary to use methods that render the best classification in AP cases. When considering organ dysfunction or failure as the central prognostic factor, methods that cover these characteristics have been used with excellent results. In our study, the strong correlation of scores with clinical outcome confirms the effectiveness of the aforementioned method with regard to the classification of AP severity.

Considering that the Marshall scoring system corresponded with the clinical course of AP patients and the need for a method to evaluate organ failure in determining AP severity, we conclude that the Marshall scoring system can be used as an effective and simplified application method to assess the severity of acute pancreatitis.

R E S U M O

Objetivo: *analisar a eficácia do sistema de pontuação de Marshall na avaliação da gravidade da pancreatite aguda.* ***Métodos:*** *foi realizado um estudo prospectivo e observacional em 39 pacientes com PA, avaliados pelo sistema de pontuação dos critérios de Marshall e Ranson (admissão e 48 horas). Foi avaliada a evolução do quadro clínico durante sete dias e comparados os dados dos dois critérios.* ***Resultados:*** *sete pacientes morreram durante o período de observação e um morreu após esse período. Todos os óbitos possuíam, pelo sistema de Marshall, falência de pelo menos um sistema.* ***Conclusão:*** *concluímos que o sistema de pontuação de Marshall pode ser utilizado, por ser um método eficaz e de aplicação simplificada, para avaliar a gravidade da pancreatite aguda.*

Descritores: *Pancreatite. Insuficiência de Múltiplos Órgãos. Escores de Disfunção Orgânica. Pancreatite Necrosante Aguda.*

REFERENCES

1. Carroll JK, Herrick B, Gipson T, Lee SP. Acute pancreatitis: diagnosis, prognosis, and treatment. Am Fam Physician. 2007;75(10):1513-20.
2. Beger HG, Rau BM. Severe acute pancreatitis: Clinical course and management. World J Gastroenterol. 2007;13(38):5043-51.
3. Mayumi T, Takada T, Kawarada Y, Hirata K, Yoshida M, Sekimoto M, et al. Management strategy for acute pancreatitis in the JPN Guidelines. J Hepatobiliary Pancreat Surg. 2006;13(1):61-7.
4. Bradley EL 3rd. A clinically based classification system for acute pancreatitis. Summary of the International Symposium on Acute Pancreatitis, Atlanta, Ga, September 11 through 13, 1992. Arch Surg. 1993;128(5):586-90.
5. Petrov MS, Windsor JA. Classification of the severity of acute pancreatitis: how many categories make sense? Am J Gastroenterol. 2010;105(1):74-6.
6. Lankisch PG. Natural course of acute pancreatitis: what we know today and what we ought to know for tomorrow. Pancreas. 2009;38(5):494-8.
7. Buter A, Imrie CW, Carter CR, Evans S, McKay CJ. Dynamic nature of early organ dysfunction determines outcome in acute pancreatitis. Br J Surg. 2002;89(3):298-302.
8. Ranson JH, Rifkind KM, Roses DF, Fink SD, Eng K, Spencer FC. Prognostic signs and the role of operative management in acute pancreatitis. Surg Gynecol Obstet. 1974;139(1):69-81.
9. Knaus WA, Draper EA, Wagner DP, Zimmerman JE. APACHE II: a severity of disease classification system. Crit Care Med. 1985;13(10):818-29.
10. Hirota M, Takada T, Kawarada Y, Hirata K, Mayumi T, Yoshida M, et al. JPN Guidelines for the management of acute pancreatitis: severity assessment of acute pancreatitis. J Hepatobiliary Pancreat Surg. 2006;13(1):33-41.
11. Singh VK, Wu BU, Bollen TL, Repas K, Maurer R, Johannes RS, et al. A prospective evaluation of the bedside index for severity in acute pancreatitis score in assessing mortality and intermediate markers of severity in acute pancreatitis. Am J Gastroenterol. 2009;104(4):966-71.
12. Banks PA, Freeman ML; Practice Parameters Committee of the American College of Gastroenterology. Practice guidelines in acute pancreatitis. Am J Gastroenterol. 2006;101(10):2379-400.
13. Rosa I, Pais MJ, Fátima C, Queiroz A. Pancreatite aguda: actualização e proposta de protocolo de aborgadem. Acta Med Port. 2004;17(4):317-24.
14. Lankisch PG, Warnecke B, Bruns D, Werner HM, Grossmann F, Struckmann K, et al. The APACHE II score is unreliable to diagnose necrotizing pancreatitis on admission to hospital. Pancreas. 2002;24(3):217-22.
15. Stevens T, Parsi MA, Walsh RM. Acute pancreatitis: problems in adherence to guidelines. Cleve Clin J Med. 2009;76(12):697-704.
16. Acute Pancreatitis Working Group. Revision of the Atlanta classification of acute pancreatitis (3rd (revision). 2008.
17. Dimagno MJ, Wamsteker EJ, Debenedet AT. Advances in managing acute pancreatitis. F1000 Med Rep. 2009;1:59.
18. Mentula P, Kylänpää ML, Kemppainen E, Jansson SE, Sarna S, Puolakkainen P, et al. Plasma anti-inflammatory cytokines and monocyte human leucocyte antigen-DR expression in patients with acute pancreatitis. Scand J Gastroenterol. 2004;39(2):178-87.
19. Marshall JC, Cook DJ, Christou NV, Bernard GR, Sprung CL, Sibbald WJ. Multiple organ dysfunction score: a reliable descriptor of a complex clinical outcome. Crit Care Med. 1995;23(10):1638-52.
20. Johnson CD, Abu-Hilal M. Persistent organ failure during the first week as a marker of fatal outcome in acute pancreatitis. Gut. 2004;53(9):1340-4.
21. Campos T, Parreira JG, Assef JC, Rizoli S, Nascimento B, Fraga GP. Classificação de gravidade na pancreatite aguda. Rev Col Bras Cir. 2013;40(2):164-8.

Received at: 05/11/2014
Accepted for publication: 21/01/2015
Conflict of interest: none.
Source of funding: none.

Mailing address:
Lucas Oliveira de Bem
E-mail: loliveira_lx@hotmail.com

DOI: 10.1590/0100-69912015005011

Use of surgical mesh of different compositions in the correction of the abdominal wall defect in rats

Emprego de telas cirúrgicas de diferentes composições na correção de defeito da parede abdominal de ratos

Ana Cristina Isa, ACBC-PR[1]; Jorge Eduardo Fouto Matias, ACBC-PR[1]; Celia Toshie Yamamoto[1]; Rosana Hapsi Isa[2]; Antônio Carlos Ligocki Campos, TCBC-PR[1]; Júlio Cezar Uili Coelho, TCBC-PR[1]

A B S T R A C T

Objective: To analyze the performance of two surgical meshes of different compositions during the defect healing process of the abdominal wall of rats. **Methods:** thirty-three adult Wistar rats were anesthetized and subjected to removal of an area of 1.5 cm x 2 cm of the anterior abdominal wall, except for the skin; 17 animals had the defect corrected by edge-to-edge surgical suture of a mesh made of polypropylene + poliglecaprone (Group U – Ultrapro™); 16 animals had the defect corrected with a surgical mesh made of polypropylene + polidioxanone + cellulose (Group P – Proceed™). Each group was divided into two subgroups, according to the euthanasia moment (seven days or 28 days after the operation). Parameters analyzed were macroscopic (adherence), microscopic (quantification of mature and immature collagen) and tensiometric (maximum tension and maximum rupture strength). **Results**: there was an increase in collagen type I in the Proceed™ group from seven to 28 days, p = 0.047. Also, there was an increase in the rupture tension on both groups when comparing the two periods. There was a lower rupture tension and tissue deformity with Proceed™ mesh in seven days, becoming equal at day 28. **Conclusion**: the meshes retain similarities in the final result and more studies with larger numbers of animals must be carried for better assessment.

Key words: Abdominal Wall/surgery. Hernia, Abdominal. Surgical Mesh. Tissue Adhesions.

INTRODUCTION

Since long ago, Surgery searches for appropriate solutions for lasting correction of hernias and abdominal wall defects with loss of substance. In the presence of large abdominal wall defects, approaching the defect edges is impractical and unwise. Over time, there have been various proposals to deal with such defects, from the use of tissues originating from various topographies of the patient to the use of synthetic material prostheses able to resist tension.

Surgical meshes are being improved for better acceptance of the organism with respect to its healing and inflammatory response[1-3].

The Ultrapro™ mesh is composed of low density, partially absorbable, monofilament yarns, with macropores 3-4 mm in size developed with a combination of equal parts of polypropylene, a non-absorbable material, and poliglecaprone, an absorbable one (Ultrapro™, Johnson & Johnson, USA). The Proceed™ mesh comprises separating multilayer fabrics, consisting of monofilament yarns with macropores and of a low density polypropylene mesh between two polydioxanone layers, one layer of regenerated oxidized cellulose (ROC), a raw material of plant origin, and absorbable polydioxanone (Proceed™, Johnson & Johnson, USA). This mesh has an area specifically designed for contact with viscera, focusing at significantly lower adherence rates compared with meshes devoid of this feature. However, no technological advances causing less adhesions should result in impairment of other performance parameters of a surgical mesh, such as offered resistance, biocompatibility and complications rates[4].

The purpose of this study is to analyze the performance of the surgical meshes Ultrapro™ and Proceed™ when used in edge-to-edge suture for correction of abdominal wall defects experimentally produced in adult rats.

METHODS

This study was conducted in the Vivarium and in the Surgery Department of Centro Universitário Positivo. We used the Guidelines for Presentation of Scientific Papers of the Federal University of Paraná (2007) and the Veterinary

1. Programa de Pós Graduação em Clínica Cirúrgica da Universidade Federal do Paraná, Curitiba, PR, Brasil; 2. Residente em Cirurgia Geral, Hospital Angelina Caron, Paraná, PR, Brasil.

Anatomical naming (1983). The research followed the principles of animal experimentation determined by the Brazilian College of Animal Experimentation (COBEA) and the Canadian Council on Animal Care, and was approved by the Ethics in Research Committee of Universidade Positivo under the Protocol at 2-2010.

The sample consisted of 33 male Wistar rats (*Rattus norvegicus albinus*), weighing between 200g and 300g, 20-30 days old, obtained in the animal vivarium of Centro Universitário Positivo.

The animals were kept in the trial environment for fifteenth days before the start of the experiment, in air-conditioned rooms with digital control, with temperature ranging from 18° to 20° C, relative humidity of 65% and 12-hour light-dark periods. They received commercial feed pellets Nuvilab-CR1™ (Nuvital-Curitiba / PR) ad libitum.

The animals were divided into two groups: U - composed of 17 animals in which we used the polypropylene and poliglecaprone surgical mesh (Ultrapro™). This group was subdivided into two subgroups: U7 – consisting of nine rats that were euthanized seven days after the operation; and U28 – with eight rats that were euthanized 28 days after the operation. The second Group, P, was composed of 16 animals in which we applied the surgical mesh composed of mixed polypropylene, absorbable polydioxanone (PDS) and ROC – regenerated oxidized cellulose (Proceed™). This group was subdivided into two subgroups: P7 – made up of eight rats that were euthanized seven days after the operation; and P28 – comprising eight rats to be euthanized 28 days after the operation. All animals received a 1.5 x 2 cm mesh on the defect created in the abdominal wall, which also measured 1.5 x 2 cm. The animals were euthanized in a gas chamber.

The rats were sedated with isoflurane vaporization in glass bell jar. Upon sedation the animals received a combination of 100 mg/kg of 10% ketamine hydrochloride and 10 mg/kg of 2% xylazine hydrochloride intramuscularly. Once reached the anesthesia, the rat was positioned in supine on the operating table. The management of pain during operation was obtained by intramuscular administration of 2.5 mg/kg morphine sulfate. In the postoperative period this same analgesic scheme was employed during the first three days followed by maintenance with paracetamol orally at a dose of 20 drops to 500 ml of consumed water[5-12].

We performed trichotomy of the abdominal region followed by the cleaning / sterilization of the skin with polyvinylpyrrolidone iodine solution (PVP).

Surgical technique used: a) longitudinal xyphopubic incision in the abdominal wall, with 15 blade scalpel and cauterization of the wall bleeding vessels; b) blunt and scissors dissection between the skin and the aponeurosis and rectus abdominis; c) abdominal wall tissue exeresis involving the aponeurosis, muscle and parietal peritoneum 1.5 x 2 cm in size; d) edge-to-edge suture of the surgical mesh of dimensions identical to the created defect, with 4 0 polypropylene suture in a continuous fashion, as illustrated in Figures 1 and 2; e) skin closure with continuous intertwined 3-0 polypropylene suture. Both groups underwent the same surgical technique, performed by the same operator.

For postoperative analgesia we administered 2.5 mg/kg intramuscular morphine every 24 hours for three days, followed by maintenance with oral paracetamol at the dose of 20 drops digested 500ml water, according to the vivarium protocol .

Once completed the time for each group (7 and 28 days), the animals were evaluated and photographed. After euthanasia, we evaluated the external appearance

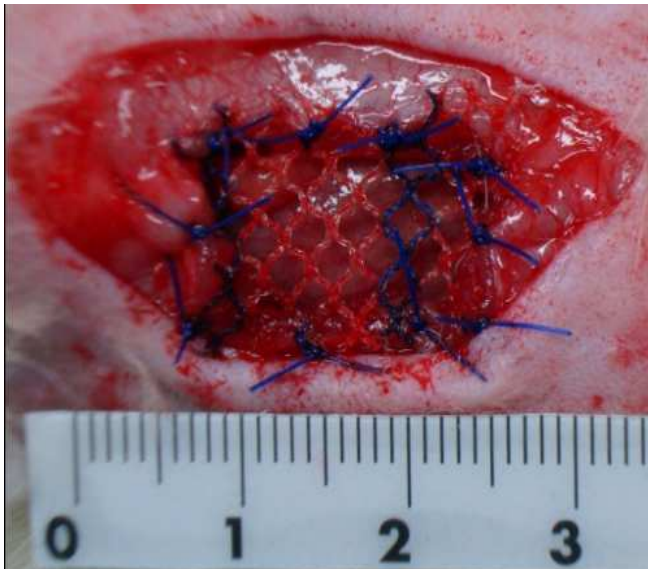

Figure 1 - *Ultrapro™ mesh placed in the abdominal wall of rats.*

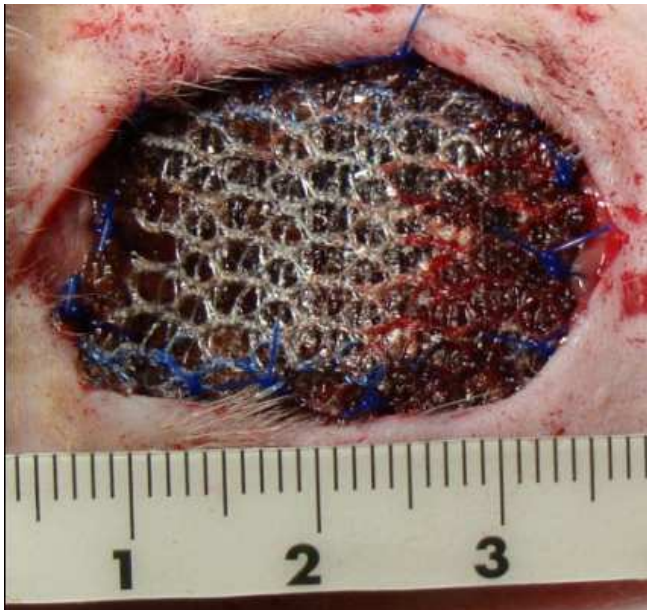

Figure 2 - *Proceed™ mesh placed in the abdominal wall of rats.*

of the surgical scar and performed a U-shaped incision, with removal of the mesh with the tissue wall measuring 7 x 1 cm with the trapezoid-shaped ends in the transverse direction (Figure 3) . The samples were placed in vials with saline solution with the identification of the animal and immediately forwarded to the Mechanics Department of Centro Universitário Positivo, where they were submitted to the rupture tension test of evidence, the values measured in Newton/cm^2 for the tensiometry study. The other fragment was laid on a white cardboard slip of paper and placed in a vial with Bouim solution properly labeled with date, researcher name and identification of the animal, being sent to the Laboratory of Cell Biology at the Centro Universitário Positivo.

Histologic processing

The processing of the collected material for optical microscopy was performed at the Laboratory of Cell Biology at the Centro Universitário Positivo. The cuts were 4 ìm thick. After 12 hours of drying they were stained with picrosirius-red F3BA (PSR).

Histological sections were stained with HE and analyzed by a optical microscope biological Nikkon™ – CI – LED and polarized light, with eyepieces of 22 mm diameter and 400 times magnification[13-15] .

Macroscopic examination

The presence of adhesions in the abdominal cavity was classified according to parameters described by Nair *et al.*[16]: grade 0 = complete lack of adherence; grade 1 = single adhesion between two organs or between an organ and the abdominal wall; grade 2 = two adhesions between organs or between organs and the abdominal wall; level 3 = more than two adhesions between organs or with the abdominal wall; or a mass of widespread adhesions of the intestine without adhering to the abdominal wall; and grade 4 = generalized adhesions between organs and the abdominal wall.

Quantitative Collagen Analysis

The PSR method consisted in the identification and quantification of mature (type I) and immature (type III) collagen fibers through optical microscope Olympus™, Japan, with a source of polarized light. The images were captured by a Iris CCD Sony™ camera, Japan, transmitted to a monitor, frozen and scanned by plates. Therefore, this system enabled the quantification of the area occupied by each type of collagen by predetermined field of histological section[17].

The images were transmitted to a computer, previously calibrated to 18 pixels, frozen and digitized by plates, Oculus TCX™ (CoreCo). Computerized morphometric analysis was done by Pro-plus image software, version 4.5 (Media Cybernetics, São Paulo, Brazil). At 400x magnification, calibration of the system was performed by reading the normal scar area, based on the optical density of the points of resolution (pixels) that form the image. We carried out three collagen measures in each longitudinal field and other three in each transversal field.

With the same Image-Pro Plus 4.5 software, we analyzed the total area (in pixels) and the collagen percentage of type I and type III. In the RGB (Red, Blue, Green) system, we considered the thicker and strongly birefringent collagen fibers, colored in shades of red and orange, as mature (type I) collagen, and the thinner, more dispersed, frankly birefringent fibers, stained in shades of green as immature (type III) collagen. This yielded an average of these percentages in each histological section. All non-collagen substance was stained in black, the mature type I collagen was stained in yellow, red-orange and red, while the type III or immature collagen was stained in green.

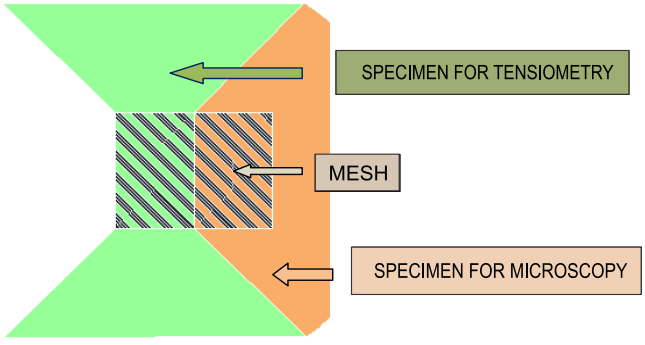

Figure 3 - *Cutting scheme of surgical specimens.*

Tensiometry

We evaluated the tensiometric resistance of the tissue sutured with surgical mesh in the seventh and 28th day after the operation. The specimen containing the sutured mesh and surrounding tissue was cut in the transverse direction to form two equal units, one being sent to microscopic examination and the other subjected to evaluation of the maximal tissue deformity and rupture tension measurement in Newton/cm^2. using an EMIC DL30000N extensometer. The specimen was inserted into the tensiometry apparatus and subjected to tensile strength with a 50 kg load cell. The grasp of the two ends of the specimen was made near the suture with the surgical mesh in the tensiometer, and subjected to a constant tension strength of acceleration speed 5mm/minute until deformity and rupture of the material. The whole procedure was recorded in charts with the Tesc software version 1.10, showing the value in N/cm2 of the maximum strength reached at the time of deformation and rupture[18].

We called maximum tension the maximum strength supported by the tissue (Figure 4), by section unit (Kgf/cm^2), a variable dependent on the dimensions of the resected tissue, which were standardized. Maximum tension is the greatest strength supported by the tissue throughout the test time[18].

The results obtained in the study were expressed as frequencies and percentages (qualitative variables) or

average, minimum, maximum values and standard deviations (quantitative variables). To compare the groups and time points regarding the dichotomous nominal variables we used Fisher's exact test. The comparisons of quantitative variables were made using the nonparametric Mann-Whitney test. Values of p d" 0.05 indicate statistical significance.

RESULTS

Adhesions

Adhesions were found in all animals of all subgroups, indicating a similarity between the meshes used in the study as for tissue adhesion induction.

Quantification of collagen

When comparing the U subgroups we observed that on the seventh day type I collagen showed a mean of 14,003 pixels, while type III collagen averaged 34,985 pixels. On the 28th day we noted a non-significant reduction of type I collagen (p = 0.16) and a significant increase of collagen type III (p = 0.01). Comparisons between P subgroups showed an average of 20,355 pixels on the seventh day for collagen type I and 46,470 for type III. On the 28th day there was no significant increase (p = 0.20) of type I collagen, and a reduction with statistical difference for collagen type III (p = 0.047) (Table 1).

There were no statistically significant differences in intergroup comparisons both for type I and type III collagens when analyzed in the seven-day. However, after 28 days of the meshes' insertion, there were quantities of type I collagen significantly higher (p = 0.03) around the Proceed™ meshes than around the Ultrapro™ ones. Conversely, at the same time (day 28), the amount of collagen type III was significantly much higher (p = 0.0003) around the Ultrapro™ meshes than around the Proceed™ ones (Table 1).

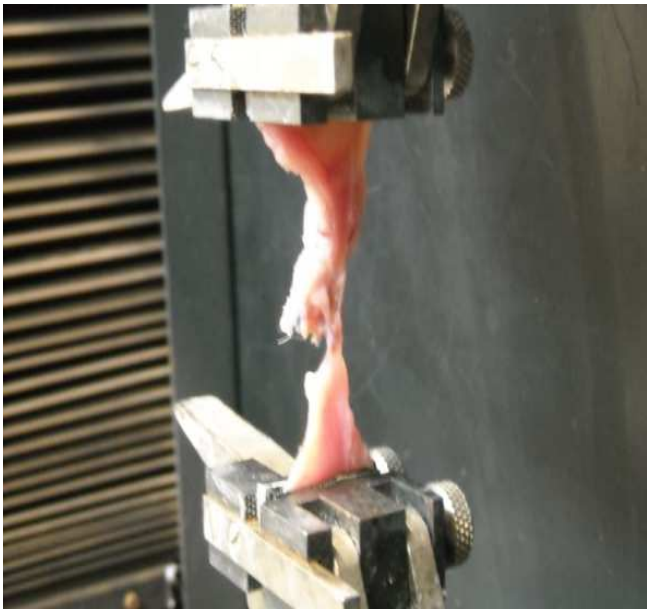

Figure 4 - *Tissue fragment submitted to rupture tension.*

Tensiometry

We noted that the two parameters monitored in the tensiometric evaluation of the samples (tissue maximum deformity and rupture tension) had similar behaviors in both intragroup and intergroup comparisons.

We found a significant increase of suture line resistance (abdominal wall-mesh interface) of the specimens over time (seven to 28 days) characterized by the statistically significant increase in the measurements, both of maximum deformity and of rupture tension, between the seventh and 28th day and for both types of mesh studied (Table 2).

Despite this, tensiometry showed interesting differences between the meshes used. We observed a distinct and statistically significant difference between the Ultrapro™ and Proceed™ meshes in the two tensiometric parameters measured on the seventh day. Both the maximum deformity and rupture tension had significantly lower rates on the seventh day in the Proceed™ mesh subgroup (Table 2). This same comparison the 28th day did not show statistically significant difference. Therefore, the tensiometry data testify a resistance increase of the abdominal wall-mesh interface along the study period, which accumulates rapidly at the beginning with the Ultrapro™ meshes, but at the end of four weeks, the Proceed™ meshes achieve similar tensiometric performance.

DISCUSSION

The choice of the meshes used in this study is easily justified by the current demand for dual composition

Table 1 - Comparison of types I and III collagen quantification (pixels) between the study subgroups.

	ULTRAPRO® (n=17)		PROCEED® (n=16)	
Colagen	U7	U28	P7	P28
TYPE I	14,003 ± 13,406	8,264 ± 9,775°	20,355 ± 17,048	30,431 ± 20,281
TYPE III	34,985 ± 24,201	62,669 ± 12,507*•	46,470 ± 11,031	38,873 ± 7,180+

** p = 0.01 compared with U7; + p = 0.047 compared with P7; ° p = 0.03 compared with P28; • p = 0.0003 compared with P28 (Mann-Whitney test).*

meshes when inserted in the peritoneal cavity to prevent the formation of intra-abdominal adhesions and at the same time provide adequate tensile strength to the abdominal wall surface in contact with the muscles[12,18,19].

Non-absorbable meshes are preferred in repair of non-contaminated abdominal wall defects, while the absorbable meshes are preferred in the repair of abdominal wall infected defects until there is resolution of the case, when, then, may be replaced by a non-absorbable prosthesis. However, the mesh is a foreign body, a significant cause of peritoneal adhesion formation, particularly in intraperitoneal use. The non-absorbable mesh still has a higher risk of infection as an additional risk factor[20-22]. The ideal mesh maintains adequate and permanent occlusion of the abdominal wall defect, with low rates of infection and adhesion, and does not induce the formation of fistulas[19,21-23].

We then used the mesh of polypropylene with polydioxanone and regenerated oxidized cellulose (Proceed™), designed for situations where one cannot prevent or avoid contact with the organs of the abdominal cavity. It has two absorbable layers that separate it from the tissues, reducing the intensity and extent of adhesion formation, preventing bacterial colonization by the neoperitonization that occurs in the mesh. The other mesh used (Ultrapro™) was developed to provide support and reinforcement to the abdominal wall with equal parts of polypropylene and poliglecaprone, which stimulates a flexible scar and promotes a multidirectional elasticity, providing the normal dynamics and physiology to the abdominal wall, but offers no physical barrier between the mesh and the viscera, and thus should be applied to the intact peritoneum. Both meshes have polypropylene in their composition, the most often employed non-absorbable material[3,24 26].

Despite the characteristics of the meshes used in this study, our results with macroscopic parameters were different from the previously found. Although the Proceed™ mesh is the only one indicated for direct contact with intraperitoneal content, both types were employed in the same way in the repair of the total abdominal wall defect produced in the rats. Therefore, one of the surfaces of the each mesh type was in contact with the viscera after correction of the defect, since all abdominal wall layers were removed when the defect was created but the skin, which stayed in contact with the other surface of the meshes. We observed that the adhesion phenomenon was universal for both mesh types and at both euthanasia moments, which also occurred in other studies[27-29]. This occurred in spite of deploying the Proceed™ mesh cellulose surface facing the interior of the peritoneal cavity during correction of the defect, which caused us to conclude that, contrary to the expected, there was no protective effect against adhesions produced by this mesh.

Microscopy

When comparing the different staining methods for collagen analysis, it was evident that the staining with picrosirius is easy to perform and interpret, and specific to the study of tissue collagen[27]. The adhered amount of dye is proportional to the amount of protein present, allowing its use for collagen quantification[28].

The U group(Ultrapro™) displayed an increase of type III collagen and decrease in type I collagen when comparing the periods of seven and 28 days. In the P group (Proceed™) there was an increase in the average type I collagen and decreased type III one at comparison between the seventh and 28th days. We found no similar results in the literature. Studies on meshes' fixation found a progressive increase in type I / III collagen content in the seventh, 14th and 56th days[28,29]. Another author compared the polypropylene mesh with the Ultrapro™ and found no difference in collagen type I and III[30], and the polypropylene meshes with different pore size showed differences in type collagen, with higher amounts in meshes with pores larger than 4 mm, though with no differences as to type III collagen[29].

We believe that the quantification of type I and III collagen, when evaluated and measured by the unit used in this study, lacked minimal reliability so that we could assume as real the differences highlighted by the statistical analysis. High values of standard deviation, sometimes of the same magnitude as the medium itself, testify to a impediment heterogeneity, hampering valid conclusions on results' interpretation.

Tensiometry

We found that the U group showed a tensile strength greater than the P group on the seventh day, but on the 28th day they were equal. Similar results to ours, studies have comparing three types of mesh found tensile strength similar among them at the 90th postoperative day[1-

Table 2 - Comparison of maximum tissue deformity (MTD) and rupture tension (RT) between the study subgroups.

	ULTRAPRO® (n=17)		PROCEED® (n=16)	
Parameter	**U7 (n=9)**	**U28 (n=8)**	**P7 (n=8)**	**P28 (n=7)**
MDT (N/cm²)	16.72 ± 7.71*°	24.08 ± 8.37	9.93 ± 4.33+	21.27 ± 4.43
RT (N/cm²)	9.05 ± 3.85 *°	14.82 ± 3.00	3.31 ± 1.86 +	12.35 ± 5.59

** p <0.05 compared with U28; + p <0.05 compared with P28; ° p <0.05 compared with P7.*

[3]. However, another author[18] evaluated the tensile strength between different meshes and found that the polyglactine mesh is not suitable for use as fascial substitute for prolonged periods, since its tensile strength decreases after 12 weeks compared with other studied mesh (polypropylene and polytetrafluoroethylene). In another study that compared the polypropylene mesh with two new forms of expanded polytetrafluoroethylene mesh, it was concluded that the latter promote more tensile strength than the polypropylene mesh, with early tissue incorporation and low potential of adhesions, being more suitable for use in abdominal operations[20].

Research on mesh made of polypropylene, PTFE, polypropylene with sodium hyaluronate and carboxymethylcellulose, polyester coated with polyethylene-glycol-glycerol, polypropylene with polyglecaprone (Ultrapro™), polypropylene with polydioxanone and oxidized cellulose (Proceed™) and polypropylene with titanium and bovine pericardium, showed that on the seventh postoperative day there was no significant difference between the meshes with respect to tensile strength, but on the 30th postoperative day tensile strength was higher in the mesh made of polyester with polyethylene-glycol-glycerol[4,12].

In the present study we note a clear difference between the meshes regarding the speed of tensile strength acquisition when evaluated by the parameters maximum deformity and rupture tension over 28 days. As expected during the healing process, over time both groups showed increases in tensile strength from the seventh to the 28th postoperative day. But in the intergroup comparison of the seventh day, the tensile strength levels achieved by the U group specimens significantly outweighed the values achieved by the P one. Such a difference over the other three weeks of observation loses any statistical value for the comparison between groups at the end of the fourth week. We believe that the behavior of the parameter tensiometry in the P group is explained by phenomena occurring and already described in other parameters of the current study. That is, the persistent wound healing inflammatory phase induced by the presence of local infection at the end of the first week leads to consequent delay in the wound maturation to the point of having less tensile strength in relation to another group at the same time. However, with the evolution of time and infection handled by the body, there is more favorable evolution of the healing process, with recovery of the delayed maturation as to match the tensiometric performance obtained by the other group at the end of the longest observation period.

The findings demonstrated in this research illustrate, in an exemplary manner, and contribute to the effective understanding of the vast and varied range of results available in the literature concerning the subject. The accumulation of new and varied evidence still remains of high contributory value in this fruitful field, of variables that insist on challenging the search for new knowledge in the area.

In conclusion, the meshes retain similarities in the final result and more studies with larger numbers of animals must be carried out to better assessment.

RESUMO

Objetivo: *analisar o desempenho de duas telas cirúrgicas de composições diferentes durante o processo de cicatrização de defeito de parede abdominal de ratos.* ***Métodos:*** *trinta e três ratos* Wistar, *machos adultos foram anestesiados e submetidos à retirada de parede abdominal anterior, exceto pele, com área de 1,5cmx2cm; 17 animais tiveram o defeito corrigido pela sutura borda a borda de tela cirúrgica, composta de polipropileno + poliglecaprone (Grupo U – Ultrapro®); 16 animais tiveram defeito corrigido utilizando tela cirúrgica composta de polipropileno + polidioxanone + celulose (Grupo P – Proceed®). Cada grupo foi dividido em dois subgrupos, de acordo com o momento da eutanásia (sete dias ou 28 dias após a operação). Foram analisados parâmetros macroscópicos (aderência), microscópicos (quantificação do colágeno maduro e imaturo) e tensiométricos (tensão máxima e força máxima de ruptura).* ***Resultado:*** *houve um aumento do colágeno tipo I no grupo Proceed® do período de sete dias para o de 28 dias, com p=0,047. E houve um aumento na tensão de ruptura quando comparados os dois períodos, nas duas telas analisadas. Houve menor tensão de ruptura e deformidade dos tecidos com a tela Proceed® em sete dias, levando a uma igualdade com 28 dias.* ***Conclusão:*** *as telas conservam semelhanças no resultado final e mais estudos com número maior de animais devem ser realizados para melhor avaliação.*

Descritores: *Parede abdominal/cirurgia. Hérnia Abdominal. Telas Cirúrgicas. Aderências Teciduais.*

REFERENCES

1. Bellón JM, García-Honduvilla N, Jurado F, García-Carranza A, García-Moreno F, Martín AC, et al. Use of composite protheses in the repair of defects in the abdominal wall: prosthetic behaviour at the peritoneum. Eur J Surg. 2001;167(9):666-71.
2. Bellón JM, Jurado F, GarcÍa-Moreno F, Corrales C, Carrera-San Martin A, Buján J. Healing process induced by three composite prostheses in the repair of abdominal wall defects. J Biomed Mater Res. 2002;63(2):182-90.
3. Bellón JM, Rodríguez M, García-Honduvilla N, Pascual G, Buján J. Partially absorbable meshes for hernia repair offer advantages over nonabsorbable meshes. Am J Surg. 2007;194(1):68-74.

4. Pundek MRZ, Czeczko NG, Yamamoto CT, Pizzatto RF, Czeczko LEA, Dietz UA, et al . Estudo das telas cirúrgicas de polipropileno/poliglecaprone e de polipropileno/polidioxanona/celulose oxidada regenerada na cicatrização de defeito produzido na parede abdominal de ratos. ABCD, arq bras cir dig. 2010; 23(2):94-9.
5. Cronin K, Jackson DS, Dunphy JE. Changing bursting strength and collagen content of the healing colon. Surg Gynecol Obstet. 1968;126(4):747-53.
6. Sher W, Pollack D, Paulides CA, Matsumoto T. Repair of abdominal wall defects: Gore-Tex vs. Marlex graft. Am Surg. 1980;46(11):618-23.
7. Gottrup F. Healing of incisional wounds in stomach and duodenum. A biomechanical study. Am J Surg. 1980;140(2):296-301.
8. Marmon LM, Vinocur CD, Standiford SB, Wagner CW, Dunn JM, Weintraub WH. Evaluation of absorbable polyglycolic acid mesh as a wound support. J Pediatr Surg. 1985;20(6):737-42.
9. Zederfeldt B. Anastomotic healing. In: Eigler FW, Gross E, Vogt E. Die Anastomose an Gastrointestinathakt TM. Verlag Hameln. 1990. p:3-16.
10. van't Riet M, de Vos van Steenwijk PJ, Bonthuis F, Marquet RL, Steyerberg EW, Jeekel J, et al. Prevention of adhesion to prosthetic mesh: comparison of different barriers using an incisional hernia model. Ann Surg. 2003;237(1):123-8.
11. Kapan S, Kapan M, Goksoy E, Karabicak I, Oktar H. Comparison of PTFE, pericardium bovine and fascia lata for repair of incisional hernia in rat model, experimental study. Hernia. 2003;7(1):39-43.
12. Burger JW, Halm JA, Wijsmuller AR, ten Raa S, Jeekel J. Evaluation of new prosthetic meshes for ventral hernia repair. Surg Endosc. 2006;20(8):1320-5.
13. Souza JB. Evolução da cicatrização de anastomose colônicas sob a ação do diclofenaco sódico administrado no periodo perioperatório. Estudo experimental em coelhos [tese]. Ribeirão Preto: Universidade de São Paulo, Faculdade Médica de Ribeirão Preto; 1994.
14. Oliveira PG. Efeito da peritonite por *Candida albicans* na cicatrização de anastomoses colônicas: estudo experimental em ratos [tese]. Ribeirão Preto: Universidade de São Paulo, Faculdade Médica de Ribeirão Preto; 1995.
15. Vizzotto Júnior AO, Noronha L, Scheffel DLH, Campos ACL. Influência da cisplatina administrada no pré e no pós-operatório sobre a cicatrização de anastomoses colônicas em ratos. J Bras Patol Med Lab. 2003; 39(2):143-9.
16. Nair SK, Bhat IK, Aurora AL. Role of proteolytic enzyme in the prevention of postoperative intraperitoneal adhesions. Arch Surg. 1974;108(6):849-53.
17. Junqueira LC, Carneiro J. Histologia Básica. 9ª ed. Rio de Janeiro: Guanabara Koogan; 1999.
18. Vrijland WW, Bonthuis F, Steyerberg EW, Marquet RL, Jeekel J, Bonjer HJ. Peritoneal adhesions to prosthetic materials: choice of mesh for incisional hernia repair. Surg Endosc, 2000;14(10):960-3.
19. LeBlanc KA, Bellanger D, Rhynes KV 5th, Baker DG, Stout RW. Tissue attachment strength of prosthetic meshes used in ventral and incisional repair. A study in the New Zeland White rabbit adhesion model. Surg Endosc. 2002;16(11):1542-6.
20. Tyrell J, Silberman H, Chandrasoma P, Niland J, Shull J. Absorbable versus permanent mesh in abdominal operations. Surg Gynecol Obstet. 1989;168(3):227-32.
21. Greene MA, Mullins RJ, Malangoni MA, Feliciano PD, Richardson JD, Polk HC Jr. Laparotomy wound closure with absorbable polyglycolic acid mesh. Surg Gynecol Obstet. 1993;176(3):213-8.
22. Baycal A, Onat D, Rasa K, Renda N, Sayek I. Effects of polyglycolic acid and polypropylene meshes on postoperative adhesion formation in mice. World J Surg. 1997;21(6):579-82; discussion 582-3.
23. Jenkins SD, Klamer TW, Parteka JJ, Condon RE. A comparison of prosthetic materials used to repair abdominal wall defects. Surgery. 1983;94(2):392-8.
24. Ferrando JM, Vidal J, Armengol M, Gil J, Manero JM, Huguet P, et al. Experimental evaluation of a new layered prosthesis exhibiting a low tensile modulus of elasticity: long-term integration response within the rat abdominal wall. World J Surg. 2002;26(4):409-15.
25. Mathews BD, Pratt BL, Pollinger HS, Backus CL, Kercher KW, Sing RF, et al. Assessment of adhesion formation to intra-abdominal polypropylene mesh and polytetrafluoroethylene mesh. J Surg Res. 2003;114(2):126-32.
26. Conze J, Rosch R, Klinge U, Weiss C, Anurov M, Titkowa S, et al. Polypropylene in the intra-abdominal position: influence of pore size and surface area. Hernia. 2004;8(4):365-72.
27. Junge K, Rosch R, Anurov M, Titkova S, Ottinger A, Klinge U, et al. Modification of collagen formation using supplemented mesh materials. Hernia. 2006;10(6):492-7.
28. Grommes J, Binnebösell M, Klink CD, von Trotha KT, Junge K, Conze J. Different methods of mesh fixation in open retromuscular incisional hernia repair: a comparative study in pigs. Hernia. 2010;14(6):623-7.
29. Binnebösell M, Klink CD, Otto J, Conze J, Jansen PL, Anurov M, et al. Impact of mesh positioning on foreign body reaction model and collagenous ingrowth in a rabbit model of open incisional hernia repair. Hernia. 2010;14(1):71-7.
30. Greca FH, de Paula JB, Biondo-Simões ML, da Costa FD, da Silva AP, Time S, et al. The influence of differing pore sizes on the biocompatibility of two polypropylene meshes in the repair of abdominal defects. Experimental study in dogs. Hernia. 2001;5(2):59-64.

Received at: 15/12/2014
Accepted for publication: 25/02/2015
Conflict of interest: none.
Source of funding: none.

Mailing address:
Ana Cristina Isa
E-mail: icrisana@yahoo.com.br

DOI: 10.1590/0100-69912015005012

Single access laparoscopic cholecystectomy: technique without the need for special materials and with better ergonomics

Colecistectomia videolaparoscópica através de acesso único: técnica sem necessidade de materiais especiais e melhor ergonomia

Marco Aurélio Lameirão Pinto, TCBC-RJ[1]; Raphael Fernando Costa Gomes de Andrade[1]; Luiz Gustavo de Oliveira e Silva, TCBC-RJ[1]; Marco Aurélio de Lacerda Pinto[2]; Roberto Jamil Muharre, TCBC-RJ[1]; Ricardo Ary Leal, TCBC-RJ[1]

A B S T R A C T

The authors describe a surgical technique which allows, without increasing costs, to perform laparoscopic cholecystectomy with a single incision, without using specific materials and with better surgical ergonomics. The technique consists of a longitudinal umbilical incision, navel detachment, use of a permanent 10mm trocar and two clamps directly and bilaterally through the aponeurosis without the use of 5mm trocars, transcutaneous gallbladder repair with straight needle cotton suture, ligation with unabsorbable suture and umbilical incision for the specimen extraction. The presented technique enables the procedure with conventional and permanent materials, improving surgical ergonomics, with safety and aesthetic advantages.

Key words: Cholecystectomy. Cholecystectomy, Laparoscopic. Video-Assisted Surgery.

INTRODUCTION

The first published laparoscopic cholecystectomy (LC) happened in 1987 by Phillipe Mouret, the year of publishing of the same procedure in France by Dubois and Perissat[1,2]. It was so successful that soon gained worldwide acceptance, being reproduced in many countries. In Brazil, the LC was first held at the Hospital Albert Einstein in Sao Paulo, by Thomas Szego [3]. Since then, laparoscopic surgery has become the gold standard for excision of the gallbladder [4].

New less invasive techniques such as NOTES (Natural Orifice Transluminal Endoscopic Surgery) and the SILS (Single Incision Laparoscopic Surgery) have been proposed. However, such procedures require specific materials. SILS requires a single incision with three accesses for trocars (permanent or disposable) and curved forceps. This cause an increase in the procedure's cost, hindering its rapid expansion [4,5].

Cholecystectomy through a single access has as advantages less postoperative pain and complications related to the extra incisions (infection, hematoma, bleeding and keloids), with better cosmetic results[4,6]. This technique more difficult to execute due to lack of triangulation and distance between incisions, as in the traditional laparoscopic route [7].

An alternative to the original SILS technique is proposed, aimed at reducing costs and improving surgical ergonomics, allowing the realization of this procedure in any center that has access to traditional laparoscopic surgical materials and staff trained in laparoscopic surgery.

TECHNICAL ASPECTS

The patient set in supine position with legs abducted and the operating table in reverse Trendelemburg (cranial elevation) and discrete left lateral decubitus. The staff must be positioned such that the surgeon is between the patient's legs, the first auxiliary on the left, and the second, on the right. The monitor should be left by the patient's right shoulder level.

A transumbilical, longitudinal incision of about 3 cm is carried out within the limit of the umbilical margins (size changed according to patient's anatomy). The skin is then dissected bilaterally, its edges are everted and secured with 3-0 nylon suture to reduce the skin damage caused by the surgical incision (Figure 1). Dissection by planes is performed until reaching the aponeurosis, with an exposure of 9 cm^2 (3cm in the longitudinal axis and 3cm in the transverse one). The repair of the aponeurosis is done bilaterally, 1 cm lateral to the umbilical ligament, with 0 prolene suture.

The aponeurosis is incised in the midline and pneumoperitoneum is instilled by open technique with

1. Clínica cirúrgica II do Hospital Federal de Bonsucesso, Rio de Janeiro, Brasil; 2. Complexo Hospitalar de Niterói, Rio de Janeiro, Brasil.

a 10 mm permanent trocar and 12 mmHg pressure. Two new incisions are made in the anterior aponeurosis of the rectus abdominis muscle, bilaterally, both 1.5 cm cranial and 1.5 cm lateral to the 10 mm trocar. Through the trocar is inserted a 10 mm, 30° angle endoscope; a conventional grasper clamp is introduced directly on the left side incision; through the right side incision are inserted clamps for dissection, repair and ligatures (Figure 2).

For an adequate examination of the cavity we introduce a conventional straight Maryland forceps. After identification of the gallbladder and lysis of possible adhesions, traction ids applied to the gallbladder towards the anterior abdominal wall by means of 2-0 cotton suture with straight needle inserted in the right subcostal region over the mid-clavicular line. This repair is performed in the gallbladder wall between the fundus and the body, with the return of the needle to the external environment (Figure 3). The cotton suture is pulled by the second auxiliary and fixed by a straight Kelly forceps, keeping the gallbladder tensioned (Figure 4). The dissection of the gallbladder pedicle starts with a grasper through the left incision for mobilization and exposure of the operative field and a conventional hook through the right incision for careful dissection.

After isolation of the cystic duct and cystic artery, we proceed to their ligations with 2-0 polypropylene suture using the extracavitary knot technique and adjusting with a knot pusher.

Afterwards, we dissect the gallbladder from the liver bed and hold a hemostasis review. We then release the cotton suture repair and remove it. With a grasper, we bring the gallbladder to the midline incision. We withdraw the 10mm trocar and extend the incision for direct visualization of the repair and removal of the gall bladder without difficulty (Figure 5).

Wound closure is performed with 0 prolene suture. The skin eversion stitches are cut and the navel repositioned with 2-0 nylon. The skin synthesis is performed with intradermic suture of 4-0 nylon (Figure 6).

DISCUSSION

With the advancement of technology after the advent of laparoscopy, new techniques have been developed to reduce surgical aggression and improve cosmetic results. Initially, the decrease in diameter and number of the ports was proposed. Then, natural orifices (NOTES) and a single access (SILS) procedures become the

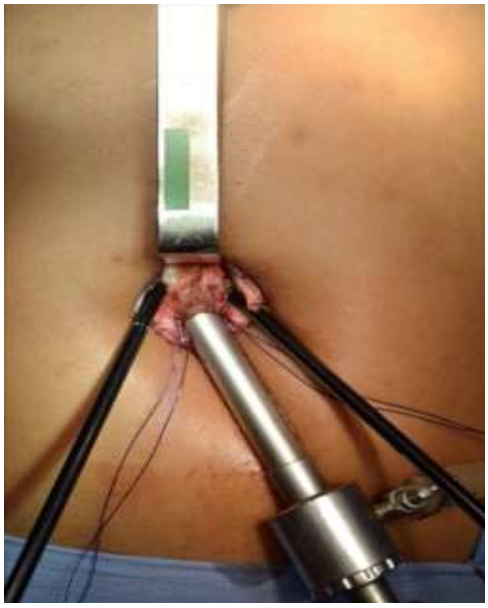

Figure 2 - *Positioning of endoscope and clamps in the single incision.*

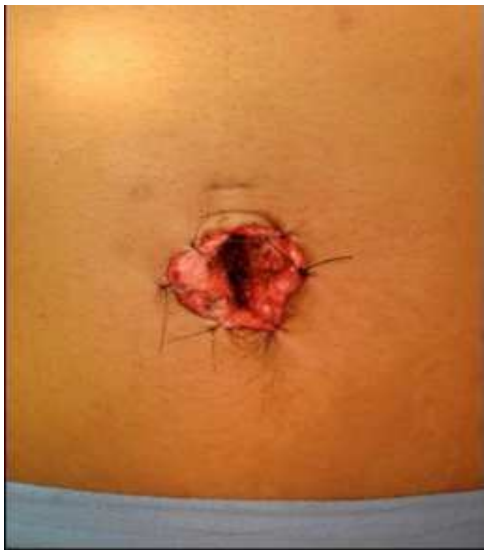

Figure 1 - *Eversion of skin for protection.*

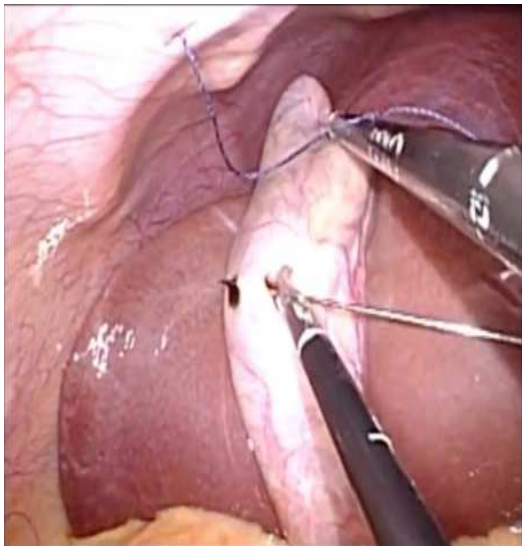

Figure 3 - *Gallbladder repair stitch with a straight needle.*

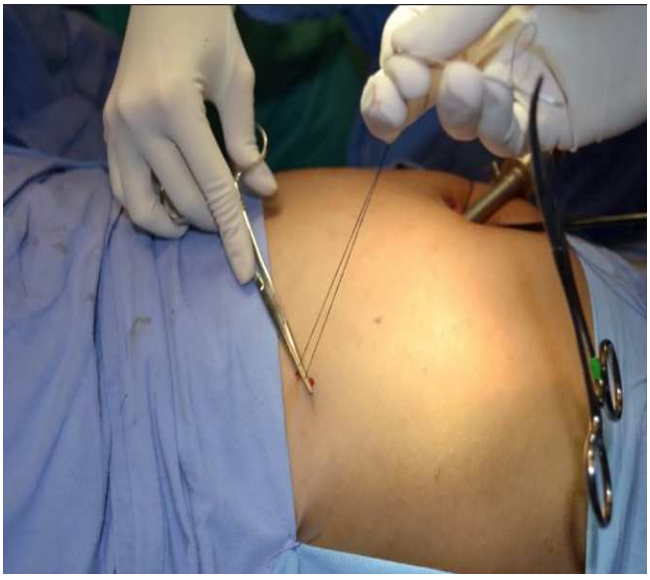

Figure 4 - *Kelly clamp pulling the transcutaneous gallbladder repair.*

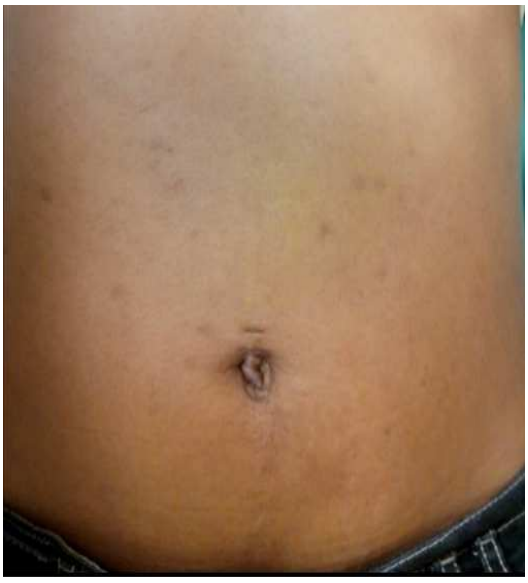

Figure 6 - *Final aesthetic result.*

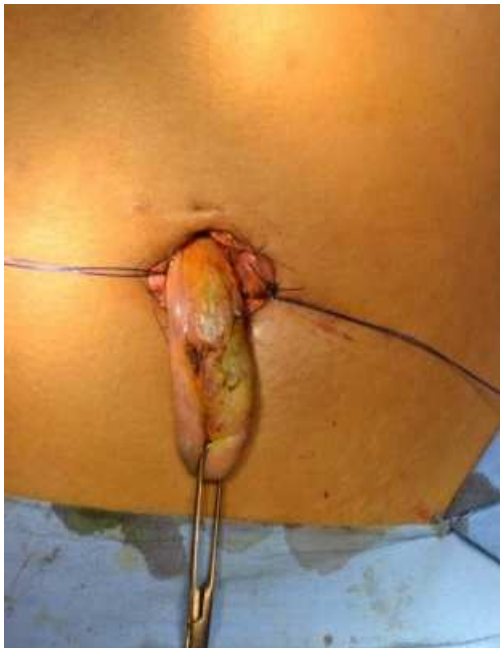

Figure 5 - *Gallbladder being removed by single umbilical incision.*

options with better aesthetic results[8]. The increase in enthusiasts of this new technique of single umbilical incision encouraged companies of surgical materials to develop a number of specific materials in order to improve its safety and ergonomics[4,7]. However, such materials are expensive.

Laparoscopic surgery has in its technical principles triangulation and traction and counter-traction, always allowing for lateralized vision (0° or 30° endoscope) and proper ergonomics to apply the necessary tractions. The difficulty of the single incision technique is the alignment of endoscope and clamps, decreasing the triangulation capability. The idea of curved or articulated clamps and endoscope with angles of up to 90° arose in the attempt to correct these obstacles, however adding a major increase in the procedure's cost[7].

Despite the optical alignment with tongs, lower ergonomics and worse triangulation, cholecystectomy by single incision did not change the iatrogenic injury rates or the percentage of conversion, only increasing operating time[9]. It is worth noting that this technique also allows a conversion to conventional laparoscopy with four incisions before resorting to laparotomy.

Alternative lower cost techniques use conventional laparoscopic materials, allowing the realization of single access surgery at any center that has access to laparoscopy and has trained staff. However, such techniques still have a difficult ergonomics due to the passing of three trocars by a single incision[2,4,7].

This alternative described herein attempts to reduce ergonomic problems, reduce surgical costs and facilitate the procedure on units with traditional laparoscopic equipment.

The techniques that use conventional straight clamps with single portal (disposable or permanent) have a significant reduction in range of motion. Similarly, the technique that uses three permanent trocars in a single incision improved range of motion, however, having three trocars with barrels (valves), collisions are inevitable, reducing the freedom of movement and hindering the procedure performance.

The improved ergonomics in this technical option has as its main cause the non-use of trocars for the 5 mm clamps, enabling the movement axis to be only the aponeurosis, greatly increasing the range of motion. When using the SILS trocar, the "single port" (three or more paths), the axis of movement of the grippers is a trocar having a

length greater than the thickness of the aponeurosis, thereby limiting surgical mobility. It is worth noting, too, that the exchange of clamps through the lateral incisions without trocar is simple and there is no loss of pneumoperitoneum because the abdominal rectus muscle functions as a valve.

This alternative technique enables the laparoscopic cholecystectomy by single access, using only permanent and conventional materials, improving cosmetic results and with good ergonomics and comfort for the surgeon.

RESUMO

Os autores descrevem uma técnica operatória que permite, sem aumento do custo, realizar a colecistectomia videolaparoscópicas, por única incisão, sem necessidade de utilizar materiais específicos, com melhor ergonomia cirúrgica. A técnica consiste na incisão umbilical longitudinal, descolamento de cicatriz umbilical, utilização de trocarter permanente de 10mm e duas pinças atravessando diretamente a aponeurose bilateralmente sem uso de trocarteres de 5mm, reparo de vesícula biliar transcutânea com fio de algodão de agulha reta, ligadura com fio inabsorvível e extração de peça cirúrgica por incisão umbilical. A técnica apresentada viabiliza o procedimento com materiais convencionais e permanentes, melhora a ergonomia cirúrgica, com segurança e vantagens estéticas.

Descritores: *Colecistectomia, Colecistectomia Laparoscópica. Cirurgia Videoassistida.*

REFERENCES

1. Litynski GS. Profiles in laparoscopy: Mouret, Dubois, and Perissat: the laparoscopic breakthrough in Europe. JSLS. 1999;3(2):163-7.
2. Alves Júnior A, Oliveira IR, Lima MP, Barros AFV, Oliveira Filho JJ, Sobral HAC. Colecistectomia videolaparoscópica transumbilical (single site) com equipamento de laparoscopia convencional. J Port Gastrenterol. 2011;18(3):118-22.
3. Guarischi A. Videocirurgia em oncologia: mitos e verdades. Rev Col Bras Cir. 2007;34(5):283-4.
4. Pinheiro RN, Castro FMB, Sousa RC, Barreira CESR, Gouveia GC, Almeida RO. Single incision laparoscopic cholescystectomy: description of a series of 30 cases of laparoscopiv cholecystectomy performed using conventional instruments. Bras J Video-Sur. 2011;4(2):91-5.
5. Dávila ÁF, Tsin DA. Cirugía por orificios naturales (NOTES y manos) ¿La tercera revolución quirúrgica? Rev Mex Cir Endoscop. 2006;7(1-4):6-13.
6. Langwieler TE, Nimmesgern T, Back M. Single-port access in laparoscopic cholecystectomy. Sur Endosc. 2009;23(5):1138-41.
7. Galvão Neto M, Ramos A, Campos J. Single port laparoscopic access surgery. Tech Gastrointest Endosc. 2009;11(2):84-93.
8. Hong TH, You YK, Lee KH. Transumbilical single-port laparoscopic cholecystectomy: scarless cholecystectomy. Surg Endosc. 2009;23(6):1393-7.
9. Deveci U, Barbaros U, Kapakli MS, Manukyan MN, Simsek S, Kebudi A, et al. The comparison of single incision laparoscopic cholecystectomy and three port laparoscopic cholecystectomy: prospective randomized study. J Korean Surg Soc. 2013;85(6):275-82.

Received at: 18/10/2014
Accepted for publication: 20/12/2014
Conflict of interest: none.
Source of funding: none.

Mailing address:
Marco Aurélio Lameirão Pinto
E-mail: marcoalp@globo.com

Basic skills for outpatient surgery in medical graduation

Habilidades básicas para cirurgias ambulatoriais na graduação médica

Kátia Sheylla Malta Purim[1]; James Skinovsky, TCBC-PR[2]; Júlio Wilson Fernandes, TCBC-PR[2]

A B S T R A C T

Medical students must have domain of basic surgery skills before starting more advanced stages of surgical learning. The authors present a practical and reproducible system of operative techniques circuit, idealized and often applied to the fourth year medical students of a private educational institution. This method has enabled accurate assessment of students' skills, improving their performance and preparing them for more advanced stages of the surgical learning.

Key words: Teaching. Education, Medical, Undergraduate. Education, Medical. Ambulatory Surgical Procedures. Aptitude.

INTRODUCTION

Studies show that, in general, surgical teaching in the classroom is accompanied by formal and informal methods combined with activities in outpatient clinics, operating rooms and wards, relying mainly on the observation and implementation of practical procedures through proper and experienced supervision [1,2].

Molds, sponges, mannequins, simulators, virtual reality, films, interactive videos, software, games, responsible use of animals, cadavers, human tissues, sutures and knots lab and surgical techniques workshops are auxiliary educational resources for teaching-learning-assessment with ethical, effective bases and with recoverable costs in the medium and long term 2.3.

In Brazil, the curricular guidelines for undergraduation recommend forming a general practitioner able to perform clinical and surgical initial emergency procedures and basic outpatient care ones[1]. Given the extreme importance of surgical techniques for medical practice, this article aims to present a proposal to implantation of a surgical skills circuit for students at the beginning of the school year, held in a private education institution teaching hospital in Curitiba, Paraná, Brazil.

SURGICAL TECHNIQUES CIRCUIT

Context

The medical school in question has achieved prominence on the national scene due to its education program, teacher training, academic management and structural support provided to student training. During the third year of the course, students receive surgical training through lectures, experimental procedures in the operating room and extension courses for development of surgical technique principles. In addition, since the beginning of graduation they are introduced to the basic health units and other health care environments where they can experience routines, conducts, and attitudes necessary for future profession[4-6].

The Discipline of Outpatient Surgery[2,5] is offered in the fourth year of Medicine for classes of 50-60 students, divided into smaller groups of 10 to 12 students for practicing, aimed at providing the student the knowledge essential to the diagnosis and treatment of frequent and important surgical diseases. The lectures are held in the teaching hospital and the practices developed in the clinic, operating room and wards, and in each class the student played a different role.

Circuit Preparation

The educational planning was based on surgical discipline infrastructure existing in the teaching hospital (Figure 1). We held prior meetings with the coordination, teachers, nursing staff, residents and the class representatives to discuss the issue, content, objectives, strategies, resources, assessment and records. We set up a list of surgical permanent and consumption material, defining what was to be held and used in each room, which was named "station". For circuit sequence of activities, we used as infrastructure a taps bench, three operating rooms and the resource room (Figure 2).

1. Disciplina de Dermatologia e Cirurgia Ambulatorial da Universidade Positivo (UP); 2. Cirurgia Ambulatorial e Clinica Cirúrgica da Universidade Positivo (UP).

The proposal was sent in advance by digital media for students, stimulating study and review of the technical textbooks, atlases and electronic resources. At the beginning of the semester, there was a general meeting in the classroom for presentation of the most important elements of the stations and clarification of doubts. As an incentive we offered one credit on the practice grade of the first bimester for those who voluntarily completed the circuit and assessment.

Stations proceedings

The circuit was organized in a practical test fashion, with fixed time and performed in the operating rooms of the discipline at the university hospital (Figures 1 and 2). Each station was equipped with the listed materials, which were rapidly replenished by nursing as needed. The time available for the student to perform the activity was ten minutes, marked in a timer to allow evaluation of five students per group.

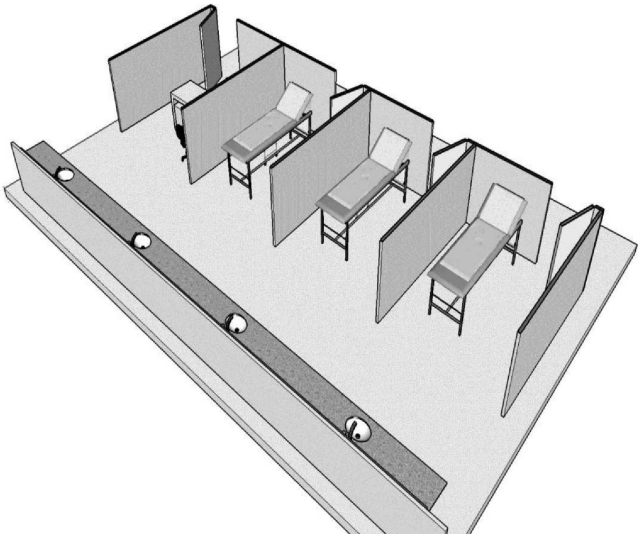

Figure 1 - *Perspective of the infrastructure of Outpatient Surgery Discipline in the university hospital.*

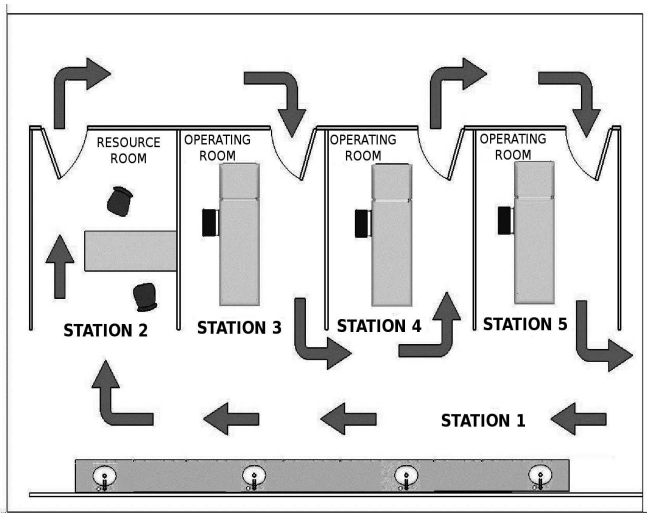

Figure 2 - *Schematic drawing of the surgical techniques circuit.*

Station 1 held hands brushing and the station 2, scrubbing. In station 3, an senior-monitor worked as a patient, and for the needlestick actions planned at stations 4 and 5, were used oranges. Supervision was carried out by three surgery professors and two residents.

Assessment criteria

We analyzed Cognitive (knowledge), psychomotor (skills) and affective (attitudes) aspects considered key for surgery, broken down by station according to Table 1.

The student performance was evaluated using an illustrated instrument with the Likert scale[7] (Table 2). After the execution of each stage, the feedback session was held, the technique being repeated by an expository and demonstrative method of the correct surgical gesture by the supervisor, followed by demonstration and simulation by the student.

DISCUSSION

The development of appropriate surgical technical skills involves the perception of their application in the reality in which we live and the learner's willingness to commit to continuous exercise of the surgical art to develop skills, improve accuracy and refine details[2]. This circuit aimed at screening cognitive, psychomotor and affective domains of the students who were beginning the fourth year of Medicine, identifying difficulties and facilities in relation to surgical techniques, mapping points for strengthening and ways to overcome challenges inherent to surgical activities.

The planning of this strategy explored the students' expected prior knowledge and helped to review, clarify and standardize operating procedures that should be checked systematically. The didactic actions set specific goals and guidelines to be achieved during the course of outpatient surgery.

Research shows that the Simulation-Based Medical Education (SBME) can provide consistent learning and has been used in urgency and emergency medicine[8] and in the prevention of infections related to health care[9]. The proposed circuit combined three categories of learning: exposure, exploration and simulation[10]. This diversity of methods tried to reach for different students within the same group, evaluate, level, adjust the teaching plan, adapting strategies and content, and also reduce, directly and indirectly, failures and cost of wasted time and material in the weekly surgical activities of the discipline.

This new architecture in the evaluation process also served to integrate theory and practice, giving priority to the dynamic methods for review, correction, structuring, strengthening and updating of surgical expertise.

Table 1 - Knowledge, skills and attitudes tested in each circuit station.

SURGICAL SKLIIS CIRCUIT	KNOWLEDGE	SKILLS AND ATTITUDES
	What the student should know	What the student should do
STATION 1	Infection prevention notions	Surgical hand scrubbing
STATION 2	Surgical garment notions	Using cap, mask and goggles. Putting apron and sterile gloves
STATION 3	Surgical instrumentation notions	Putting fields on the table and on the patient, preparing turban, checking cautery and lights, recognizing and using instruments
STATION 4	Physiology and anesthesia notions	Inserting and removing scalpel blades, removing anesthetic from the vial, performing local anesthesia, using antiseptics, suturing and assembling the needle holder
STATION 5	Basic knowledge of anatomy and surgical techniques, prescription and medical documentation	Incision and marking for pathology, hemostasis, basic suturing and knots, applying dressing, discarding sharps, checking prescription, histopathological examination request, surgery description of the operating room discharge.

Table 2 - Instrument used to evaluate medical students during the surgical techniques circuit[7].

DIAGNOSTIC EVALUATION		LIKERT SCALE				
OBJECTIVES PROPOSED FOR EACH STATION		5	4	3	2	1
1	Hand scrubbing and resourcefulness					
2	Putting apron and gloves					
3	Putting the table fields, fields on the patient, preparing turban, checking cautery and surgical lights, using instruments.					
4	Inserting and removing scalpel blades, removing anesthetic from the vial, performing local anesthesia, using antiseptics, suturing and assembling the needle holder					
5	Incisions and marking for pathology, hemostasis, basic suturing, dressing, prescription and filling paperwork for surgery description, histological examination, and operating room discharge.					

LEGEND: **5** = Fully satisfactory; **4** = Satisfactory; **3** = Fair; **2** = Unsatisfactory; **1** = Fully unsatisfactory.

Date: / /

Evaluator name:_____

Student's name:_____

One of the advantages of the circuit putting students a in practical activities setting to mobilize knowledge, articulate skills and attitudes in view of their duties and responsibilities. The multitasking performance way introduced in this proposal intended to raise awareness of the importance of the field of surgical techniques in the development of the individual and collective assistance to the community, with fewer errors[11] and more accuracy, and, above all, to encourage students' skills, increase patient safety and prevent adverse surgical events[12-14].

However, there are precautions to be taken when using this circuit. One of them refers to the fact that while the basic techniques are essential, the success of the operation depends on a set of factors related to the surgical team, the patient and the surrounding environment[2,15]. As limitations of this method, we can list the student anxiety, fear of exposing weaknesses in front of colleagues / teachers and fatigue by the apparent reproduction and repetition of techniques, although isolated acts were not equal. Another aspect is the common sense of the supervisor to manage time, enabling a favorable learning environment. In addition, as in other areas of health, the teaching staff need to be trained, integrated, cohesive, communicate clearly, and receive support and resources to achieve the proposed objectives.

On the other hand, there is awareness that evaluation is a complex and multidimensional process and it would not be possible at the time to deepen the matter of assessment of what has been internalized by the student. However, this learning experience sparked debates about the role of the institution, the professor, the student and society in the teaching-learning-assessment process[1,3,10-13].

It is noteworthy that in the Department of Ambulatory Surgery, professors keep up to date and research resources, techniques and tools to better understand students (initial or diagnostic assessment), follow learning during the teaching process (continuous, training or procedural assessment) and globally analyze results (final or summative evaluation) to add more quality. Hits and

misses are used for improvement of methods, tools and logistics activities.

It can be inferred that this proposal has achieved success by offering knowledge integration opportunities gained from previous cycles of the Medical School and enable analysis of some techniques and skills necessary to perform basic surgical procedures. Its improvement can awaken in professors and students the satisfaction of new discoveries and achievement of more meaningful knowledge in higher education.

In conclusion, this surgical skills circuit may constitute an evaluation resource for students and add benefits in the outpatient surgery teaching-learning process for medical undergraduates.

R E S U M O

Estudantes de Medicina devem ter domínio de habilidades básicas de cirurgia antes de iniciarem etapas mais avançadas no aprendizado cirúrgico. Os autores apresentam sistema prático e reprodutível de circuito de técnicas operatórias, idealizado e frequentemente aplicado aos alunos do quarto ano médico de uma instituição privada de ensino. Este método tem permitido avaliação precisa das habilidades dos estudantes, aprimorando seu desempenho, e preparando-os para etapas mais avançadas do aprendizado cirúrgico.

Descritores: *Ensino. Educação de Graduação em Medicina. Educação Médica. Procedimentos Cirúrgicos Ambulatoriais. Aptidão.*

REFERENCES

1. Brasil. Ministério da Educação. Diretrizes curriculares nacionais para o curso de medicina. Acessado em: 20 mar 2015. Disponível em: http://portal.mec.gov.br/cne/arquivos/pdf/Med.pdf.
2. Purim KSM. Oficina de cirurgia cutânea. Rev Col Bras Cir. 2010;37(4):303-5.
3. Bravo Neto GP. O ensino da cirurgia para alunos de graduação. Rev Col Bras Cir. 2000;27(5):1.
4. Purim KSM. Portal Universitário: acesso e uso no ensino da dermatologia. Rev Bras Educ Med. 2014;38(3):356-66.
5. Purim KSM, Skinovsky J, Fernandes JW. Uso de painel de artigos científicos no ensino da cirurgia ambulatorial. Rev Col Bras Cir. 2013;40(6):490-3.
6. Ugarte ON, Acioly MA. O princípio da autonomia no Brasil: discutir é preciso... Rev Col Bras Cir. 2014;41(5):374-7.
7. Likert R, Roslow S, Murphy G. A simple and reliable method of scoring the thurstone attitude scales. Person Psychol. 1993;46(3):689-90.
8. Flato UAP, Guimarães HP. Educação baseada em simulação em medicina de urgência e emergência: a arte imita a vida. Rev Soc Bras Clin Méd. 2011;9(5):360-4.
9. Silva ARA, Campos ALM, Giraldes JM, Almeida MM, Oka CM. Uso de simuladores para treinamento de prevenção de infecções relacionadas à assistência à saúde. Rev Bras Educ Med. 2015;39(1):5-11.
10. Mourão MGM, Caldeira AP, Raposo JJBV. A avaliação no contexto da formação médica brasileira. Rev Bras Educ Med. 2009;33(3):441-53.
11. Bitencourt AGV, Neves NMBC, Neves FBCS, Brasil ISPS, Santos LSC. Análise do erro médico em processos ético-profissionais: implicações na educação médica. Rev Bras Educ Med. 2007;31(3):223-8.
12. Fragata JIG. Erros e acidentes no bloco operatório: revisão do estado da arte. Rev Port Saúde Pública. 2010;Vol Temat(10):17-26.
13. Organização Pan-Americana da Saúde/Organização Mundial da Saúde. Segundo desafio global para a segurança do paciente: cirurgias seguras salvam vidas. Acessado em: 06 mar 2015. Disponível em: http://new.paho.org/bra/ index.php?option=com_docman&task=doc_ download&gid=980&ltemid=423
14. World Health Organization. World Alliance for Patient Safety: Forward Programme, 2008-2009. Acessado em: 10 mar 2015. Disponível em: www.who.int/patientsafety/en
15. Moriya T, Vicente YAMVA, Tazima MFGS. Instrumental cirúrgico. Medicina. 2011;44(1):18-32.

Received: 30/03/2015
Accepted for publication: 10/05/2015
Conflict of interest: none.
Source of funding: none.

Mailing address:
Kátia Sheylla Malta Purim
E-mail: kspurim@gmail.com

DOI: 10.1590/0100-69912015005014

Laparoscopy in uterine cervical cancer. Current state and literature review

Laparoscopia no câncer de colo uterino. Estado atual e revisão da literatura

Audrey Tieko Tsunoda, ACBC-SP[1]; Carlos Eduardo Mattos da Cunha Andrade[1]; Marcelo Andrade Vieira[1]; Ricardo dos Reis[1]

A B S T R A C T

Cervical cancer remains the most frequent gynecological tumor in Brazil and other developing countries. Minimally invasive techniques, especially laparoscopy, have been increasingly employed in such tumors. This article aims to describe the main applications of laparoscopy in the treatment and staging of cervical cancer. In the early stages, it is possible to provide a fertility-preserving surgery in the form of radical trachelectomy and, in a study protocol, the function-preserving surgery, avoiding parametrectomy and the associated morbidity. A fully laparoscopic radical hysterectomy is fairly standard in the literature and has the tendency to become the standard of care in early cases, for patients who want to bear no more children. In advanced stages, minimally invasive surgery can offer ovarian transposition, with intent to prevent actinic castration, without upsetting the time for the start of radiotherapy and chemotherapy. Staging laparoscopic surgery, including pelvic and para-aortic lymphadenectomy, has been the subject of studies, since it has the potential to modify the extension of radiotherapy depending on the extent of lymph node spread.

Key words: Colonic Neoplasms. Laparoscopy. Neoplasm Staging. Therapeutics. Hysterectomy. Lymph Node Excision.

INTRODUCTION

In developing countries, cervical cancer is the most common cause of cancer death in women, accounting for the highest number of years of life lost due to cancer. It is most commonly diagnosed around the fifth decade of life, ie, several years earlier than the average age for breast, lung and ovarian cancers. The cervical cancer in the early stages is highly curable when treated properly[1]. Laparoscopy has now been applied for the management of cervical cancer both at early and advanced stages[2].

Early-stage cervical cancer

In 1912, Wertheim (Austria, 1864-1920), who designed the surgical treatment for cervical cancer used today (radical hysterectomy), published his first results. In 1944, Meigs (United States, 1892-1963) added the bilateral pelvic lymphadenectomy. The procedure became known as the Wertheim-Meigs surgery[3].

The Wertheim-Meigs surgery includes the exeresis of the uterus, 25% of the proximal vagina, the uterosacral ligaments, the uterovesical ligaments and both parametria[4]. Moreover, a bilateral pelvic lymphadenectomy is held, which includes the four major lymph node groups: ureteral, obturator, hypogastric and pelvic. This is the classical treatment of early stages of cervical cancer[1].

Laparoscopy has been applied in the realization of some steps or even the complete procedure. The literature thus describes a combination of routes and procedures for early cervical cancer, such as pelvic lymphadenectomy, laparoscopic radical hysterectomy, laparoscopic-assisted radical vaginal hysterectomy, laparoscopic-assisted radical vaginal trachelectomy and vaginal-assisted radical laparoscopic trachelectomy[2].

Laparoscopic Radical Hysterectomy

The first laparoscopic radical hysterectomy with pelvic and para-aortic lymphadenectomy was performed by Nezhat et al. In 1989 and described in the literature in the early 90s[5]. Since then, several authors have published their experience with the procedure. In the series described by the MD Anderson Cancer Center all patients with cervical cancer undergoing laparoscopic radical hysterectomy showed clear margins and no patient required conversion to laparotomy. This study was the first to demonstrate a median hospital stay of one day after this type of procedure[6].

Several studies confirm that laparoscopy is associated with better postoperative outcome compared with laparotomy, ie, less intraoperative bleeding, smaller incisions, shorter hospital stays, without compromising the size of the radical hysterectomy specimen. As for cancer

1. Departamento de Ginecologia Oncológica, Hospital de Câncer de Barretos / Fundação Pio XII, Barretos, SP, Brasil.

prognosis, it seems to have similar results to those of laparotomy surgery[6-9]. Moreover, laparoscopic radical hysterectomy can be performed in developing countries with quality similar to the technique used in major world reference centers[10]. A recent study evaluated the role of laparoscopic radical hysterectomy compared with laparotomy radical hysterectomy in patients with tumors ≥3cm. The authors concluded that the laparoscopic approach may be used for this surgical approach without harm for the treatment of patients with this tumor size[11].

In order to assess whether minimally invasive surgery presents results similar to laparotomy, the prospective, randomized LACC (Laparoscopic Approach to Cervical Cancer, MD Anderson Cancer Center, NCT00614211, www.clinicaltrials.gov) clinical trials being conducted. This unpublished, multicenter study has the participation of a Brazilian center (Hospital de Câncer de Barretos, HCB). Through it, one can measure the cancer effectiveness, lower morbidity and the potential gain in quality of life offered by laparoscopy and robotics[12].

In HCB, this procedure was first performed laparoscopically in 2009, with an increasing number of cases over the past three years (Table 1).

Laparoscopic lymphadenectomy

In cervical cancer lymph node involvement is an important prognostic factor[1]. Approximately 7% to 15% of patients with cervical cancer in the early stages presents with compromised pelvic lymph nodes. The number of lymph nodes removed is an important prognostic factor[13] and can be equal or even superior in laparoscopy[9].

The realization of the pelvic and para-aortic lymphadenectomy by laparoscopy is safe, feasible and displays acceptable complications rates within Oncologic Gynecology[14,15].

Lymphatic mapping

Lymphatic mapping in cervical cancer can be accomplished by injection of dye (patent blue, indocyanine green) and radiopharmaceutical in the cervix. It is a feasible procedure, but with limitations in terms of sensitivity and specificity[1,16]. The technique for surgical detection of the sentinel lymph node can be performed entirely by laparotomy or laparoscopy[2].

In HCB the laparoscopic approach is offered to all patients with indication of radical hysterectomy, ie, cervical cancer confined to the cervix, in stages IA1 with lymphovascular invasion, IA2 and IB1. Only those patients randomized to the laparotomy for the LACC research protocol (previously cited, NCT00614211, www.clinicaltrials.gov) have the surgery performed in the conventional manner. Whenever possible, we research the sentinel lymph node with combined technique, patent blue and radiopharmaceutical. The sentinel lymph node is sent to perioperative pathological examination, followed by systematic pelvic lymphadenectomy. If the sentinel node is negative, the radical hysterectomy indication remains. If it is positive, hysterectomy is abandoned and lymphadenectomy is extended to the para-aortic. In cases without sentinel node search, we carry out a systematic iliac and obturator bilateral lymphadenectomy, with selection of the largest and/or suspected lymph nodes for perioperative pathological examination. If lymph node involvement is detected, radical hysterectomy is abandoned and the lymphadenectomy is extended to the retroperitoneum (para-aortic), till the level of the left renal vein.

Fertility-sparing treatment - radical trachelectomy

With the increased incidence of cervical cancer in younger age groups, with sometimes undefined progeny, fertility-preserving techniques have become a demand for the surgeon and a hope for patients.

Infertility generated by cancer can cause depression, stress and sexual dysfunction in young women and the preserving alternative should be considered and discussed with the patient.

Conducted by Daniel Dargent since 1987, radical trachelectomy was first described as totally vaginal. It includes the removal of the cervix, the vaginal cuff and parametria, keeping the uterine body, fundus and

Table 1 - Totally Laparoscopic Radical Hysterectomy.

	N
Number of procedures	62
Surgical time	
First 32	259.1min
Last 30	222.4min
p=0.024	
Perioperative bleeding	
First 32	134.7ml
Last 30	99.7ml
p=0.316	
Perioperative complications	5 (10%)
Bladder injury	1
Ureteral injury	1
Neural injury	1
Vascular injury	2
Reoperations/reinterventions	0
Conversions	2 (5%)
Late complications	7 (12.9%)
Ureteral stricture	1
Urinary retention	1
Dehiscence of vaginal cuff	2
Peripheral neuropathy	2
Urinary fistula	1

Source: Department of Gynecology Oncology, Hospital de Câncer de Barretos / Fundação Pius XII (2009-2013).

attachments. Concomitant pelvic lymphadenectomy, in turn, was conducted via laparoscopic[17].

The vaginal radical trachelectomy is the most performed fertility-sparing procedure in the world for early cervical cancer. More than 700 cases have been reported, with later 250 pregnancies that generated about 100 live births. Some groups have shown success in up to 80% of pregnancy attempts with the use of assisted reproduction therapy[18].

The indications for the procedure are: age ≤45 years, desire to preserve fertility, fertile patient, stages IA1 with invasion of lynphovascular spaces, IA2 and IB1 < 2cm, with magnetic resonance imaging showing no parametrial invasion and no evidence of lymph node or distant metastases[19]. Factors such as invasion of lymphovascular space, high grade tumors and the diameter > 2cm can be considered contraindications for fertility-preserving surgery[18]. A recent study showed that radical trachelectomy could be indicated in patients with tumor size between 2 and 4 cm in 30% of patients who would be candidates for fertility-loosing radical surgery[20], but the current consensus is to indicate this procedure in patients with tumors up to 2 cm.

Laparotomy started to be used in radical trachelectomy over the past decade[18]. In 500 patients undergoing abdominal radical trachelectomy, there was 10% conversion to radical hysterectomy, 0.4% deaths and three intraoperative complications. During 32 months of follow-up, recurrence was 3.8%. Of those who tried to conceive, 60% were able to get pregnant, with 40% term pregnancies[21].

The techniques of radical trachelectomy by laparoscopy and by robotic surgery have been feasible in initial experiments, with low rates of intraoperative complications and no conversion to laparotomy with seasoned teams[22].

The laparoscopic approach has been less used, possibly because of the technical difficulty to perform the suturing of the isthmus / residual cervix to the vaginal cuff. However, for teams with experience in laparoscopic radical surgery for cervical cancer, it remains an alternative access with reduced morbidity, similar oncological outcomes and good fertility rates[23].

In countries where the access to robotic surgery is limited, laparoscopic surgery may represent a good option among the minimally invasive techniques[23]. At we HCB perform vaginal-assisted laparoscopic radical trachelectomy, using the vaginal route only to amputation of the cervix and reanastomosis of the remaining uterus to the vagina.

Less Radical Treatment for Early Stage Cervical Cancer

As already described, treatment options for patients in early stages of cervical cancer are surgery (radical hysterectomy or radical trachelectomy) or radiotherapy (with or without chemotherapy)[1]. The choice between these treatment modalities involves multiple factors, such as the most common morbidities of each treatment, patient's performance status, desire to maintain fertility and prognostic factors. Radical surgery is the standard treatment for young patients with good performance status.

The most frequent and significant sequelae presented in radical surgical treatment are due to the removal of the parametrium, which contains autonomic nerve fibers associated with bladder, bowel and sexual function[24]. Removal of the parametrium in patients in early stages that do not have poor prognostic factors (larger lesions with lymphovascular invasion or deep stromal invasion) was questioned from studies that identified a small percentage of parametrial involvement in this subgroup[25]. Due to the morbidity of parametrectomy, some services are developing an autonomic nerve-sparing radical hysterectomy, both minimally invasive and by laparotomy, in order to decrease the nervous sequelae in the vagina, bladder and rectum. A recent study has shown that this technique is associated to lower anorectal dysfunction[26]. Another long-term study showed that laparoscopy for radical hysterectomy improves nervous dissection and preservation due to the better magnification[27].

The first study to evaluate the possibility of treating low-risk women in the early stages without resection of the parametrium was conducted by Kinney et al. In 1995. They analyzed 387 women with cervical cancer who underwent radical hysterectomy. Of these, 83 (21.4%) were classified as belonging to a subgroup of low risk among patients in early stages of cervical cancer. The criteria adopted were only cases with histological subtype of squamous cell carcinoma, larger tumor diameter less than 2 cm and no lymphovascular invasion. In this low-risk subgroup, no case had parametrial involvement, and the authors raised the possibility of a less radical treatment[28].

In 2002, Covens et al. evaluated the incidence and predictors of parametrial involvement in women undergoing radical hysterectomy for cervical cancer in stages Ia1 through IB1. Of 842 patients, 33 (4%) had parametrial involvement, and as compared to patients without involvement, patients were older, had larger tumor diameter, increased incidence of lymphovascular invasion, higher frequency of histological grades 2 or 3, deeper stromal invasion and higher incidence of metastases to pelvic lymph nodes. The incidence of parametrial commitment in patients with tumor ≤2cm, negative pelvic lymph nodes and depth of invasion ≤10 mm was 0.6%[29].

The MD Anderson Cancer Center conducted an analysis of all women undergoing radical hysterectomy with pelvic lymphadenectomy for cervical cancer between 1990 and 2006. They included 350 women, of whom 27 (7.7%) had parametrial commitment with statistically significant increased frequency and: tumor size > 2cm ($p = 0.001$), histological grade 3 ($p = 0.01$), lymphovascular invasion ($p = 0.002$) and pelvic lymph node metastases ($p < 0.001$). Patients with squamous histology, adenocarcinoma or adenosquamous carcinoma, with tumor smaller than 2 cm

and without lymphovascular invasion showed no parametrial commitment[25].

The prospective study by Pluta *et al*. showed that in patients with negative sentinel lymph node frozen section radicality reductio is safe without performing the parametrectomy in the subgroup of patients with tumors < 2cm and with stromal invasion < 50%. Of 60 patients, 55 had a negative sentinel node, and after simple vaginal hysterectomy and laparoscopic lymphadenectomy no recurrence occurred in a 47-month median follow-up[30].

The standardization of prognostic criteria for the performance of function-conserving surgery is not yet established. A South Korean multicenter study compared the most commonly used criteria for itss indication: 1) Tumor ≤1cm, 2) tumor ≤1cm and stromal invasion ≤5mm, 3) Tumor ≤1cm and absence of lymphovascular invasion, and 4) tumor ≤1cm, stromal invasion ≤5mm and absence of lymphovascular invasion. Among these, the criterion Tumor ≤1cm seems to be safe enough for the indication of treatment without parametrectomy[31].

To evaluate the obstetric results of parametrium preservation, Raju *et al.* analyzed a subgroup of low-risk patients, comparing radical vaginal trachelectomy with simple trachelectomy, and there was no significant difference in prognosis between the methods. However, the morbidity related to treatment was reduced and the potential for fertility increased in the group submitted to simple trachelectomy[32].

To evaluate safety and application of function-conserving surgery in women with early stage cervical cancer and favorable pathologic criteria, the MD Anderson Cancer Center team is conducting a multicenter, prospective study, with the participation of the Hospital de Câncer de Barretos (NCT01048853, www.clinicaltrials.gov). The inclusion criteria are: cases of cervical cancer in IA2 / IB1 stages with tumor ≤2cm without lymphovascular invasion, with histology of squamous cell carcinoma (any grade) or adenocarcinoma (grades 1 or 2), cone margin and endocervical canal curettage negative for invasive, high-grade squamous intraepithelial lesions, and stromal invasion < 10mm. The sample size was calculated in 100 patients and the protocol adopts strict security criteria for patients, the study being suspended if there are two or more relapses.

Another ongoing study in this context is the SHAPE Trial (NCT 01658930, www.clinicaltrials.gov), a Canadian randomized trial that includes patients at stages IA2 / IB1, with favorable histology (squamous cell carcinoma, adenocarcinoma or adenosquamous carcinoma), tumor < 2cm, stromal invasion < 50% and MRI or CT scan without evidence of lymph node involvement. Women included are randomized, the control group undergoing radical hysterectomy with pelvic lymphadenectomy (with or without sentinel lymph node) and the experimental groups undergoes simple hysterectomy with superior colpectomy and pelvic lymphadenectomy (with or without sentinel lymph node). They will assess postoperative quality of life, disease-free interval and overall survival[33].

Function-conserving surgery may represent a therapeutic option in the early stages with favorable prognostic criteria. But ongoing studies should define what criteria should be adopted so that low-risk patients benefit from this morbidity reduction without compromising their good prognosis.

ADVANCED STAGES

Concept and current treatment of locally advanced cervical cancer

The tumor of the cervix that goes beyond the cervical ring is considered locally advanced cervical cancer according to the International Federation of Gynecology and Obstetrics – FIGO[34]. Some centers, like the Cancer Hospital of Barretos (HCB), adopt the concept of locally advanced disease, even for tumors confined to the cervix and upper third of the vagina, but measuring more than 4 cm in the major axis (IB2 and IIA2 stages)[1]. This is because, for the vast majority of these cases, there is need for treatment with pelvic radiotherapy to offer greater overall survival and disease-free interval[35,36]. The traditional criteria of adjuvant radiotherapy indication for cervical cancer were established from the higher chance of relapse when there is parametrial invasion, compromised pelvic lymph nodes and positive resection margins[36]. Other minor factors, when combined, also confer higher recurrence risk, such as angiolymphatic invasion, tumor size > 4cm or deep cervical stromal invasion[37]. It is known that radical surgery for primary tumor, followed by adjuvant therapy with radiation, presents more complications than exclusive radiotherapy and chemotherapy, with no benefits in terms of local control and overall survival[38].

Therefore, the current treatment for locally advanced cervical cancer, stages IB2 to IVA, is pelvic radiotherapy combined with radiosensitising chemotherapy, followed by cervical high-dose brachytherapy [1].

Locally advanced cervical cancer and evaluation of lymph node status

To date, FIGO did has not included the evaluation of lymph nodes as part of cervical cancer staging, which remains eminently clinical[34]. However, lymph node involvement remains a significant prognostic factor that can change the therapeutic approach and hence modify these patients' the survival rates[36]. In the treatment guidelines suggested by the American National Comprehensive Cancer Network – NCCN, the assessment of lymph node stage prior to the combined treatment can be done through imaging or minimally invasive surgery[39]. In the presence of involved para-aortic lymph nodes, there is indication of radiotherapy with field extension to this topography[39].

Between 12% and 25% of locally advanced cervical cancers have para-aortic lymph node metastases. Computed tomography, magnetic resonance imaging and PET-CT have been used to assess pretreatment lymph node status in such patients. The chances of false-negative results in this group ranges from 10% to 28% in several series[40]. For women with positive pelvic lymph nodes, the chance of positive para-aortic lymph nodes, even with negative PET-CT, is 20% to 25%[40,41]. Thus, surgery is considered more appropriate than the imaging studies available today for assessing lymph node status in locally advanced cervical cancer.

Pretreatment surgical staging

The surgical staging prior to combined radiotherapy and chemotherapy for the treatment of advanced cervical cancer has the potential benefit to modify the extent of the therapeutic field set to radiotherapy (extension for para-aortic space). Moreover, removal of lymph nodes enlarged due to involvement by tumor disease provides a reduction in volume, with the increase in efficacy of radiotherapy in the para-aortic space. This explains why, in order to eliminate macroscopic disease > 2 cm in diameter, it would require a radiation dose of at least 6000 cGy, prohibitive in this topography, even with the use of intensity modulated radiotherapy technology (IMRT). In the absence of macroscopic disease, with the intention of adjuvant therapy after removal of the lymph nodes, the recommended effective dose for radiobiological effect is about 4500 cGy, offered with greater safety in a conventional planning in three dimensions[42].

Therefore, removal of committed para-aortic lymph nodes previous to combined treatment can modify the field and reduce the need of high radiation doses on the site.

Three studies conducted by the Gynecologic Oncology Group – GOG – identified by the numbers 85, 120 and 165, analyzed the potential benefit of surgical staging prior to the combined treatment with radiotherapy and chemotherapy. Among the surgically staged 555 patients, overall survival and four-year disease-free interval were, respectively, 54% and 49%. On the other hand, among the 130 patients who underwent clinical and radiological staging, these percentages were 40% and 36%, respectively[43]. Although these studies did not intend to evaluate this issue, that difference was statistically significant.

When comparing the survival of women with para-aortic lymph node metastasis ≤5mm in diameter undergoing surgery, it was observed that it was similar to women with negative para-aortic lymph nodes (70% in four years)[40,41]. Among the patients with lymph node metastasis > 5mm and / or capsular involvement and / or fixed nodes, the overall survival rate at four years was greater than 30%, much lower than in previous groups but greater than the overall survival of patients in FIGO stage IVB (distant metastases)[34,40,41].

Other groups performing surgical staging prior to combined treatment corroborate these results, observing low morbidity, especially after reaching the procedure's learning curve[44].

The first large prospective, randomized clinical trial in this scenario is being conducted by the University Charité in Berlin, sponsored by the AGO (Arbeitsgemeinschaft Gynäkologische Onkologie - German Study Group in Gynecologic Oncology). In this study, 250 women with cervical cancer FIGO stage IIB to IVA were randomized to staging minimally invasive surgery followed by radiotherapy and chemotherapy versus radiotherapy and conventional chemotherapy. A total of 16 German institutions and one Brazilian (HCB) participated in the study recruitment, ended in 2013. The preliminary results are awaited for the next months[45].

More specifically, for patients with positive PET-CT for the pelvis and negative for the para-aortic space, the EPLND study provides randomization for surgery followed by radiotherapy and chemotherapy versus conventional radiotherapy and chemotherapy[45].

Currently, the recommendation remains to offer minimally invasive surgical staging for patients with locally advanced cervical cancer with the aim of adjusting the radiation field to the real extent of the disease[38]. The group of patients that seem to benefit more from the surgical evaluation approach is the one with suspected pelvic lymph nodes at imaging tests, preferably PET-CT[40].

FINAL CONSIDERATIONS

Early cervical cancer can be adequately addressed through minimally invasive surgery, with likely similar oncological efficacy, and apparent reduction of morbidity. For the preservation of fertility, laparoscopy offers adequate lymph node staging and treatment with oncological results similar to radical surgery in selected patients. In this context, the function-preserving surgery has been the subject of studies and has the potential to become the treatment of choice for patients with early tumors of very good prognosis. In advanced cervical cancer, minimally invasive surgical staging can tailor the radiation therapy field and reduce the amount of disease to be treated, with potential gain in the disease-free interval and overall survival. Studies, including in partnership with Brazilian institutions, are underway to clatiry the evidence supporting the potential benefits of minimally invasive approaches to cervical cancer.

RESUMO

O câncer de colo uterino permanece o tumor ginecológico mais incidente no Brasil e em diversos países em desenvolvimento. As técnicas minimamente invasivas, principalmente a videolaparoscopia, têm sido progressivamente mais empregadas nestes tumores. Este artigo tem o objetivo de descrever as principais aplicações da videolaparoscopia no tratamento e no estadiamento do câncer de colo. Para os estádios iniciais, é possível oferecer a cirurgia preservadora de fertilidade, na forma de traquelectomia radical e, em protocolo de estudo, na cirurgia conservadora de função, evitando-se a parametrectomia e a morbidade associada. A histerectomia radical totalmente videolaparoscópica está adequadamente padronizada na literatura e tem a tendência de se tornar o padrão de tratamento nos casos iniciais, para pacientes com prole definida. Nos estádios avançados, a cirurgia minimamente invasiva pode oferecer a transposição ovariana, com intenção de evitar a castração actínica, sem prejudicar o tempo para o início do tratamento radioterápico e quimioterápico. A cirurgia laparoscópica estadiadora, incluindo linfadenectomia pélvica e paraórtica, tem sido alvo de estudos, uma vez que tem o potencial de modificar a extensão do tratamento radioterápico, na dependência da extensão da disseminação linfonodal.

Descritores*: Neoplasias do Colo. Laparoscopia. Estadiamento de Neoplasias. Terapêutica. Histerectomia. Excisão de Linfonodo.*

REFERENCES

1. Waggoner SE. Cervical cancer. Lancet. 2003;361(9376):2217-25.
2. Cho JE, Liu C, Gossner G, Nezhat FR. Laparoscopy and gynecologic oncology. Clin Obstet Gynecol. 2009;52(3):313-26.
3. Meigs JV. Radical hysterectomy with bilateral pelvic lymph node dissections; a report of 100 patients operated on five or more years ago. Am J Obstet Gynecol. 1951;62(4):854-70.
4. Piver MS, Rutledge F, Smith JP. Five classes of extended hysterectomy for women with cervical cancer. Obstet Gynecol. 1974;44(2):265-72.
5. Nezhat CR, Burrell MO, Nezhat FR, Benigno BB, Welander CE. Laparoscopic radical hysterectomy with paraaortic and pelvic node dissection. Am J Obstet Gynecol. 1992;166(3):864-5.
6. Ramirez PT, Slomovitz BM, Soliman PT, Coleman RL, Levenback C. Total laparoscopic radical hysterectomy and lymphadenectomy: the M. D. Anderson Cancer Center experience. Gynecol Oncol. 2006;102(2):252-5.
7. Abu-Rustum NR Gemignani ML, Moore K, Sonoda Y, Venkatraman E, Brown C, et al. Total laparoscopic radical hysterectomy with pelvic lymphadenectomy using the argon-beam coagulator: pilot data and comparison to laparotomy. Gynecol Oncol. 2003;91(2):402-9. Erratum in: Gynecol Oncol. 2004;93(1):275.
8. Gil-Moreno A, Díaz-Feijoo B, Roca I, Puig O, Pérez-Benavente MA, Aguilar I, et al. Total laparoscopic radical hysterectomy with intraoperative sentinel node identification in patients with early invasive cervical cancer. Gynecol Oncol. 2005;96(1):187-93.
9. Frumovitz M, dos Reis R, Sun CC, Milam MR, Bevers MW, Brown J, et al. Comparison of total laparoscopic and abdominal radical hysterectomy for patients with early-stage cervical cancer. Obstet Gynecol. 2007;110(1):96-102.
10. Pareja R, Nick AM, Schmeler KM, Frumovitz M, Soliman PT, Buitrago CA, et al. Quality of laparoscopic radical hysterectomy in developing countries: a comparison of surgical and oncologic outcomes between a comprehensive cancer center in the United States and a cancer center in Colombia. Gynecol Oncol. 2012;125(2):326-9.
11. Kong TW, Chang SJ, Lee J, Paek J, Ryu HS. Comparision of laparoscopic versus abdominal readical hysterectomy for FIGO stage IB and IIA cervical cancer with tumor diameter of 3cm or greater. Int J Gynecol Cancer. 2014;24(2):280-8.
12. Obermair A, Gebski V, Frumovitz M, Soliman PT, Schmeler KM, Levenback C, et al. A phase III randomized clinical trial comparing laparoscopic or robotic radical hysterectomy with abdominal radical hysterectomy in patients with early stage cervical cancer. J Minim Invasive Gynecol. 2008;15(5):584-8.
13. Fregnani JH, de Oliveira Latorre Mdo R, Novik PR, Lopes A, de Oliveira JC, Tsunoda AT, et al. Extent of pelvic lymphadenectomy in women with squamous cell carcinoma of the uterine cervix: is there any prognostic value? J Surg Oncol. 2009;100(3):252-7.
14. Magrina JF, Kho RM, Weaver AL, Montero RP, Magtibay PM. Robotic radical hysterectomy: comparison with laparoscopy and laparotomy. Gynecol Oncol. 2008;109(1):86-91.
15. Tillmanns T, Lowe MP. Safety, feasibility, and costs of outpatient laparoscopic extraperitoneal aortic nodal dissection for locally advanced cervical carcinoma. Gynecol Oncol. 2007;106(2):370-4.
16. Reis R, Tavares EB, Amaral B, Monego HI, Binda M, Magno V, et al. Sentinel lymph node identification in patients with stage IB1 invasive cervical carcinoma. Curr Cancer Ther Rev. 2007;3(3):209-14.
17. Dargent D, Martin X, Sacchetoni A, Mathevet P. Laparoscopic vaginal trachelectomy: a treatment to preserve the fertility of cervical carcinoma patients. Cancer. 2000;88(8):1877-82.
18. Plante M, Gregoire J, Renaud MC, Roy M. The vaginal radical trachelectomy: an update of a series of 125 cases and 106 pregnancies. Gynecol Oncol. 2011;121(2):290-7.
19. Diaz JP, Sonoda Y, Leitao MM, Zivanovic O, Brown CL, Chi DS, et al. Oncologic outcome of fertility-sparing radical trachelectomy versus radical hysterectomy for stage IB1 cervical carcinoma. Gynecol Oncol. 2008;111(2):255-60.
20. Wethington SL, Sonoda Y, Park KJ, Alektiar KM, Tew WP, Chi DS, et al. Expanding the indications for radical trachelectomy: a report on 29 patients with stage IB1 tumors measuring 2 to 4 centimeters. Int J Gynecol Cancer. 2013;23(6):1092-8.
21. Pareja R, Rendón GJ, Sanz-Lomana CM, Monzón O, Ramirez PT. Surgical, oncological, and obstetrical outcomes after abdominal radical trachelectomy - A systematic literature review. Gynecol Oncol. 2013;131(1):77-82.
22. Ramirez PT, Schmeler KM, Malpica A, Soliman PT. Safety and feasibility of robotic radical trachelectomy in patients with early-stage cervical cancer. Gynecol Oncol. 2009;116(3):512-5.
23. Lu Q, Zhang Y, Liu C, Wang S, Guo S, Zhang Z. Total laparoscopic radical trachelectomy in the treatment of early squamous cell cervical cancer: a retrospective study with 8-year follow-up. Gynecol Oncol. 2013;130(2):275-9.
24. Schmeler KM, Frumovitz M, Ramirez PT. Conservative management of early stage cervical cancer: is there a role for less radical surgery? Gynecol Oncol. 2011;120(3):321-5.
25. Frumovitz M, Sun CC, Schmeler KM, Deavers MT, Dos Reis R, Levenback CF, et al. Parametrial involvement in radical hysterectomy specimens for women with early-stage cervical cancer. Obstet Gynecol. 2009;114(1):93-9.
26. Loizzi V, Cormio G, Lobascio PL, Marino F, De Fazio M, Falagario M, et al. Bowel dysfunction following nerve-sparing radical hysterectomy for cervical cancer: a prospective study. Oncology. 2014;86(4):239-43.

27. Puntambekar SP, Lawande A, Puntambekar S, Joshi S, Kumar S, Kenawadekar R. Nerve-sparing radical hysterectomy made easy by laparoscopy. J Minim Invasive Gynecol. 2014;21(5):732.
28. Kinney WK, Hodge DO, Egorshin EV, Ballard DJ, Podratz KC. Surgical treatment of patients with stages IB and IIA carcinoma of the cervix and palpably positive pelvic lymph nodes. Gynecol Oncol. 1995;57(2):145-9.
29. Covens A, Rosen B, Murphy J, Laframboise S, DePetrillo AD, Lickrish G, et al. How important is removal of the parametrium at surgery for carcinoma of the cervix? Gynecol Oncol. 2002;84(1):145-9.
30. Pluta M, Rob L, Charvat M, Chmel R, Halaska M Jr, Skapa P, et al. Less radical surgery than radical hysterectomy in early stage cervical cancer: a pilot study. Gynecol Oncol. 2009;113(2):181-4.
31. Kim HS, Choi CH, Lim MC, Chang SJ, Kim YB, Kim MA, et al. Safe criteria for less radical trachelectomy in patients with early-stage cervical cancer: a multicenter clinicopathologic study. Ann Surgical Oncol. 2011;19(6):1973-9.
32. Raju SK, Papadopoulos AJ, Montalto SA, Coutts M, Culora G, Kodampur M, et al. Fertility-sparing surgery for early cervical cancer-approach to less radical surgery. Int J Gynecol Cancer. 2012;22(2):311-7.
33. NCIC Clinical Trials Group. Radical versus simple hysterectomy and pelvic node dissection in patients with early stage cervical câncer. NCT 01658930. clinical trials.gov: clinical trials.gov. The SHAPE Trial (2013).
34. Pecorelli S, Zigliani L, Odicino F. Revised FIGO staging for carcinoma of the cervix. Int J Gynaecol Obstet. 2009;105(2):107-8.
35. Morris M, Eifel PJ, Lu J, Grigsby PW, Levenback C, Stevens RE, et al. Pelvic radiation with concurrent chemotherapy compared with pelvic and para-aortic radiation for high-risk cervical cancer. N Engl J Med. 1999;340(15):1137-43.
36. Peters WA 3rd, Liu PY, Barrett RJ 2nd, Stock RJ, Monk BJ, Berek JS, et al. Concurrent chemotherapy and pelvic radiation therapy compared with pelvic radiation therapy alone as adjuvant therapy after radical surgery in high-risk early-stage cancer of the cervix. J Clin Oncol. 2000;18(8):1606-13.
37. Sedlis A, Bundy BN, Rotman MZ, Lentz SS, Muderspach LI, Zaino RJ. A randomized trial of pelvic radiation therapy versus no further therapy in selected patients with stage IB carcinoma of the cervix after radical hysterectomy and pelvic lymphadenectomy: A Gynecologic Oncology Group Study. Gynecol Oncol. 1999;73(2):177-83.
38. Monk BJ, Wang J, Im S, Stock RJ, Peters WA 3rd, Liu PY, et al. Rethinking the use of radiation and chemotherapy after radical hysterectomy: a clinical-pathologic analysis of a Gynecologic Oncology Group/Southwest Oncology Group/Radiation Therapy Oncology Group trial. Gynecol Oncol. 2005;96(3):721-8.
39. Guidelines N. NCCN Clinical Practice Guidelines in Oncology - Cervical Cancer. 2013 [cited 2013]; Available from: http://www.nccn.org/professionals/physician_gls/pdf/cervical.pdf.
40. Leblanc E, Gauthier H, Querleu D, Ferron G, Zerdoud S, Morice P, et al. Accuracy of 18-fluoro-2-deoxy-D-glucose positron emission tomography in the pretherapeutic detection of occult para-aortic node involvement in patients with a locally advanced cervical carcinoma. Ann Surg Oncol. 2011;18(8):2302-9.
41. Gouy S, Morice P, Narducci F, Uzan C, Martinez A, Rey A, et al. Prospective multicenter study evaluating the survival of patients with locally advanced cervical cancer undergoing laparoscopic para-aortic lymphadenectomy before chemoradiotherapy in the era of positron emission tomography imaging. J Clin Oncol. 2013;31(24):3026-33.
42. Potish RA, Downey GO, Adcock LL, Prem KA, Twiggs LB. The role of surgical debulking in cancer of the uterine cervix. Int J Radiat Oncol Biol Phys. 1989;17(5):979-84.
43. Gold MA, Tian C, Whitney CW, Rose PG, Lanciano R. Surgical versus radiographic determination of para-aortic lymph node metastases before chemoradiation for locally advanced cervical carcinoma: a Gynecologic Oncology Group Study. Cancer. 2008;112(9):1954-63.
44. Köhler C, Tozzi R, Klemm P, Schneider A. Laparoscopic paraaortic left-sided transperitoneal infrarenal lymphadenectomy in patients with gynecologic malignancies: technique and results. Gynecol Oncol. 2003;91(1):139-48.
45. Surgical Staging in Cervical Cancer Prior to Chemoradiation (uterus11) - NCT01049100 [database on the Internet]. Clinical Trials - U.S. National Institutes of Health. [cited 2011]. Available from: http://clinicaltrials.gov/ct2/show/NCT01049100?term=marnitz&rank=1.

Received: 20/12/2014
Accepted for publication: 18/02/2015
Conflict of interest: none.
Source of funding: none.

Mailing address:
Audrey Tieko Tsunoda
E-mail: atsunoda@hcancerbarretos.com.br / atsunoda@gmail.com

DOI: 10.1590/0100-69912015005015

Agenesis or pseudoagenesis of the dorsal pancreas

Agenesia ou pseudoagenesia do pâncreas dorsal

Alberto Brunning Guimarães[1]; Carlos Alberto Guimarães, TCBC-RJ[2]; José Eduardo Ferreira Manso, TCBC-RJ[2]

A B S T R A C T

The authors present an evidence-based case report of a patient with agenesis or pseudoagenesis of the dorsal pancreas.

CASE REPORT

A 57-year-old woman was referred in 2007 for assessment of jaundice of cholestatic pattern. The patient's vital signs and physical examination were unremarkable. Laboratory test results were normal except for elevated total bilirubin level, 6.4 mg/dL (direct bilirubin level, 5.8 mg/dL**)**. In her past medical history, she reported anything remarkable until 1995, when she developed acute biliary pancreatitis, characterized by abdominal pain accompanied by vomiting, diarrhea, and elevated serum pancreatic amylase (5,000 IU/L). Abdominal ultrasonography (US) showed gallstones. At that occasion, she underwent a conventional open cholecystectomy to prevent another episode of acute biliary pancreatitis. Routine perioperative cholangiography did not visualize the pancreatic duct.

During the hospitalization, an abdominal ultrasonography showed dilated bile ducts and stones in the choledochal duct. A computed tomography (CT) did not reveal the pancreatic corpus or tail (Figures 1). An endoscopic retrograde cholangiopancreatography (ERCP) was carried out with stones removal. It was not possible to perform a pancreatography, and the minor papilla was not visualized even after careful examination. The major papilla was normal. A conservative management was instituted, since dorsal pancreas agenesis is quite consistent with a normal life. She was discharged three days later.

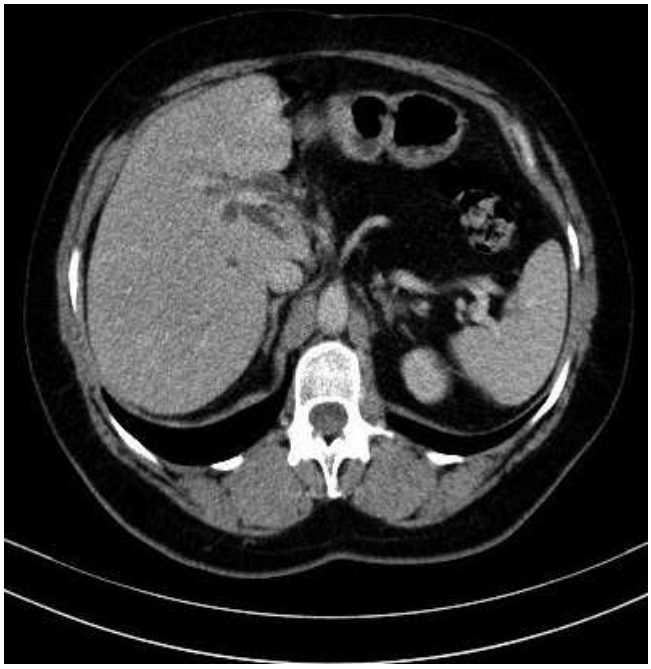

Figure 1 - *Computed tomography did not reveal the pancreatic body or tail.*

Formulating the questions

It is frequently written that the first step in evidence based practice is to turn the clinical problem into an answerable question. This proved more difficult than we first thought – as we wanted answers to several clinical questions –, involving quite a different way in thinking the anatomical-pathological-physiological questions and formulating empirical ones. We wanted to use an evidence based approach to guide our assessment and management, so we considered five issues: frequency, etiology, clinical manifestations, diagnosis and association with other diseases[1].

Searching for evidence

We searched PubMed (March 2015) with the terms "Pancreas/abnormalities" OR "dorsal pancreas agenesis" OR "short pancreas" OR "pancreas hypoplasia" (articles published in the last 10 years), which yielded 421 references. Browsing these titles, we limited our search to

1. Hospital Federal do Andaraí, Rio de Janeiro, RJ, Brasil; 2. Departamento de Cirurgia, Faculdade de Medicina da Universidade Federal do Rio de Janeiro, RJ, Brasil.

case reports. We also searched the references list of each case report selected for full reading.

We also searched PubMed for published articles with the search terms "dorsal pancreas agenesis", "short pancreas", and "pancreas hypoplasia". All papers identified were English or German (full-text papers, case reports, and letters to the editor). The references lists of identified articles were searched for further papers.

How common is agenesis of the body and tail of the pancreas?

In 1911 the first description of agenesis of the dorsal pancreas was published as an autopsy finding.

The exact prevalence of agenesis of the dorsal pancreas is not known. From 1913 through 2006, only 20 cases have been reported in the literature. Complete agenesis is actually quite rare, with a total of 16 cases reported in that period. Agenesis of the dorsal pancreas may be complete or partial, the latter being more frequent. In the complete dorsal pancreatic agenesis, the minor papilla, the accessory pancreatic duct (duct of Santorini) and the body and tail of the pancreas are absent; whereas in partial agenesis, the minor papilla, the duct of Santorini and body are present.

When one considers the criterion for dorsal pancreas agenesis as the absence of pancreatic tissue above the pancreatic artery, either on computed tomography (CT) or as an anatomopathological finding, one finds around 50 patients over the last 100 years. But, with the development of new image diagnostic techniques, many authors advised that the diagnosis of dorsal pancreas agenesis should only be firmed if there is the absence of the pancreatic duct of Santorini during either ERCP, magnetic nuclear resonance (MNR) or as an anatomopathological finding[2-7].

Another curious findings are the pseudo-agenesis of the dorsal pancreas and pancreatic distal lipomatosis. Pseudo-agenesis is a clinical scenario that may follow a necrohemorrhagic pancreatitis, which could be responsible for the partial destruction of the pancreatic tissue, its atrophy and its substitution by fat. Some cases could have been misdiagnosed as dorsal pancreas agenesis, given the higher prevalence of pancreatitis. However, in such cases it is possible to identify the duct of Santorinni[5].

What causes the agenesis of the dorsal pancreas?

The name pancreas is derived from the Greek words *pan* and *creas*, meaning all and flesh, respectively.

The origin of dorsal pancreas agenesis consists in the absence or regression of the embryonic dorsal bud, which arises from the posterior duodenal wall. This dorsal bud usually provides the isthmus, body and tail of the pancreas and the cranial part of the head; the caudal part of the head, the retro-duodenal process, is supplied by the ventral bud, which is sometimes duplicated.

The pancreas presents a complicated embryogenesis between the 5th and the 7th week of gestation. At the 6-7th week, the ventral pancreas fuses with the dorsal one. During the fusion, the ventral and the dorsal ducts form the main pancreatic duct. The accessory pancreatic duct is formed from the portion of the dorsal bud, which gives rise to the upper pancreatic head.

The causes of agenesis of the dorsal pancreas are unknown. A primary dysgenesis of the dorsal pancreatic bud and an ischemic insult to the developing pancreas are possible explanations.

Family cases have been reported in the literature, but the genetic transmission remains unclear. One report of dorsal pancreatic agenesis inherited by 2 sons from their mother clearly suggests a genetic etiology, with an X-linked or autosomal-dominant mode of transmission[3].

What are the clinical manifestations of the dorsal pancreas agenesis?

Most cases of dorsal pancreas agenesis are likely asymptomatic because of the functional reserves of the exocrine and endocrine pancreas, and the diagnosis is usually made incidentally on abdominal imaging during evaluation for an unrelated issue. However, abdominal pain with or without recurrent acute pancreatitis, weight loss with or without diabetes mellitus, and jaundice are the most commonly reported indicators of dorsal pancreatic agenesis. Hyperglycemia is found in around 50% of patients with dorsal pancreas agenesis, suggesting that it may cause diabetes mellitus[2,8]. Exocrine pancreatic insufficiency is not common, because this condition is avoided if there is only 10% of functioning pancreatic tissue. The relationship between agenesis of the dorsal pancreas and exocrine pancreatic insufficiency remains unclear; only one case has been reported up to 2006[9].

Some authors suggest that abdominal pain is more common in patients with partial agenesis, and diabetes mellitus is more common in patients with complete agenesis of the dorsal pancreas.

Abnormalities of the bile duct system have been found in several cases, and there are reports of other congenital anomalies, such as polysplenia syndrome, and pancreatic tumors[3,8].

Pancreatic agenesis is a rare cause of neonatal diabetes mellitus, characterized by severe intrauterine growth retardation, early onset of permanent neonatal diabetes mellitus, failure to thrive due to lack of pancreatic exocrine dysfunction, and associated malformations mainly of the heart or the biliary tract. Neonatal diabetes in association with pancreatic agenesis is a rare condition that has been reported only in 15 cases in the literature up to 2008[10].

Is the complete agenesis of the dorsal pancreas associated with other diseases?

Of the 14 reported patients (1913 through 1999) with complete agenesis of the dorsal pancreas,

nine had diabetes mellitus, while only one had chronic pancreatitis.

Most likely, diabetes mellitus develops because most of the â cells of the islets of Langerhans are located in the absent pancreatic body and tail[3].

More then 50% of patients with this agenesis of the dorsal pancreas were hyperglycaemic. It is known that the majority of islets are located in the pancreatic tail, and that â cells of the dorsal pancreas respond better to glucose stimulation. It is thus believed that agenesis of the dorsal pancreas may cause diabetes mellitus. The most common way to Type 1 and 2 diabetes is a decrease in â cell mass. It seems that, as in dorsal pancreas agenesis, the decreased â cell mass and the limited *in vivo* replication capacity of â-cells after surgical resection lead to diabetes mellitus in a high number of affected patients[8].

This anomaly may be complicated by recurrent acute and chronic pancreatitis (calcified or non-calcified). The explanation for the association between pancreatitis and dorsal pancreas agenesis is far from clear. There are two suggested causes for the pathogenesis of pancreatitis in dorsal pancreatic agenesis: first, sphincter of Oddi dysfunction; and second, elevated intrapancreatic ductal pressures in the compensating hypertrophied remnant ventral pancreas[3].

Abnormalities of the bile duct system have been found in several cases in the literature (common embryological origin of the pancreas and bile duct system from the distal foregut). In some of the reported patients, additional congenital anomalies were found (ectopic spleen, duodenal malrotation, intestinal malrotation, heterotaxy syndrome, left-sided gallbladder, choledochal cyst, annular pancreas, vaginal atresia, coarctation of the aorta, atrioventricular septal defects; anomalous pulmonary veins drainage, pulmonary stenosis, Tetralogy of Fallot, and anatomical variant of the abdominal arteries or veins), but there was no consistent pattern resulting in a syndromic diagnosis. Few cases of dorsal pancreas agenesis are associated with polysplenia syndrome.

A very limited number of pancreatic tumors (n = 4) have been found in association with agenesis of the dorsal pancreas, including solid papillary and pseudopapillary tumors and adenocarcinomas[3].

Does this patient have complete agenesis of the dorsal pancreas?

Complete agenesis of the dorsal pancreas is a rare pancreatic anomaly. Differential diagnosis is necessary to distinguish this entity from pancreatitis and various other pancreatic anomalies. Partial agenesis of the dorsal pancreas has been described, in which the pancreatic body and the main dorsal duct of the Santorini remain. Autodigestion of pancreatic tissue (pseudo-agenesis) due to pancreatitis should also be excluded. The pseudo-agenesis may be associated with ventral pancreas hypertrophy.

Prior to 1979, agenesis of the dorsal pancreas was diagnosed only after laparotomy or at autopsy. The preoperative diagnosis of pancreatic agenesis is difficult, with various imaging techniques being used. Ultrasonography may not visualize the body and tail of the pancreas due to interference of overlying bowel gas or technical failure. Understanding the detailed information of the pancreatic duct on CT is difficult. The three-dimensional (3D) CT reconstruction, especially using the volume rendering technique, and the MRI are very helpful for assessing this entity, despite not being strictly necessary to confirm the diagnosis. ERCP, an invasive, operator-dependent procedure, is useful for obtaining information about the pancreatic duct, but this is an invasive method, and locating and cannulating the minor papilla are sometimes difficult. Because magnetic resonance cholangiopancreatography (MRCP) clearly reveals the pancreatic major and accessory ducts, this technique is useful for the diagnosis of pancreas abnormalities, and, in recent years, has been used as a non-invasive alternative to ERCP, but the latter is still the gold standard. So, to differentiate complete versus partial agenesis of the dorsal pancreas, ERCP is necessary to define absence of the dorsal ductal system, of the accessory duct and of the minor papilla.

Although MRCP can diagnose dorsal agenesis of the pancreas, considerations of cost, availability, and the recent advancement in 3-dimensional imaging capability of a CT scan rendered it the initial diagnostic modality of choice.

Nowadays, the diagnosis is based on four imaging studies: transabdominal US, CT, MRCP and, the gold-standard, ERCP. Sometimes the ability of such studies is limited to distinguishing agenesis of the dorsal pancreas from another congenital abnormalities.

Recently, endoscopic ultrasonography (EUS) has been shown to be useful in the diagnosis of agenesis of the dorsal pancreas. The role of EUS in its identification has not been evaluated, but it may be as good as ERCP[10].

In our patient, pancreatic tissue was present in the pancreatic head, but the distal pancreas was absent on CT scans. Further, the pancreatic accessory and dorsal duct system were not observed in ERCP.

Whether the present patient had agenesis or pseudo-agenesis is a matter of speculation as there is no definite diagnostic test, just non-conclusive classic imagines studies.

DISCUSSION

How has an evidence based approach helped? The main difference was the change in clinical thinking that allowed us to break away from the pathological-anatomical-physiological approach and adopt an empirical one. These steps are not easy. Searching the published

reports is still awkward and time consuming. Some answers are difficult to find. How long, for example, should we carry on looking before concluding that there seems to be no published work to guide us?

We report a case of a patient with a probable agenesis of the body and tail of the pancreas, who was referred to our institution in order to treat cholestatic jaundice due to choledocal stones. The distal pancreas was absent on CT scans. It was not possible to identify the accessory pancreatic and dorsal duct system during ERCP, and the MRCP was not available. Taking into account her past medical history of previous pancreatitis, a pseudoagenesis (resulting from a severe necrohemorrhagic pancreatitis) could not be ruled out. However, based on the medical reports, she had not presented severe pancreatitis in the past, but only mild clinical manifestations. To our knowledge, this is the first evidence based case report published in our country.

R E S U M O

Os autores apresentam um relato de caso baseado em evidência de uma paciente com agenesia ou pseudoagenesia de pâncreas dorsal.

REFERENCES

1. Glasziou PP, Del Mar C, Salisbury J. Evidence-Based Practice Workbook. 2nd ed. Oxford: BMJ;2007. EBM Step 1: Formulate an answerable question; p.21-38.
2. Schnedl WJ, Piswanger-Soelkner C, Wallner SJ, Krause R, Lipp RW. Agenesis of the dorsal pancreas. World J Gastroentelorol. 2009;15(3):376-7.
3. Sakpal SV, Sexcius L, Babel N, Chamberlain RS. Agenesis of the dorsal pancreas and its association with pancreatic tumors. Pancreas. 2009;38(4):367-73.
4. Lingareddy S, Duvvuru NR, Guduru VR, Lakhtakia S, Kalapala R. Dorsal agenesis of pancreas: CT and ERCP. Gastrointest Endosc. 2007;65(1):157-8; discussion 158.
5. Thakur S, Jhobta A, Sharma D, Thakur CS. MR in complete dorsal pancreatic agenesis: case report and review of literature. Indian J Radiol Imaging. 2014;24(2):156-9.
6. Vijayaraghavan B, Gouru S, Senthil S. Sonographic features of agenesis of dorsal pancreas. Indian J Radiol Imaging. 2013;23(2):179-82.
7. Schnedl WJ, Piswanger-Soelkner C, Wallner SJ, Krause R, Lipp RW. Agenesis of the dorsal pancreas. Diabet Med. 2009;26(1):112.
8. Doxey BW, Jackson WD, Adler DG. A unique presentation: dorsal agenesis of the pancreas manifesting as pancreatic exocrine insufficiency in the absence of diabetes mellitus in an 8-year-old boy. Dig Dis Sci. 2008;53(7):2005-6.
9. Taha D, Bardise J, Hegab A, Bonnefond A, Marchand M, Drunat S, et al. Neonatal diabetes mellitus because of pancreatic agenesis with dysmorphic features and recurrent bacterial infections. Pediatric Diabetes. 2008:9(3 Pt 1):240-4.
10. Sempere L, Aparicio JR, Martinez J, Casellas JA, de Madaria E, Pérez-Mateo M. Role of endoscopic ultrasound in the diagnosis of agenesis of the dorsal pancreas. JOP. 2006;7(4):411-6.

Received on: 15/01/2015
Accepted for publication: 21/03/2015
Conflict of interest: none.
Source of funding: none.

Address for correspondence:
Alberto Brunning Guimarães
E-mail: albertobrugui@yahoo.com.br

INSTRUÇÕES AOS AUTORES

A Revista do Colégio Brasileiro de Cirurgiões, órgão oficial do CBC, é publicada bimestralmente em um único volume anual, e se propõe à divulgação de artigos de todas as especialidades cirúrgicas, que contribuam para o seu ensino, desenvolvimento e integração nacional.

Os artigos publicados na Revista do Colégio Brasileiro de Cirurgiões seguem os requisitos uniformes recomendados pelo Comitê Internacional de Editores de Revistas Médicas (www.icmje.org), e são submetidos à avaliação por pares (peer review). A Revista do Colégio Brasileiro de Cirurgiões apoia as políticas para registro de ensaios clínicos da Organização Mundial da Saúde (OMS) e do International Committee of Medical Journal Editor (ICMJE), reconhecendo a importância dessas iniciativas para o registro e divulgação internacional de informação sobre estudos clínicos, em acesso aberto. Sendo assim, somente serão aceitos para publicação os artigos de pesquisas clínicas que tenham recebido um número de identificação em um dos registros de ensaios clínicos validados pelos critérios estabelecidos pela OMS e ICMJE. O número de identificação deverá ser registrado ao final do resumo.

O Conselho de Revisores (encarregado do peer-review) recebe os textos de forma anônima e decidem por sua publicação. No caso de ocorrência de conflito de pareceres, o Diretor de Publicações avalia a necessidade de um novo parecer. Artigos recusados são devolvidos aos autores. Somente serão submetidos à avaliação os trabalhos que estiverem dentro das normas para publicação na Revista. Os artigos aprovados poderão sofrer alterações de ordem editorial, desde que não alterem o mérito do trabalho.

INFORMAÇÕES GERAIS

A Revista do CBC avalia artigos para publicação em português, inglês ou espanhol que sigam as Normas para Manuscritos Submetidos às Revistas Biomédicas, elaborados e publicadas pelo International Committe of Medical Journal Editors (ICMJE www.icmje.org) traduzidas como Conselho Internacional de Editores de Revistas Médicas (CIERM Rev Col Bras Cir. 2008;35(6):425-41) ou de artigo no site da Revista do CBC (www.revistadocbc.org.br) com as seguintes características:

► **Editorial:** É o artigo inicial de um periódico, geralmente a respeito de assunto atual solicitado a autor de reconhecida capacidade técnica e científica.

► **Artigo Original:** É o relato completo de investigação clínica ou experimental com resultados positivos ou negativos. Deve ser constituído de Resumo, Introdução, Método, Resultados, Discussão, Abstract e Referências, limitadas ao máximo de 30 procurando incluir sempre que possível artigos de autores nacionais e periódicos nacionais

O título deve ser redigido em português, em inglês ou espanhol (quando o trabalho for enviado nesta língua). Deve conter o máximo de informações, o mínimo de palavras e não deve conter abreviatura. Deve ser acompanhado do(s) nome(s) completo(s) do(s) autor(es) seguido do(s) nome(s) da(s) instituição(ões) onde o trabalho foi realizado. Se for multicêntrico, informar em números arábicos a procedência de cada um dos autores em relação às instituições referidas. Os autores deverão enviar junto ao seu nome somente um título e aquele que melhor represente sua atividade acadêmica.

O resumo deve ter no máximo 250 palavras e estruturado da seguinte maneira: objetivo, método, resultados, conclusões e descritores na forma referida pelo DeCS (http://decs.bvs.br). Podem ser citados até cinco descritores. O abstract também deve conter até 250 palavras e ser estruturado da seguinte maneira: objective, methods, results, conclusion e keywords (http://decs.bvs.br).

► **Artigo de Revisão:** O Conselho Editorial incentiva a publicação de matéria de grande interesse para as especialidades cirúrgicas contendo análise sintética e crítica relevante e não meramente uma descrição cronológica da literatura. Deve ter uma introdução com descrição dos motivos que levaram à redação do artigo, os critérios de busca, seguido de texto ordenado em títulos e subtítulos de acordo com complexidade do assunto, resumo e abstract não estruturados. Quando couber, ao final poderão existir conclusões, opiniões dos autores sumarizando o referido no texto da revisão. Deve conter no máximo 15 páginas e 45 referências.

► **Nota Prévia:** Constitui observação clínica original, ou descrição de inovações técnicas, apresentada de maneira concisa, de preferência não excedendo a 500 palavras, cinco referências, duas ilustrações e abstract não estruturado. Permite-se três autores.

► **Relato de Caso:** Descrição de casos clínicos de interesse geral seja pela raridade na literatura médica ou pela forma de apresentação não usual do mesmo. Não deve exceder a 600 palavras e não necessita resumo, apenas abstract não estruturado, cinco referências e duas ilustrações. Número de autores até cinco.

► **Cartas ao Editor:** Comentários científicos ou controvérsias com relação aos artigos publicados na Revista do CBC. Em geral tais cartas são enviadas ao autor principal do artigo em pauta para resposta e ambas as cartas são publicadas no mesmo número da Revista, não sendo permitido réplica.

► **Comunicação Científica:** Conteúdo que aborde a forma da apresentação da comunicação científica, investigando os problemas existentes e propondo soluções. Por suas características, essa Seção poderá ser multiprofissional e multidisciplinar, recebendo contribuições de médicos, cirurgiões e não-cirurgiões e de outros profissionais das mais variadas áreas.

► **Nota Técnica:** Informação sobre determinada operação ou procedimento de importância na prática cirúrgica. O original não deve ultrapassar seis páginas incluídas as fotos e referências se necessário. É artigo com formato livre, com resumo e abstract.

► **Ensino:** Conteúdo que aborde o ensino da cirurgia na graduação e na pós-graduação com formato livre. Resumo e abstract não estruturados.

► **Bioética na cirurgia:** discussão dos aspectos bioéticos na cirurgia. O conteúdo deverá abordar os dilemas bioéticos existentes no desempenho da atividade cirúrgica. Formato livre. Resumo e abstract não estruturados.

FORMA E ESTILO

► **Texto:** A forma textual dos manuscritos apresentados para publicação devem ser inéditos e enviados na forma digital (Word Doc), espaço duplo e corpo de letra arial, tamanho 12. As imagens deverão ser encaminhadas separadas no formato JPG, GIF, TIF e referido no texto o local de inserção. Os artigos devem ser concisos e redigidos em português, inglês ou espanhol. As abreviaturas devem ser em menor número possível e limitadas aos termos mencionados repetitivamente, desde que não alterem o entendimento do texto, e devem ser definidas a partir da sua primeira utilização.

► **Referências:** Devem ser predominantemente de trabalhos publicados nos cinco últimos anos não esquecendo de incluir autores e revistas nacionais, restringindo-se aos referidos no texto, em ordem de citação, numeradas consecutivamente e apresentadas conforme as normas de Vancouver (Normas para Manuscritos Submetidos às Revistas Biomédicas - ICMJE www.icmje.org - CIERM Rev Col Bras Cir. 2008;35(6): 425-41 - www.revistadocbc.org.br). Não serão aceitas como referências anais de congressos, comunicações pessoais. Citações de livros e teses devem ser desestimuladas. Os autores do artigo são responsáveis pela veracidade das referências.

► **Agradecimentos:** Devem ser feitos às pessoas que contribuíram de forma importante para a sua realização.

TABELAS E FIGURAS (Máximo permitido 6 no total)

Devem ser numeradas com algarismos arábicos, encabeçadas por suas legendas com uma ou duas sentenças, explicações dos símbolos no rodapé. Cite as tabelas no texto em ordem numérica incluindo apenas dados necessários à compreensão de pontos importantes do texto. Os dados apresentados não devem ser repetidos em gráficos. A montagem das tabelas deve seguir as normas supracitadas de Vancouver.

São consideradas figuras todos as fotografias, gráficos, quadros e desenhos. Todas as figuras devem ser referidas no texto, sendo numeradas consecutivamente por algarismos arábicos e devem ser acompanhadas de legendas descritivas.

Os autores que desejarem publicar figuras coloridas em seus artigos poderão fazê-lo a um custo de R$ 650,00 para uma figura por página. Figuras adicionais na mesma página sairão por R$ 150,00 cada. O pagamento será efetuado através de boleto bancário, enviado ao autor principal quando da aprovação do artigo para publicação.

CONDIÇÕES OBRIGATÓRIAS (LEIA COM ATENÇÃO)

Fica expresso que, com a remessa eletrônica, o(s) autor(es) concorda(m) com as seguintes premissas: 1) que no artigo não há conflito de interesse, cumprindo o que diz a Resolução do CFM nº.1595/2000 que impede a publicação de trabalhos e matérias com fins promocionais de produtos e/ou equipamentos médicos; 2) citar a fonte financiadora, se houver; 3) que o trabalho foi submetido a CEP que o aprovou colocando no texto o número com que foi aprovado; 4) que todos os autores concedem os direitos autorais e autorizam o artigo em alterações no texto enviado para que ele seja padronizado no formato linguístico da Revista do CBC, podendo remover redundâncias, retirar tabelas e/ou figuras que forem consideradas não necessárias ao bom entendimento do texto, desde que não altere seu sentido. Caso haja discordâncias dos autores quanto às estas premissas, deverão eles escrever carta deixando explícito o ponto em que discordam e a Revista do CBC terá então necessidade de analisar se o artigo pode ser encaminhado para publicação ou devolvido aos autores. Caso haja conflito de interesse ele deve ser citado com o texto: "O(s) autores (s) (nominá-los) receberam suporte financeiro da empresa privada (mencionar o nome) para a realização deste estudo". Quando houver fonte financiadora de fomento a pesquisa ela deverá ser citada.

A responsabilidade de conceitos ou asserções emitidos em trabalhos e anúncios publicados na Revista do Colégio Brasileiro de Cirurgiões cabe inteiramente ao(s) autor (es) e aos anunciantes. Não serão aceitos trabalhos já publicados ou simultaneamente enviados para avaliação em outros periódicos.

Endereço para contato:
Rua Visconde de Silva, 52 - 3° andar
Botafogo - 22271-090 Rio de Janeiro - RJ - Brasil
Tel.: (21) 2138-0659 (Dna. Ruth)
Site: http://www.revistadocbc.org.br/
Endereço para envio dos manuscritos:
E-mail: revistacbc@cbc.org.br