

## Acute Scrotum in Neonates: Clinical, Radiological and Surgical Correlation

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### Abstract

**Background:** Acute scrotum in neonates is a significant medical and surgical entity to deal with. It may be due to diverse causes.

**Aim of Study:** To evaluate the radiological findings of acute scrotum in neonates and compare them with clinical and surgical data; especially as regards testicular and intestinal viability.

**Patients and Methods:** Thirty boys (neonates) examined for acute scrotum. Clinical evaluation was done to all patients. Suitable radiological imaging was done according to the case including sonography, color Doppler and may be X-Ray. Medical or surgical management was achieved accordingly.

**Results:** The study includes the following lesions; unilateral testicular torsion in 5 cases, bilateral testicular torsion in one case, complicated inguinal hernia in 12 cases, epididymitis and epididymo-orchitis in 6 cases, scrotal pyocele in 2 cases, scrotal hematoma in one case, skin infection with scrotal edema in two cases and meconium peri-orchitis with scrotal edema in one case. Sonography with color Doppler has the sensitivity, specificity and accuracy of 100%, 85% and 90% respectively as compared with surgical and clinical data.

**Conclusion:** Acute scrotum in neonates and infants has many causes. Radiology has a major role in the differential diagnosis of these causes and correlated well with surgery. Still surgical exploration is to be considered when radiological evaluation is not conclusive.

**Key Words:** Acute scrotum – Torsion – Complicated inguinal hernia – Ultrasonography – Neonates.

### Introduction

ACUTE scrotum in neonates is an important medical problem. Acute scrotum means acute onset painful swelling of the scrotum which is tender and may be red and edematous [1]. Acute scrotum in neonates has many causes such as torsion, incarcerated hernia, epididymo-orchitis, abscess, pyocele, hematocele and trauma [2]. Rarely con-

genital testicular tumors and adrenal hemorrhage come with acute scrotum [3,4].

We have to worry when a neonate comes with acute scrotum because of vascularity of the testicles.

This study aimed to assess the different causes of acute scrotum in neonates in our location and accuracy of color Doppler sonography. It also stresses upon how to differentiate different lesions to salvage the testicle and encourage surgical procedure or prevent inappropriate surgical exploration. To our knowledge; no similar study could be found in literatures, especially this age group.

### Material and Methods

Our study was done in a retrospective manner. Our archive from 2017 to 2019 was examined and found 30 boys have symptoms and signs of acute scrotum.

Clinical history was taken from the parents including gestational and birth history, crying, fever, onset of swelling and associated physical scrotal changes. General clinical examination was done to every boy including body temperature and presence of any abdominal signs.

Local examination of both inguino-scrotal regions was done including any visible swelling and its extension, redness, tenderness and consistency of the lesion.

Our main radiological examination is sonography with color Doppler application. We used TOSHIBA APLIO instrument with their high resolution soft tissues probes (10 Mtz). Sonography

### Abbreviations:

US : Ultrasonography.  
NEC : Necrotizing enterocolitis.

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started with abdominal and pelvic examination searching for intestinal obstruction, peritoneal fluid, kidneys and supra-renal glands.

Then; local sonographic examination of the inguino-scrotal region was made. Our findings include the site and extent of the lesion and searching for any hernial sac and what about its contents and vascularity. It is inguino-scrotal, or scrotal. Examination of the spermatic cord, epididymis and testicles were made.

The most important point of examination is what about the vascularity of the testicle to quickly depicts cases of testicular or even hydatid torsion, presence of fluid in processus vaginalis and its state (turbid or not) and presence of septations.

Sonographic examination of the parietal scrotal layers for detection of idiopathic scrotal edema or hematoma is mandatory in these cases. Neonates without full radiological assessment and boys over 30 days were excluded from the study.

Medical or surgical treatment was planned according to final diagnosis. The results was gathered and tabulated and we use SPSS.

### Results

Our study included 30 boys. Their age ranged from 1 day to 30 days. All the babies presented with acute scrotum (Fig. 1). Our series found the following causes of acute scrotum in the examined patients; 6 cases with testicular torsion, 12 cases with complicated hernia, 6 cases with epididymitis and epididymo-orchitis, 2 cases with pyocele, one case with scrotal hematoma, two cases with scrotal edema due to angioneurotic oedema with parietal infection and one case with scrotal edema with meconium peri-orchitis (Tables 1,2).

Color Doppler Sonography has the sensitivity, specificity and accuracy of 100%, 85% and 90% respectively as compared with surgical findings.

Unilateral neonatal testicular torsion was found in 5 cases; one of them had undescended inguinal testis with torsion (Figs. 2,3,4). On sonography; enlarged edematous mildly inhomogenous testicles were found in all cases. No vascularity could be found in these testicles by color Doppler. Surgery found definitely gangrenous testicles in 3 cases where orchidectomy was done. Two cases were preserved after de-rotation of the torsion with evidence of viability of the testicle. Contralateral orchopexy was done in all cases with unilateral torsion.

The 6<sup>th</sup> case came immediately after birth with bilateral bluish dark scrotum (firm to hard scrotal swellings) (Fig. 5). The testicles were mildly small in size with inhomogeneous texture. Color Doppler revealed absent vascularity in both testicles. Bilateral gangrenous testicles were revealed on surgery, the testicles were preserved after discussion with the parents.

Complicated hernias were reported in 12 cases in this work (Figs. 6,7,8). The newborns presented with unilateral acute scrotum with repeated vomiting. Evidence of intestinal obstruction found on plain erect abdomen X-ray. On sonography; unilateral hernial sacs were seen extending through the inguinal canals in the 12 patients. Contra-lateral sonography found early inguinal hernial sacs in two of them. The hernial contents and testicles were vascularized on color Doppler except two of them; the intestine has no vascularity. Surgery revealed strangulated hernias. Nine hernias sacs contents were viable where reduction and herniotomy was done but three were gangrenous (resection anastomosis and herniotomy was done). The testicles were viable on surgery.

Epididymitis was found in 2 neonates in this study (Fig. 9). The patients came with acute scrotum with evidence of unilateral involvement. Sonography illustrated the enlarged epididymis without significant enlargement of the testicle. Minimal hydrocele was also observed. Increase vascularity of the epididymis was seen on color Doppler. These cases were improved on medical treatment and confirmed on follow-up.

We found 4 cases with epididymo-orchitis in our series (Fig. 10). The patients presented with more severe clinical data than those with epididymitis. Sonography revealed enlargement of the epididymis and testicle with small hydrocele. Color Doppler demonstrated increase vascularity of the epididymis and testicle. All improved with medical treatment. Medical treatment was the best choice for them. Complete cure was observed on follow-up clinically and radiologically.

Scrotal pyocele was seen in two cases (Fig. 11). One of them was due to necrotizing enterocolitis. The patient was known to have necrotizing enterocolitis in the form of abdominal distension and turbid peritoneal fluid with air, the patient was operated for NEC 7 days before diagnosis of pyocele. The scrotal fluid was turbid and drained surgically. The other patient of scrotal pyocele was small amount after scrotal surgery and treated conservatively on antibiotics.

Neonatal scrotal birth trauma was found in one newborn (Fig. 12). Actually a hard red left scrotal compartment was observed on clinical examination of the patient. It was confused with torsion. On Doppler sonography the testicle has average size with normal vascularity Patient proved to have hemophilia A. However; thickened heterogenous parietal scrotal layer is seen. The patient improved medical treatment (factor IIIIV, and coverage broad spectrum antibiotics).

Scrotal parietal infection, edema and cellulitis was seen in two boys (Fig. 13). The whole scrotum was swollen and edematous with some redness. Average size of the testicles with normal vascularity was seen on color Doppler sonography. These cases were improved on antibiotic and anti-allergic treatment.

The last case in our research work was scrotal edema with bilateral meconium peri-orchitis (Fig. 14). This new-born presented one hour after birth by swollen bluish scrotum. Sonography revealed bilateral irregular heterogenous partially calcified lesions are seen below the lower poles of the

testicles. Parietal scrotal soft tissue thickening and edema are also seen. Within normal size and vascularity of the testicles were found on color Doppler sonography. Routine abdominal sonography was within normal data. This case treated conservatively and the lesions are partially decreased in size on follow-up.

Table (1): Summarize the different causes of neonatal acute scrotum found in the study.

Causes of neonatal acute scrotum	Number of patients and percentage
Torsion	6 (20%)
Complicated hernia	12 (40%)
Epididymitis	2 (6.7%)
Epididymo-orchitis	4 (13.3%)
Pyocele	2 (6.7%)
Hematoma	1 (3.3%)
Scrotal edema due to parietal infection	2 (6.7%)
Meconium peri-orchitis with scrotal edema	1 (3.3%)
<b>Total</b>	<b>30</b>

Table (2): Illustrates the spectrum of clinical, radiological and surgical data of all cases in this work.

Case number	Age in days	History	Clinical data	US findings	Color Doppler	Surgical data (including intraoperative)	Final diagnosis	Other
1	1	Bilateral scrotal swellings at birth	Bilateral scrotal hard swellings	Bilateral small and heterogenous testicles	No testicular vascularity	Bilateral testicular torsion	Prenatal testicular torsion	
2	1	RT scrotal swelling	RT scrotal hard swelling	Enlarged heterogenous RT testicle	No vascularity at the RT testicle	RT testicular torsion, removed	Prenatal RT testicular torsion	
3	11	LT scrotal painful swelling	LT scrotal tender swelling	Enlarged edematous LT testicle	No vascularity at the LT testicle	LT early testicular torsion, Saved	LT testicular torsion	
4	21	LT scrotal painful swelling	LT scrotal tender swelling	Enlarged edematous LT testicle	No vascularity at the LT testicle	LT early testicular torsion, Saved	LT testicular torsion	
5	19	LT scrotal painful swelling	LT scrotal tender swelling	Enlarged edematous LT testicle	No vascularity at the LT testicle	LT testicular torsion, removed	LT testicular torsion	
6	10	RT scrotal painful swelling	RT scrotal tender swelling	Enlarged edematous RT testicle	No vascularity at the RT testicle	RT testicular torsion, removed	RT testicular torsion	
7	22	LT painful scrotal swelling	LT inguino-scrotal tender swelling with picture of IO	LT complicated hernia	Normal vascularity	Reduction of contents (sigmoid) and herniotomy	LT irreducible hernia	
8	28	LT painful scrotal swelling	LT inguino-scrotal tender swelling	LT complicated hernia	Absent vascularity of herniated parts	Resection of gangrenous parts	LT strangulated hernia	
9	15	RT scrotal swelling	RT inguino-scrotal tender swelling	RT complicated hernia	Normal vascularity	Reduction of contents and herniotomy	RT complicated hernia	

Table (2): Count.

Case number	Age in days	History	Clinical data	US findings	Color Doppler	Surgical data (including intraoperative)	Final diagnosis	Other
10	8	LT painful scrotal swelling	LT inguino-scrotal tender swelling	LT complicated hernia	Normal vascularity	Reduction of contents and herniotomy	LT irreducible hernia	
11	29	LT painful scrotal swelling	LT inguino-scrotal tender swelling with picture of IO	LT complicated hernia	Absent vascularity of herniated parts	Resection of gangrenous parts	LT strangulated hernia	
12	23	RT scrotal swelling	RT inguino-scrotal tender swelling	RT complicated hernia	Normal vascularity	Reduction of contents and herniotomy	RT complicated hernia	
13	27	LT painful scrotal swelling	LT inguino-scrotal tender swelling	LT complicated hernia	Normal vascularity	Reduction of contents and herniotomy	LT irreducible hernia	
14	30	LT painful scrotal swelling	LT inguino-scrotal tender swelling	LT complicated hernia	Normal vascularity	Reduction of contents and herniotomy	LT complicated hernia	
15	24	RT scrotal swelling	RT inguino-scrotal tender swelling	RT complicated hernia	Normal vascularity	Reduction of contents and herniotomy	RT complicated hernia	
16	30	LT painful scrotal swelling	LT inguino-scrotal tender swelling with picture of IO	LT complicated hernia	Normal vascularity	Resection of gangrenous parts	LT strangulated hernia	
17	21	RT scrotal swelling	RT inguino-scrotal tender swelling	RT complicated hernia	Normal vascularity	Reduction of contents and herniotomy	RT complicated hernia	
18	18	RT scrotal swelling	RT inguino-scrotal tender swelling	RT complicated hernia	Normal vascularity	Reduction of contents and herniotomy	RT complicated hernia	
19	11	LT scrotal swelling	LT scrotal tender swelling	Enlarged edematous LT epididymis	Increase vascularity	Medical treatment	LT acute epididymitis	
20	17	RT scrotal swelling	RT scrotal tender swelling	Enlarged edematous RT epididymis	Increase vascularity	Medical treatment	RT acute epididymitis	
21	24	LT scrotal swelling	LT scrotal tender swelling	Enlarged edematous LT epididymis and testicle	Increase vascularity	Medical treatment	LT acute epididymo-orchitis	
22	27	RT scrotal swelling	RT scrotal tender swelling	Enlarged edematous RT epididymis and testicle	Increase vascularity	Medical treatment	RT acute epididymo-orchitis	
23	16	RT scrotal swelling	RT scrotal tender swelling	Enlarged edematous RT epididymis and testicle	Increase vascularity	Medical treatment	RT acute epididymo-orchitis	
24	25	LT scrotal swelling	LT scrotal tender swelling	Enlarged edematous LT epididymis and testicle	Increase vascularity	Medical treatment	LT acute epididymo-orchitis	
25	15	LT scrotal swelling	LT scrotal tender swelling	Moderate LT turbid hydrocele	Normal vascularity of the testicle	Surgical drainage	LT pyocele	NEC operated on 8th day
26	13	LT scrotal swelling	LT scrotal tender swelling	Small LT turbid hydrocele	Normal vascularity of the testicle	Medical treatment	LT pyocele	

Table (2): Count.

Case number	Age in days	History	Clinical data	US findings	Color Doppler	Surgical data (including intraoperative)	Final diagnosis	Other
27	2	RT scrotal swelling	RT scrotal red swelling	heterogonous parietal organized hematoma	Normal vascularity of the testicle	Medical	RT parietal hematoma	Birth trauma, bleeding tendency
28	15	Scrotal swelling	Diffuse tender scrotal red swelling	Edematous and thickened parietal layers	Normal vascularity of the testicles	Medical treatment	Angioneurotic oedema	
29	12	Scrotal swelling	Diffuse tender scrotal red swelling	Edematous and thickened parietal layers	Normal vascularity of the testicles	Medical treatment	Angioneurotic oedema	
30	5	Scrotal swelling	Diffuse scrotal bluish swelling	Bilateral lower scrotal irregular lesions	Normal vascularity of the testicles	Follow-up	Meconium peri-orchitis	



Fig. (1): Clinical photo of baby with acute scrotum (left side).

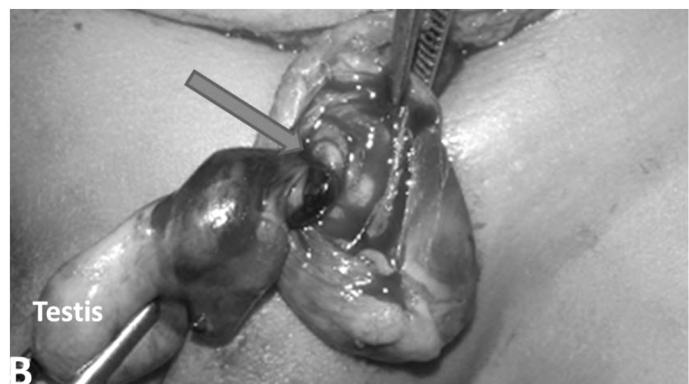
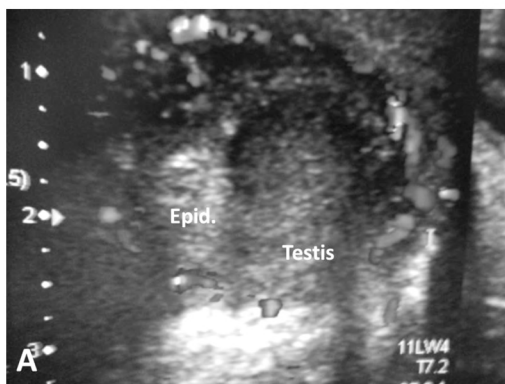


Fig. (2): Acute testicular torsion in a neonate. (A) Color Doppler image shows no evidence vascularity could be seen on the epididymis or testicle. (B) Surgical photo after urgent operation illustrates the site of the torsion (arrow) and viability of the testis.

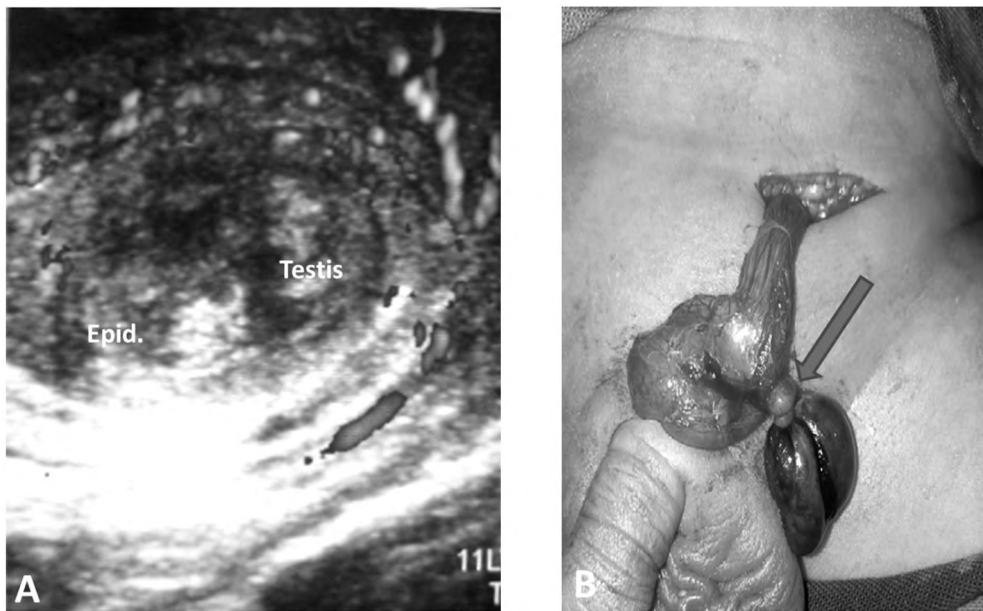


Fig. (3): Acute testicular torsion in a boy. (A) Color Doppler image demonstrates no evidence vascularity in the epididymis or testicle. (B) Surgical photo documented the site of the torsion (arrow).

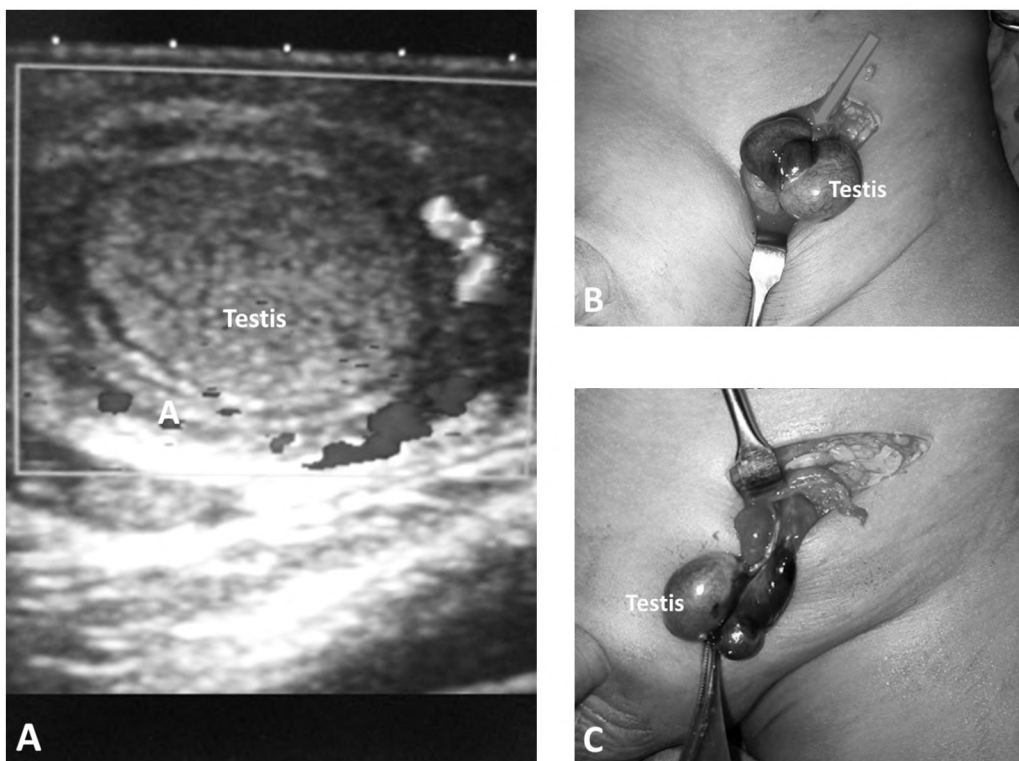


Fig. (4): Acute testicular torsion in a boy. (A) Color Doppler image shows the testicle without vascularity. (B) Surgical photo during operation (undescended testis with torsion) shows the site of the torsion (arrow). (C) Viable testis is noted after de-rotation of the torsion.

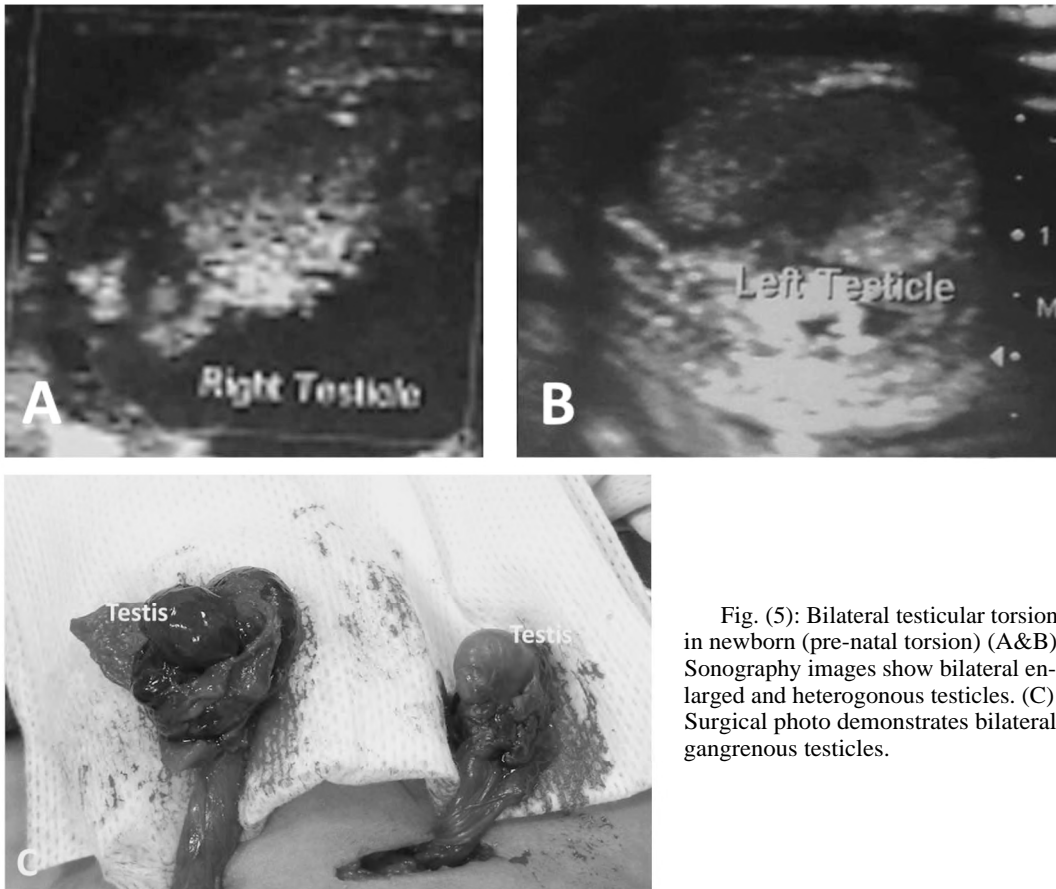


Fig. (5): Bilateral testicular torsion in newborn (pre-natal torsion) (A&B) Sonography images show bilateral enlarged and heterogenous testicles. (C) Surgical photo demonstrates bilateral gangrenous testicles.

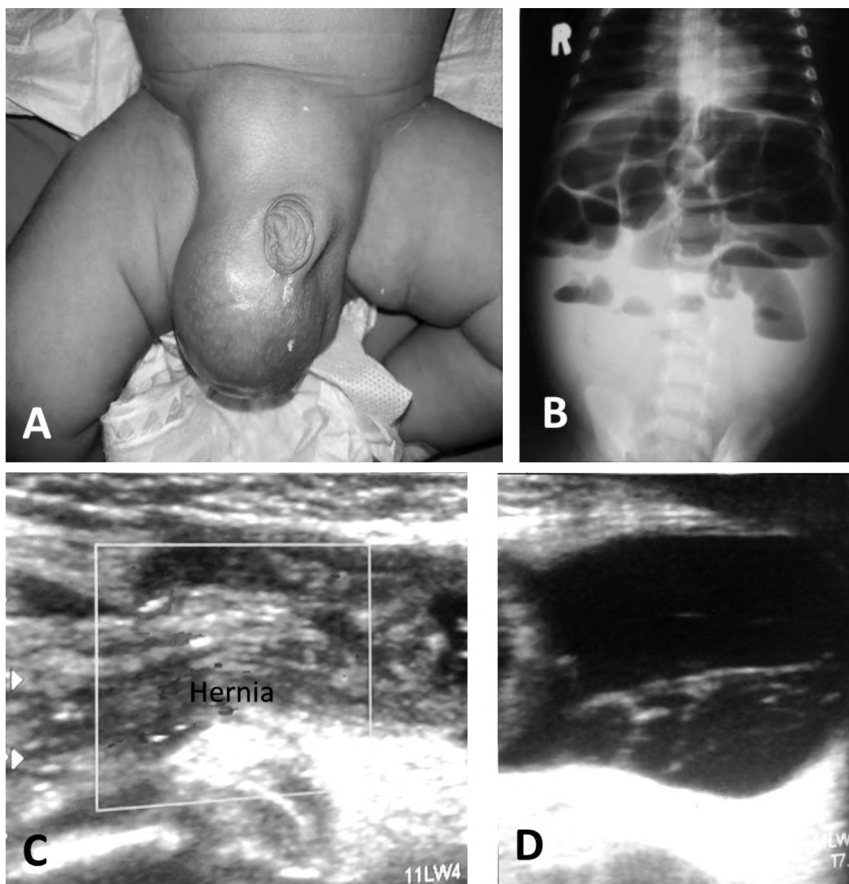


Fig. (6): Complicated right inguinal hernia in neonate. (A) Clinical photo shows right inguino-scrotal swelling. (B) Plain X-ray abdomen shows signs of intestinal obstruction. (C) Color Doppler image demonstrating vascularity of hernial contents. (D) Sonography image shows septated hydrocele.

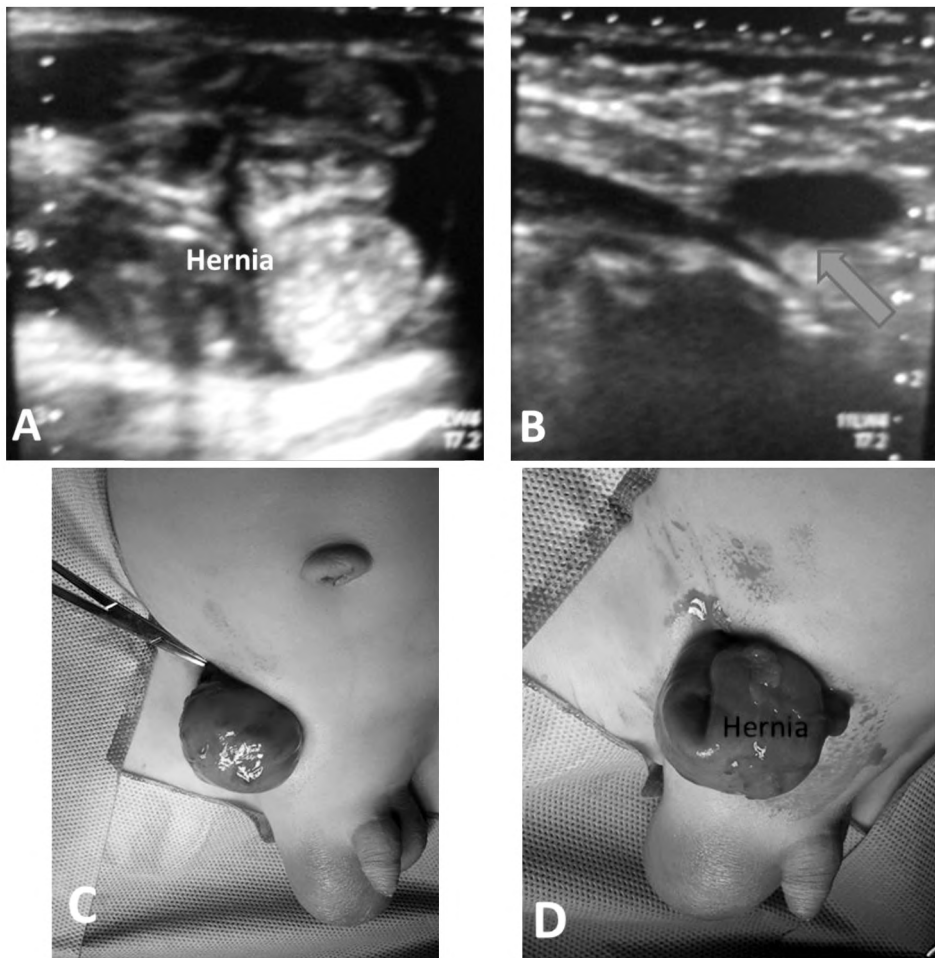


Fig. (7): Complicated right inguinal hernia in neonate (A) Sonography image shows a big inguinal hernia containing multiple intestinal loops. (B) Sonography image of the contra-lateral inguinal side shows early hydrocele of hernia sac. (C&D) Surgical photos demonstrating the inguinal hernia and documented viable intestine.

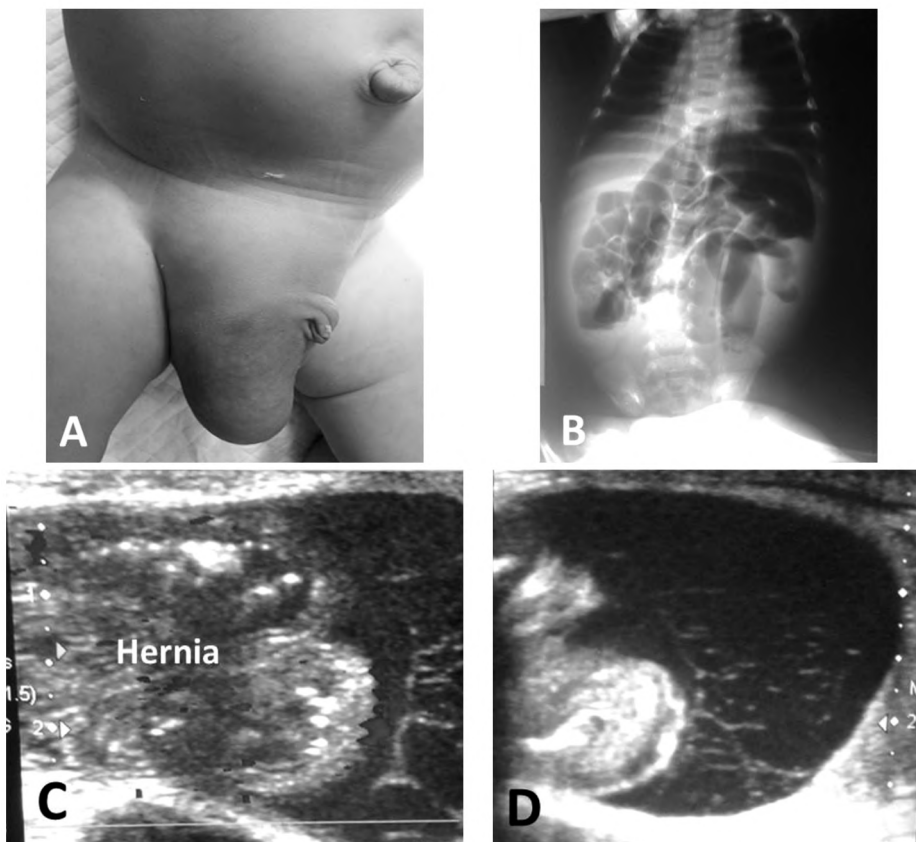


Fig. (8): Complicated right inguinal hernia. (A) Clinical photo illustrates a very big right inguino-scrotal swelling. (B) Plain X-ray abdomen shows multiple air-fluid levels denoting intestinal obstruction. (C) Color Doppler image demonstrating good vascularity of hernial contents. (D) Sonography image shows turbid hydrocele.



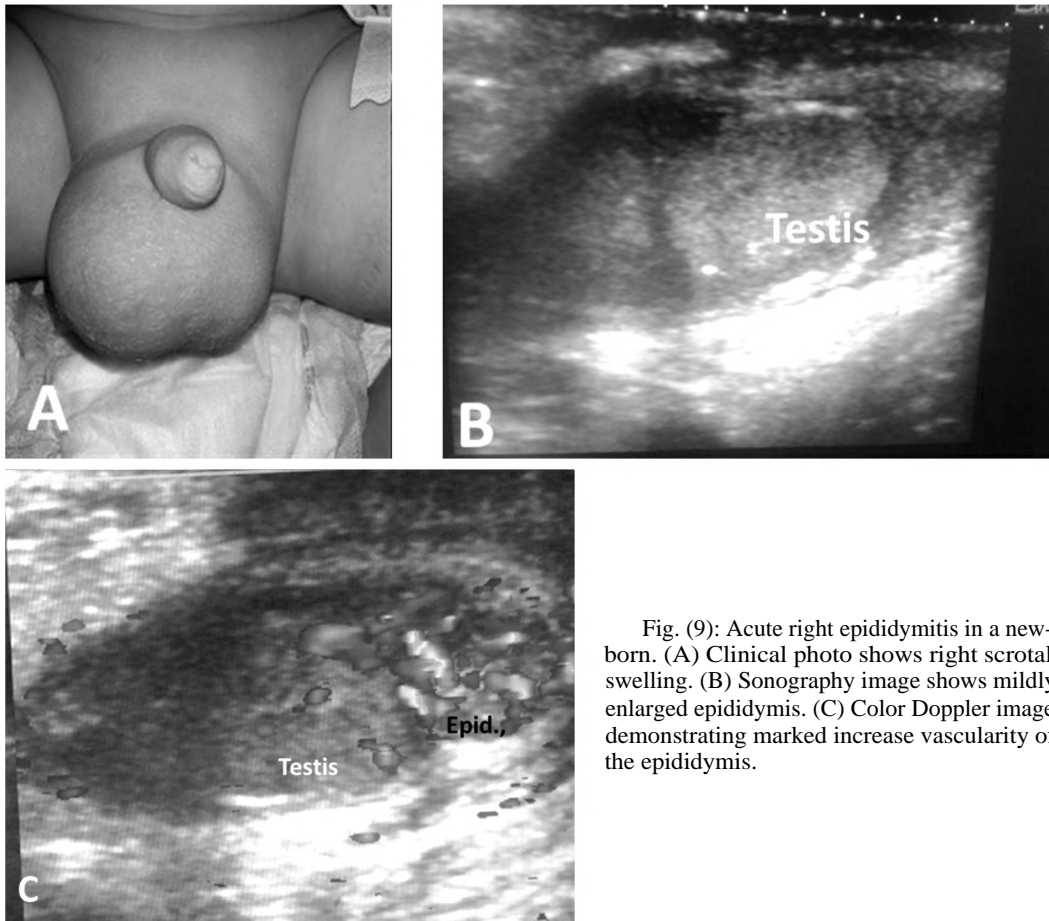


Fig. (9): Acute right epididymitis in a newborn. (A) Clinical photo shows right scrotal swelling. (B) Sonography image shows mildly enlarged epididymis. (C) Color Doppler image demonstrating marked increase vascularity of the epididymis.

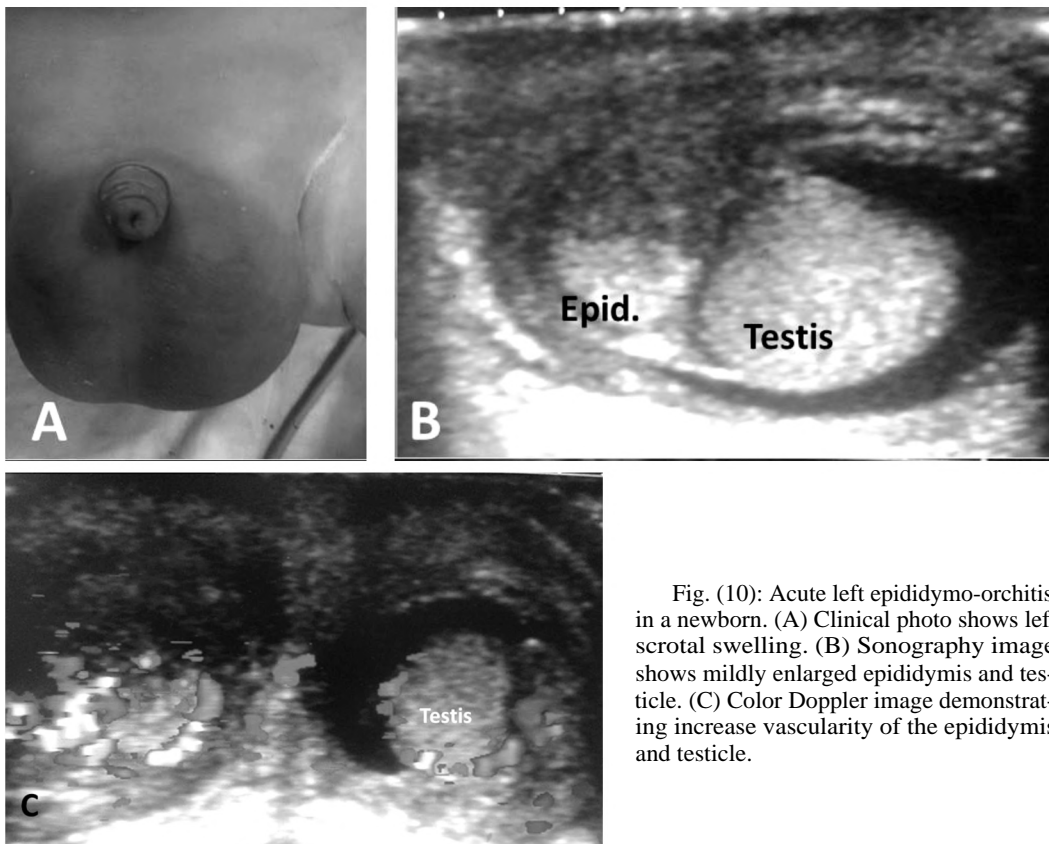


Fig. (10): Acute left epididymo-orchitis in a newborn. (A) Clinical photo shows left scrotal swelling. (B) Sonography image shows mildly enlarged epididymis and testicle. (C) Color Doppler image demonstrating increase vascularity of the epididymis and testicle.

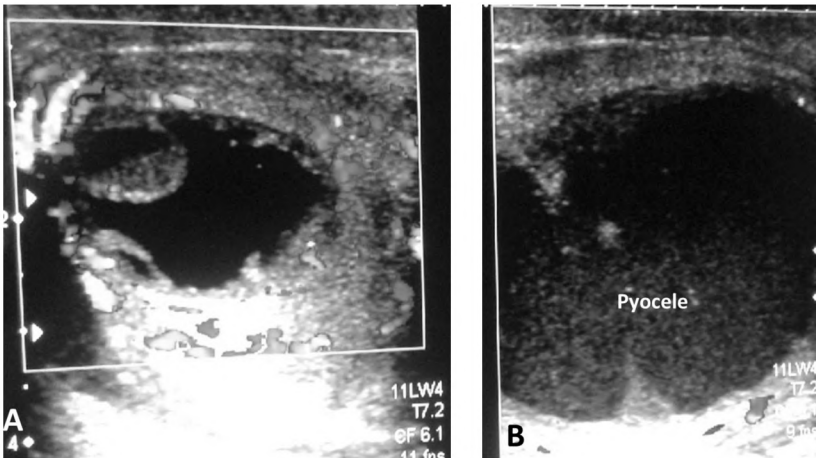


Fig. (11): Pyocele in a neonate. (A) Color Doppler image demonstrating increase vascularity around the pyocele. (B) Sonography image shows large amount of turbid fluid (pyocele).

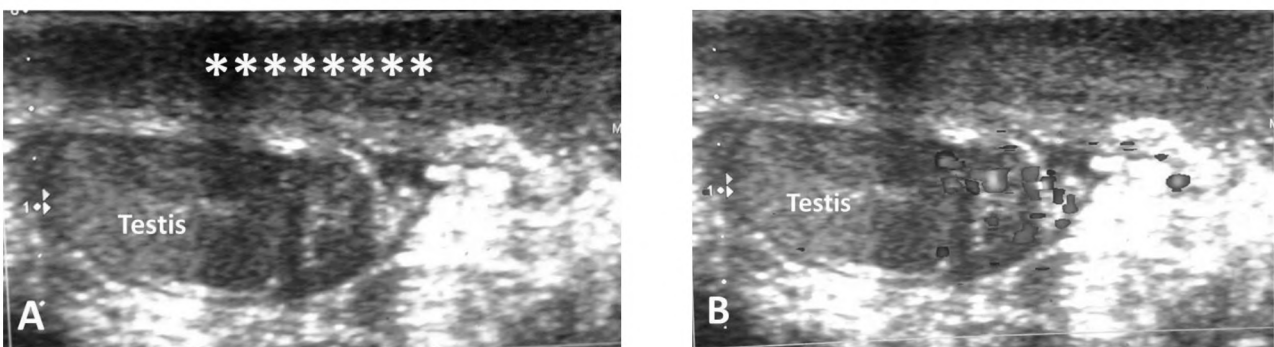


Fig. (12): Scrotal parietal layers diffuse hematoma. (A&B) Sonography and color Doppler images showing the diffuse parietal hematoma (\*\*\*\*\*).

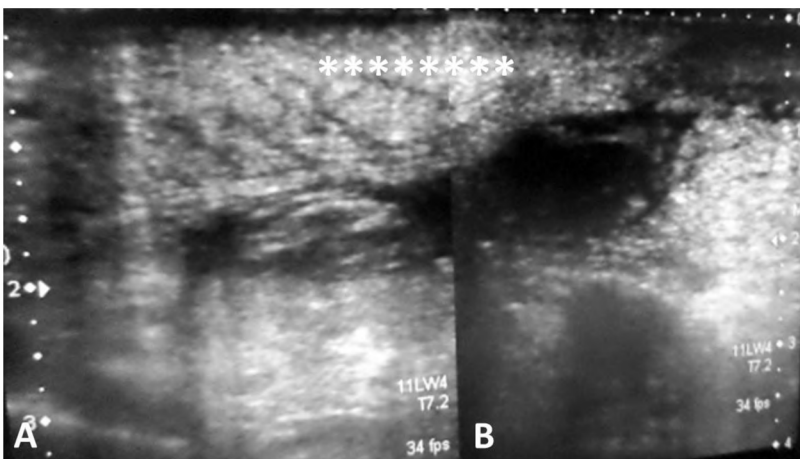


Fig. (13): Cellulitis (A&B) Sonography images showing the marked diffuse parietal edema due to cellulitis (\*\*\*\*\*).

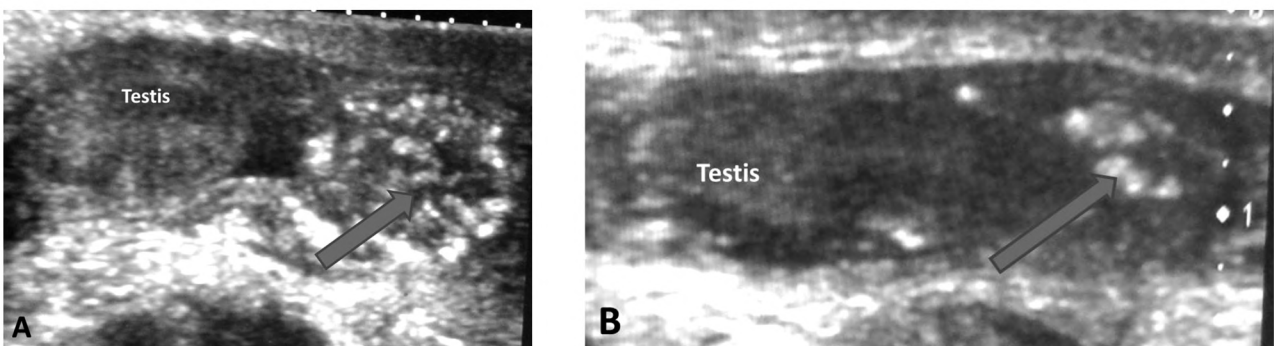


Fig. (14): Bilateral meconium peri-orchitis. (A&B) Sonography images demonstrating bilateral partially defined heterogenous lesions at the lower scrotal compartments (meconium components).

## Discussion

Acute scrotum in neonates is rarely seen. They are of utmost important because some of them consider surgical emergencies especially testicular torsion and complicated hernia [5]. Our study included 30 neonates with acute scrotum. The causes were diverse from torsion to inflammatory edema. Clinical, radiological and surgical data were compared to each other. The sensitivity, specificity and accuracy of the color Doppler sonography for differential diagnosis of the causes of acute neonatal scrotum in comparable to surgical and clinical follow-up after treatment were as follow 100%, 85% and 90% respectively. Chiang MC et al., [6] reported sensitivity up to 90% of color Doppler sonography in assessment of cases of testicular torsions and epididymo-orchitis in boys under 3months.

Neonatal testicular torsion is a very important surgical emergency. It is reported since 1897 [7]. From that time; testicular torsion in pediatric age was reported in many literatures with many neonatal testicular torsion research works [8,9]. It is due to rotation of the spermatic cord along its axis. Our work reported 5 cases with unilateral testicular torsion. Two of them were saved and 3 were gangrenous on surgical exploration. The 6<sup>th</sup> case was bilateral testicular torsion. We found bilateral testicular gangrene during surgery. Actually the last case was mostly due to pre-natal testicular torsion of a long duration. Our salvage rate in testicular torsion is about 30% and more than the salvage rate reported in the literatures which is 8.9-21% [10].

Congenital inguinal hernia is frequently seen in neonates. It is due to the entrance of the abdominal contents into the patent processus vaginalis [11,12]. However; complicated inguinal hernia is rarely encountered in this age group. We found 12 cases of complicated inguinal hernia in this study. Intestinal and testicular viability are our goals in management in such cases. Testicular viability was persevered in all cases but three cases of intestinal gangrene were encountered. Bamigbola KT [13] found 8 cases with neonatal inguinal hernia, one intestinal resection. Erikci V et al., [14] found similar number of cases with strangulated neonatal inguinal hernia. Shun and his colleague [15] studies 61 cases with complicated inguinal hernia in the neonatal period over 15 years period.

Epididymitis and epididymo-orchitis are rarely seen in newborns. They occur with cases with genitor-urinary and ano-rectal malformations es-

pecially with fistulous tracts [16]. Our series reported 6 cases with epididymitis and epididymo-orchitis. Color Doppler sonography diagnosed the all cases and assesses the testicular vascularity to exclude testicular torsion. All of them improved on medical treatment. Acute epididymo-orchitis is not so frequent published in literatures [17,18,19]. Most of them reported as a case presentation.

Neonatal scrotal pyocele is usually secondary to other abdominal causes such as necrotizing enterocolitis or scrotal causes such as epididymo-orchitis. Scrotal pyocele due to NEC is well known in the literature. We found a case like this in our work and drained surgically. The other one was small pyocele after scrotal surgery. Mondal et al., [20] reported two cases of neonatal scrotal pyocele. The first case was secondary to epididymo-orchitis and the second case was due to NEC.

Acute scrotum due to trauma is one of the confusing conditions that clinically misdiagnosed as testicular torsion [21]. Actually; we encounter such a case. A newborn boy came immediately after birth with left scrotal hard tender red-bluish swelling. Doppler sonography assesses the normal vascularity of the testicle and found a parietal hematoma.

Scrotal edema may be idiopathic which was demonstrated in literature [22] and may be due to allergic or inflammatory causes. We faced two cases with scrotal edema due to parietal infection and improved with anti-biotic.

Meconium peri-orchitis is due to intra-uterine perforation of the intestine with passage of meconium into the peritoneum then to the patent processus vaginalis [23]. In this series; we found a bilateral significant meconium peri-orchitis with scrotal edema. Doppler sonography could diagnose the disease and confirm good vascularity of the testicle. Alanbuki et al., [24] could present a case with small meconium peri-orchitis.

Our study has limitations in the form of small number of patients and we didn't have prenatal data for the patients.

### Conclusion:

Acute scrotum in neonates is serious medical emergency to the save the viability of the testicles and may be the intestine. It has many causes. Our study included cases of testicular torsion, strangulated inguinal hernia, epididymitis, epididymo-orchitis, scrotal pyocele, trauma, and cellulitis and meconium peri-orchitis. Color Doppler sonography could assess all these causes and determine the

cause of acute obstruction and viability of the testicles and intestine with the sensitivity, specificity and accuracy of 100%, 85% and 90 % as compared with surgical data. Still surgical exploration is to be considered when radiological evaluation is not conclusive. We recommend further research work on a big number of neonates.

*Conflict of interest:*

No conflict of interest.

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## الصفن الحاد عند الولدان العلاقة السريرية والإشعاعية والجراحية

يعد كيس الصفن الحاد عند الولدان مشكلة طبية مهمة: يعنى كيس الصفن الحاد تورماً مؤلماً فى كيس الصفن وقد يكون لونه أحمر وللصفن الحاد عند الولدان أسباب كثيرة مثل التواء الخصية، فتق حاد غير مرتجع، إتهاب بالخصية، نادراً ما تأتي أورام الخصية الخلقية ونزيف الغدة الكظرية مع كيس الصفن الحاد.

الغرض من البحث: تقييم النتائج الإشعاعية للصفن الحاد عند الولدان ومقارنتها بالبيانات السريرية والجراحية، خاصة فيما يتعلق بتدفق الدم المغذى للخصية والأمعاء.

المرضى والطرق: تم فحص ثلاثين ولداً (حديثى الولادة) يعانون من كيس الصفن الحاد حيث تم إجراء التقييم السريرى لجميع المرضى. تم إجراء التصوير الإشعاعى المناسب وفقاً للحالة بما فى ذلك التصوير بالموجات فوق الصوتية والدوبلر الملون والأشعة السينية فى بعض الحالات.

الخلاصة: للصفن الحاد عند الولدان والرضع أسباب كثيرة. الأشعة لها دور رئيسى فى التشخيص التفريقى لهذه الأسباب. وترتبط بشكل جيد مع الجراحة. لا يزال يجب التفكير فى الاستكشاف الجراحى عندما يكون التقييم الإشعاعى غير قاطع.