DOI: 10.36959/926/543 | Volume 1 | Issue 1

Otolaryngology Research and Reviews

Original Research Article Open Access

Treatment and Prevention of Severe Primary Postoperative Hemorrhage in Obstructive Sleep Apnea-Hypopnea Syndrome Surgery

Renyi Hei[1], Jie Qin[1], Jimin Bao[2], Dahai Wu[1] and Shuhua Li[1]*

[1]Department of Otolaryngology-head and neck surgery, General Hospital of Shenyang Military Area Command, China

[2]Department of Otolaryngology-head and neck surgery, Liaoning Jinqiu Hospital, China

Abstract

Objective: This study was conducted to summarize experiences of handling severe primary postoperative hemorrhage (SPPH) in obstructive sleep apnea-hypopnea syndrome (OSAHS) surgery and to evaluate the role of multiple interventions in decreasing the incidence of SPPH.

Methods: A total of 1505 patients with OSAHS underwent surgical treatments. Based on the time periods, the patients were divided into three consecutive phases. Patients from the first phase to the third phase received few to most types of intervention. SPPH therapeutic experience was summarized and SPPH incidence rates were compared among the three phases. SPPH incidence rates with mono-level or multi-level surgeries were also compared.

Results: A total of 19 patients suffered from SPPH within 24 h after surgical treatments. They were all successfully cured under general anesthesia. The incidence rates were 4.32%, 1.47%, and 0.00% for Phases I, II, and III respectively. Significant differences were found in the three phases ($P < 0.001$). SPPH incidence rates of UPPP-only and multi-level treatment patients were 1.25% and 2.08% respectively, with no significant difference ($P > 0.05$).

Conclusions: SPPH is a common perioperative complication in OSAHS patients and can be successfully treated under general anesthesia. Combining multiple medical interventions could lower the incidence of SPHH related to the surgical treatments in OSAHS patients. Multi-level surgeries would not increase SPPH incidence rate.

Keywords

Obstructive sleep apnea, Postoperative hemorrhage, Surgery

Introduction

Obstructive sleep apnea-hypopnea syndrome (OSAHS) is a range of sleeping disorders and symptoms, which include apnea, hypopnea, low blood oxygen saturation, snoring during sleep, and daytime sleepiness. OSAHS is mainly caused by obstruction and frequent collapse of the narrow upper airway during sleep. Surgery is an effective treatment on selected patients [1-3]. However, possible serious postoperative complications have been always difficult problems to otolaryngologists [4-6].

Severe primary postoperative hemorrhage (SPPH) is among the most common and serious postoperative complications of OSAHS. SPPH typically appears within 24 h after surgery with rapid bleeding that could not be controlled by local compression or coagulant drugs. The only effective treatment is surgical hemostasis under general anesthesia with tracheal intubation. Improper and delayed intervention might lead to serious consequences and even death [7]. Thus, effective prevention and therapy methods should be a research focus.

In this study, we retrospectively reported and analyzed the SPPH incidence rate of 1505 OSAHS patients who un-

***Corresponding author:** Shuhua Li, MD, Department of Otolaryngology-head and neck surgery, General Hospital of Shenyang Military Area Command, No.83, Wenhua Road, Shenhe District, Shenyang, 110840, China, Tel: +86-24-28856253, E-mail: lishsy@sina.com

Received: November 25, 2016; **Accepted:** March 18, 2017; **Published online:** March 21, 2017

Citation: Hei R, Qin J, Bao J, et al. (2017) Treatment and Prevention of Severe Primary Postoperative Hemorrhage in Obstructive Sleep Apnea-Hypopnea Syndrome Surgery. Otolaryngol Res Rev 1(1):9-14

derwent surgical treatments. The 1505 patients received varying surgical treatments and medical interventions. We then tried to discover effective medical interventions that could prevent or reduce the occurrence of SPPH, as well as therapy methods that could treat SPPH.

Materials and Methods

Patients

All patients with OSAHS underwent surgical treatment in the Otolaryngology-Head and Neck Department from January 1995 through October 2016. Age and body mass index (BMI) were recorded. PolyWin or Alice 5 PSG systems (Respironics Inc., USA) were used for sleep monitoring. Apnea-hypopnea index (AHI) and lowest arterial O_2 saturation ($LaSO_2$) data were both recorded. OSAHS grade classification was based on the criteria of the American Academy of Sleep Medicine [8]. High-resolution spiral computed tomography (Lightspeed SCT scanner, General Electric Inc., USA) and fiber or electronic nasopharyngolarygnoscopy examinations (Pantex Inc., Japan) were performed to display and evaluate the morphology of the upper airway.

All patients underwent surgical treatments under general anesthesia. Surgical treatments included uvulopalatopharyngoplasty (UPPP), nasal septal construction, nasal polypectomy, adenoidectomy, hyoid suspension, midline glossectomy, tongue suspension, and lingual tonsillectomy. OSAHS patients underwent different types of surgeries based on the site and type of upper airway obstruction.

Multiple medical interventions for SPPH prevention

The data of 1505 patients were analyzed in three phases according to the different types of medical interventions and time periods. The medical interventions are as follows:

During the first phase (from January 1995 to December 2002, Phase I): No special interventions were used. Short- and long-acting anesthetics were both used for general anesthesia. All patients were transferred to the general wards immediately upon waking from anesthesia and with trachea cannula extracted.

During the second phase (from January 2003 to December 2009, Phase II): Short-acting anesthetics and muscle relaxants, such as propofol, remifentanil, and atracurium, were used for general anesthesia. Long-acting anesthetics or muscle relaxants were no longer utilized. After surgery, patients with mild or moderate OSAHS were transferred to the general wards immediately upon waking from anesthesia and with trachea cannula extracted. Patients with severe OSAHS were admitted to the intensive care unit (ICU). After intensive care for over 4 h and when patients were fully awake, trachea cannula was extracted. The patients were then transferred to general wards.

Comprehensive and accurate preoperative evaluation of patients was performed. Patients with hypertension, hyperglycemia, and coagulation disorders received professional treatments from cardiologists, endocrinologists, and hematologists in our hospital until the physiological indices were close to or completely normal. The region around the lower pole of tonsil was fully exposed

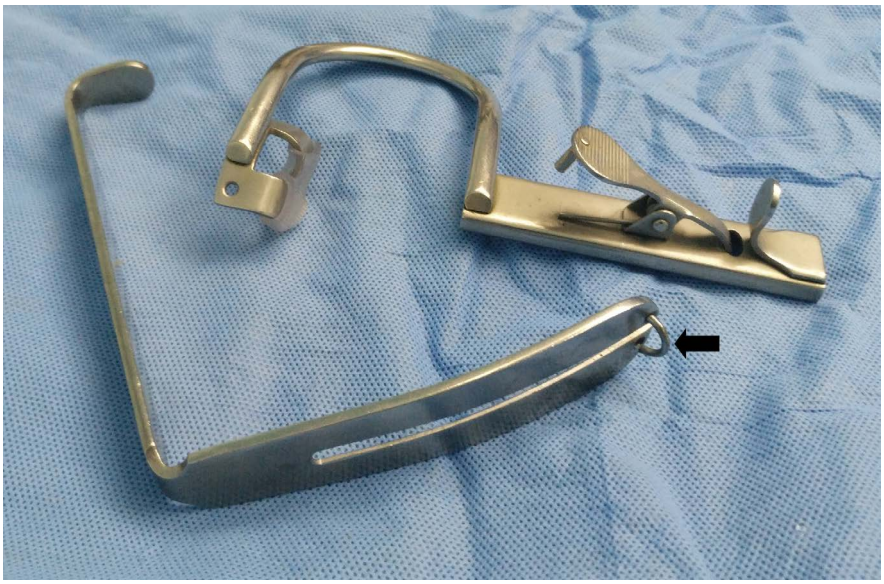

Figure 1: An improved Davis mouth gag. It has a longer and less curved tongue depressor than other common mouth gag. There is a metal semi-ring welded on the end of tongue depressor (indicated by black arrow). The improved gag would depress the tongue base and expose the lower pole of tonsil more easily. The metal semi-ring would depress the soft tissue of posterior pharyngeal and make more space of operation around the lower pole of tonsil.

using improved mouth gag (Figure 1) and obtained definitive hemostasis by stitching.

During the third phase (from January 2010 to October 2014, Phase III): Short-acting anesthetics and improved mouth gag were still used. However, there were two more medical interventions compared with Phase II. Patients with mild, moderate, or severe OSAHS were all transferred to the ICU and received intensive care for over 4 h. The trachea cannula was not extracted until the patients were fully awake from anesthesia and in stable condition. Plasma-mediated radio frequency ablation at low temperature with EVac 70 wand (ArthroCare ENT Coblator II Surgery System, ArthroCare Corp., USA) was used, replacing the traditional operation knife. This surgery instrument was also used for coagulation during the operation. The suture of region around the lower pole of tonsil was not negligible even if careful coagulation was performed.

Procedure of treatments for SPPH

All SPPH patients were transferred to the operating room after failure of hemostasis by local compression and coagulant drugs. Anesthetists applied reintubation and general anesthesia. Tracheotomy under local anesthesia was needed in case of reintubation failure through the mouth. Suture and electric coagulation were both utilized to manage the bleeding sites. Physiologically dead space in amygdaloid fossa should be eliminated completely by suture.

Statistical analysis

Statistical analysis was performed using the Statistical Package for Social Sciences version 17.0. The results were presented as mean ± standard deviation. Values of $P < 0.05$ were considered statistically significant. Chi-square test and one-way ANOVA were used to analyze the differences of SPPH incidence rate, demographic, and biometric characteristics among the patients.

Results

Patients' demographics

A total of 1505 patients were enrolled in this study, including 1286 males and 219 females. Their ages were in the range 18-67 years old, with a mean of 38.7 ± 9.9 years. AHI was in the range 13.8-102.0 times/h with a mean of 44.6 ± 24.3 times/h. $LSaO_2$ ranged from 33% to 89% with a mean of 67% ± 11%. BMI ranged from 19.21 kg/m^2 to 39.87 kg/m^2 with a mean of 28.79 ± 3.4 kg/m^2. Epworth Sleepiness Scale ranged from 3-24 points with a mean of 12.4 ± 5.9 points. All patients had significant nocturnal snoring and varying degrees of daytime sleepiness and fatigue. A total of 638 OSAHS patients also suffered from primary hypertension.

A total of 1119 patients received the traditional or modified UPPP as the only treatment. A total of 386 patients with multi-level obstruction received other surgical treatments simultaneously, including 93 patients with nasal morphology, 224 patients with obstruction in tongue base area, and 69 patients with obstructions in both nasal and tongue base level. In addition, 147 patients with multi-level surgical treatments received tracheotomy to prevent asphyxia.

SPPH patients and therapeutic results

A total of 19 patients with normal coagulation time and bleeding time suffered from SPPH. The overall SPPH incidence rate was 1.26%. Twelve out of the 19 patients had hypertension. Patients with hypertension received medical treatment until they exhibited normal blood pressure before surgery. SPPH occurred within 24 h after surgery in all the 19 patients. Two cases occurred within 2 h, 7 cases occurred within 2-4 h, 3 cases occurred within 6-8 h, and 1 case occurred within 8-24 h. A total of 17 patients without tracheal intubation suffered from SPPH in the general ward and 2 patients with tracheal intubation suffered from SPPH in the ICU.

The 19 patients were sent back to the operating room and were instantly administered with general anesthesia after hemostasis failure by local compression and coagulant drugs. Careful examination revealed that the bleeding sites were located in the lower pole of tonsil in 16 cases, in the upper pole of tonsil in one case, and in the soft palate in another case. Diffuse hemorrhage was found in left amygdaloid fossa in one case. The approximate amount of bleeding ranged from 200 mL to 400 mL. After hemostasis with electric coagulation and suture, the SPPH of the 19 patients were all well controlled without recurrence. All 19 patients recovered and were discharged smoothly. No postoperative suffocation or death occurred.

SPPH incidence rates of the three phases

No significant difference was observed in terms of gender, age, hypertension incidence, AHI, BMI, or $LaSO_2$ among the three phases ($P > 0.05$, Table 1). The number of patients suffering from SPPH for Phases I, II, and III were shown in Table 2. The incidence rates had a notable trend of decrease. Chi-square test showed a significant difference among the three phases ($P < 0.001$).

SPPH incidence rates of patients with UPPP alone

To eliminate the influence of different multi-level surgical treatments in incidence rates of SPPH, comparison was conducted among the patients with UPPP alone from the three phases. The number of patients who received UPPP as the only treatment from Phases I, II, and III were shown in Table 3. No significant difference in terms of gender, age, hypertension incidence, AHI, BMI, or $LaSO_2$ was observed

Table 1: Demographics data of patients.

Phase	Cases	Gender (female)	Hypertension (cases)	Ages (years)	BMI (kg/m^2)	AHI (times/h)	$LSaO_2$ (%)
I	301	39	115	40.07 ± 9.64	28.82 ± 3.82	48.70 ± 25.05	66.8 ± 13.1
II	415	68	188	41.18 ± 10.03	28.55 ± 3.65	47.82 ± 24.46	66.8 ± 12.8
III	789	112	335	40.99 ± 9.69	28.46 ± 3.54	47.55 ± 23.81	66.9 ± 12.7
F/χ^2 Value		2.173	3.599	1.278	1.054	0.243	0.017
P Value		0.337	0.165	0.279	0.349	0.785	0.983

Table 2: SPPH incidence rates of the three phases.

Phase	Bleeding cases	Non-bleeding cases	Total cases	Incidence (%)
I	13	288	301	4.32
II	6	409	415	1.47
III	0	789	789	0.00
Total	19	1486	1505	1.26

Table 3: Demographics data of patients with UPPP alone.

Phase	Cases	Gender (female)	Hypertension (cases)	Ages (years)	BMI (kg/m^2)	AHI (times/h)	$LSaO_2$ (%)
I	287	38	107	40.32 ± 9.64	28.85 ± 3.75	48.64 ± 25.32	66.8 ± 12.8
II	319	44	114	41.50 ± 9.95	28.57 ± 3.63	47.81 ± 24.37	66.6 ± 12.7
III	513	81	203	40.81 ± 10.17	28.49 ± 3.68	47.75 ± 24.28	67.0 ± 12.9
F/χ^2 Value		1.175	1.290	1.081	0.834	0.132	0.087
P Value		0.556	0.524	0.339	0.435	0.877	0.916

Table 4: SPPH incidence rates of patients with UPPP alone.

Phase	Bleeding cases	Non-bleeding cases	Total cases	Incidence (%)
I	13	274	287	4.74
II	4	315	319	1.25
III	0	513	513	0.00
Total	17	1102	1119	1.52

Table 5: Demographics data of patients with mono/multi level surgeries.

Group	Cases	Gender (female)	Hypertension (cases)	Ages (years)	BMI (kg/m^2)	AHI (times/h)	$LSaO_2$ (%)
UPPP	319	44	114	40.96 ± 9.93	28.51 ± 3.56	47.66 ± 24.76	67.0 ± 12.8
Multi-level	96	10	41	38.25 ± 10.19	29.41 ± 3.84	56.61 ± 23.76	65.8 ± 12.5
T/χ^2 Value		0.389	0.216	1.469	2.109	3.131	0.768
P Value		0.489	0.230	0.143	0.036	0.002	0.443

Table 6: SPPH incidence rates of patients with mono/multi level surgeries.

Group	Bleeding cases	Non-bleeding cases	Total cases	Incidence (%)
UPPP	4	315	319	1.25
Multi-level	2	94	96	2.08
Total	6	409	415	1.47

among the three phases ($P > 0.05$). The number of patients with UPPP alone suffered from SPPH in Phases I, II, and III were shown in Table 4. Chi-square test showed a significant difference among the three phases ($P < 0.001$).

SPPH incidence rates of multi-level treatments

To determine whether the multi-level surgical treatments could increase the incidence rate of SPPH, comparison was conducted between patients who received UPPP as the only treatment (319 cases) and patients who received multi-level surgical treatments (96 cases) of the second phase. No significant difference was found in gender, age, hypertension incidence, or $LaSO_2$, but patients with multi-level surgical treatments had higher BMI and AHI (Table 5). SPPH incidence rates of UPPP-only and multi-level treatment patients were shown in Table 6. However, no significant difference was found ($P > 0.05$).

Discussions

Because of the rapid bleeding, SPPH could increase death risk and not be stopped completely by conventional therapeutic methods, such as local compression, coagulant drug injection, and mouthwash with noradrenaline solution. Thus, the most important principle is to

prevent the occurrence of SPPH.

The mechanism of SPPH is not yet completely clear. We analyzed the data of the 13 Phase I patients suffering from SPPH at the beginning of 2003 to determine underlying influencing factors and effective treatments of SPPH. In most patients, the bleeding sites are located in the lower pole of tonsil, which is difficult to expose during surgery. Incomplete suture, restlessness, and fluctuation of blood pressure after recovery from narcotism are considered high-risk factors.

In Phase II, we improved the medical interventions of Phase I and performed perioperative interventions. Reduction of high blood pressure before surgery helped to get lower and smoother blood pressure after multilevel surgery of the upper airway. Short-acting anesthetics helped to get more easily controlled sober/sleeping state. An improved mouth gag helped to make the exposure and suture of tonsil lower pole completely. Patients with severe OSAHS were provided with intensive care for more than 4 h, and the trachea cannula extraction was delayed until after surgery [9]. During the period in ICU, adequate time and stable blood pressure ensured the activation of platelets and the clotting system sufficiently, as well as the stabilization and anchor of thrombus in operating area. Within these interventions, SPPH incidence rates decreased from 4.32% to 1.47%.

In Phase III, we improved the medical interventions further. Surprisingly, four patients in Phase II with mild or moderate OSAHS suffered from SPPH. Therefore, all patients in Phase III received intensive care for over 4 h, and the trachea cannula extraction was delayed. Plasma-mediated radio frequency device was also adopted. SPPH incidence rate dropped to zero (0/789). These data showed that detailed preoperative preparation, proper anesthetics, sufficient time for postoperative intensive care, and advanced surgical apparatus could significantly reduce SPPH incidence rates. In Phase III, the incidence rate of noninfectious secondary postoperative hemorrhage rose significantly (data not shown). This unexpected and delayed complication usually occurred from 7 days to 14 days after surgical treatment but without any infection in bleeding site. This phenomenon was reported by a previous study [10] and it might be ascribed to the application of plasma-mediated radio frequency ablation. Most patients with noninfectious secondary postoperative hemorrhage suffered from mild bleeding and they did not have narcotism. Hemostasis by local compression in bleeding sites, injection of coagulant drugs, and mouthwash with noradrenaline solution were effective.

In Phase I, UPPP was considered as the main therapy method. With the development of the concept of multi-level airway obstruction, multi-level surgical treatments were performed on increasing number of patients [11,12]. In our study, the proportions of patients receiving multi-level surgical treatments from Phase II and Phase III were significantly higher than those from Phase I. The comparison conducted among the patients with UPPP alone from the three phases eliminated the influence of different multi-level surgical treatments in SPPH incidence rates. Incidence rates also gradually reduced from 4.74% to 0%. Results showed that the improved medical interventions to prevent SPPH were highly effective.

We also tried to discover if enlarging the surgery site would increase the SPPH incidence rate. Few patients underwent multi-level surgical treatments in Phase I, and the SPPH incidence rate in Phase III was zero. We analyzed the data of patients with UPPP alone (319 cases) and those with multi-level surgical treatments (96 cases) in Phase II. Despite higher AHI and BMI, the SPPH incidence of patients with multi-level surgical treatments was not significantly higher. In addition, the 6 SPPH patients in Phase II were all confirmed to have bleeding sites located in the operative region of UPPP. This result suggested that multi-level surgical treatments would not increase the incidence rates of SPPH.

SPPH is an intractable complication and should be prevented. However, when it happens, proper emergency treatments must be performed rapidly. In this study, SPPH occurred within 2-6 h after surgery in most patients. They had not yet completely recovered from anesthesia, with the trachea cannula extracted. The extraction of their trachea cannula limited the patients' ability to breath, swallow and vomit. A high amount of blood would block the respiratory passage and cause asphyxia or even death. Maintaining the respiratory tract unobstructed is important after the occurrence of SPPH. Blood and clot need to be removed by anesthetists, surgeons and patients themselves while transferring the patients into the ICU or operating room.

General anesthesia is the prerequisite to successfully determine bleeding sites and sutures. Reintubation through the mouth is the preferred assisted ventilation method. Accurate assessment of difficulty of reintubation through mouth is important. Blood and swollen pharyngeal soft tissue make this procedure risky. Repeated reintubation might worsen the bleeding and swelling of soft tissue. Video laryngoscope and prompt blood removal would create a clear view for anesthetists. Tracheotomy under local anesthesia is also needed in the case of failure of reintubation through mouth.

Reoperation under general anesthesia is the only effective therapy. Local re-suture is a recommended method to control SPPH. After general anesthesia with reintubation through the mouth, the bleeding sites of the 19

SPPH patients were discovered and sutured successfully. The SPPH was well controlled and did not recur. All 19 patients recovered and were discharged later. No postoperative suffocations or deaths occurred.

In conclusion, SPPH, which is a common and severe complication after surgical treatments for OSAHS, could be treated successfully under general anesthesia. Utilizing multiple medical interventions could reduce the incidence rate and control the symptom completely.

Ethical Approval

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Acknowledgments

This study was sponsored by the Natural Science Foundation of Liaoning Province (Grant Number: 2015020441).

Conflict of Interest

None.

References

1. Friedman M, Ibrahim H, Joseph NJ (2004) Staging of obstructive sleep apnea/hypopnea syndrome: a guide to appropriate treatment. Laryngoscope 114: 454-459.
2. Li S, Wu D, Bao J, et al. (2014) Nasopharyngeal tube: a simple and effective tool to screen patients indicated for glossopharyngeal surgery. J Clin Sleep Med 10: 385-389.
3. Li SH, Wu DH, Bao JM, et al. (2013) Outcomes of upper airway reconstructive surgery for obstructive sleep apnea syndrome based on polysomnography after nasopharyngeal tube insertion. Chin Med J (Engl) 126: 4674-4678.
4. Lin HC, Friedman M, Chang HW, et al. (2008) The efficacy of multilevel surgery of the upper airway in adults with obstructive sleep apnea/hypopnea syndrome. Laryngoscope 118: 902-908.
5. Kandasamy T, Wright ED, Fuller J, et al. (2013) The incidence of early post-operative complications following uvulopalatopharyngoplasty: identification of predictive risk factors. J Otolaryngol Head Neck Surg 42: 15.
6. Epstein LJ, Kristo D, Strollo PJ Jr, et al. (2009) Clinical guideline for the evaluation, management and long-term care of obstructive sleep apnea in adults. J Clin Sleep Med 5: 263-276.
7. Franklin KA, Anttila H, Axelsson S, et al. (2009) Effects and side-effects of surgery for snoring and obstructive sleep apnea-a systematic review. Sleep 32: 27-36.
8. Iber C, Ancoli-Israel S, Chesson AL, et al. (2007) The AASM manual for the scoring of sleep and associated events: rules, terminology and technical specifications. American Academy of Sleep Medicine, Illinois, 57.
9. Spiegel JH, Raval TH (2005) Overnight hospital stay is not always necessary after uvulopalatopharyngoplasty. Laryngoscope 115: 167-171.
10. Pang KP, Siow JK, Tseng P (2012) Safety of multilevel surgery in obstructive sleep apnea: a review of 487 cases. Arch Otolaryngol Head Neck Surg 138: 353-357.
11. Kezirian EJ, Goldberg AN (2006) Hypopharyngeal surgery in obstructive sleep apnea: an evidence-based medicine review. Arch Otolaryngol Head Neck Surg 132: 206-213.
12. Virk JS, Nouraei R, Kotecha B (2014) Multilevel radiofrequency ablation to the soft palate and tongue base: tips and pitfalls. Eur Arch Otorhinolaryngol 271: 1809-1813.