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Original article

Inguinoscrotal and inguinolabial swelling in infancy: Role of ultrasound

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KEYWORDS
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Abstract
Objectives: Inguinoscrotal and inguinolabial swellings are common findings in infancy. In this study, color Doppler ultrasonography was used to identify the different etiologies of inguinoscrotal and inguinolabial swelling, thus helping to decide on the optimal management.
Patients and methods: 150 infants with a history of intermittent swelling or presenting with a palpable swelling in the inguinoscrotal or inguinolabial region were included in the study. All patients were subjected to color Doppler ultrasound examination in supine position.
Results: Out of 135 male infants with inguinoscrotal swelling 119 were found to have chronic, 16 acute and 14 bilateral swelling. Out of 15 female infants, 12 were found to have chronic and 3 acute inguinolabial swelling.
Conclusion: Color Doppler ultrasonography is an accurate, safe and readily available imaging modality which can be used to identify different etiologies of inguinoscrotal and inguinolabial swelling in infants.

Introduction

Hernias and hydroceles are common findings in infancy. Male hydrocele, most commonly non-communicating hydrocele, accounts for 1–2% [1,2], while the reported incidence of inguinal hernia, most commonly indirect inguinal hernia, is 5–50/1000 with a male-to-female ratio of 5:1 [3–7]. Most inguinal hernias are unilateral, but 10% of the patients present with bilateral inguinal hernias. The incidence of inguinal hernia in premature infants has been reported to be about 5–30% with about two thirds being bilateral cases. Inguinal hernia repair is considered the most common surgical procedure in children [3–7]. Other causes of inguinoscrotal swelling include testicular torsion, undescended testis, retractile testis, epididymo-orchitis, inguinal lymphadenitis, paratesticular tumors and tumors of the inguinal region such as lipoma and liposarcoma. Although paratesticular tumors are uncommon, they should be taken into consideration in the differential diagnosis [8].

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Causes of inguinolabial swelling include hydrocele of the canal of Nuck, hernias and inguinal lymphadenitis [9–11]. The complete androgen insensitivity syndrome is an androgen receptor defect seen in patients with female external genitalia and 46, XY karyotype showing uterine vaginal agenesis. Such patients commonly present with inguinal hernias [11,12].

In many of these cases, clinical examination may suffice to obtain a definite diagnosis, but when the diagnosis is inconclusive, ultrasonography can play an important role. This study was carried out to assess the role of color Doppler ultrasonography in the identification of the different etiologies of inguinoscrotal and inguinolabial swelling, thus helping to decide on the optimal management.

Patients and methods

Between March 2012 and March 2014, 150 infants with a history of intermittent swelling or presenting with a palpable swelling in the inguinoscrotal or inguinolabial region were referred to the radiology department. Before referring them, the 135 boys and 15 girls aged between 1 day and 12 months (mean age: 3 months) were subjected to a complete clinical evaluation by an expert pediatrician.

Only infants with a completed follow-up were included in the study. Those lost to follow-up were excluded.

All the children were examined in supine position with a multifrequency superficial ultrasound probe (ranging from 5 to 12 MHz) using the Sono ace X8 ultrasound device (Medison, Korea) with color Doppler and 3-dimensional imagery. For the examination of male infants, the scrotal sacs were elevated over a pillow and the penis was displaced ventrally. The examination was preferably carried out when the child's urinary bladder was empty.

The right and left inguinal regions were examined for abnormal cystic or solid lesions with the ultrasound in the sagittal and axial directions.

The examination of infants with a history of non-palpable inguinal swellings was easier when done while they were crying or by exerting gradual manual compression of the right and left iliac regions in order to increase intra-abdominal pressure.

The scrotal sacs were examined on both sides for the presence or absence of testes, any localized or diffuse fluid collections, the size and texture of the epididymis, the size and texture of the testes, the thickness of the scrotal sac wall and any abnormal scrotal contents. Color Doppler evaluation of both testes and the epididymis was done to identify the presence or absence of vascular markings, the presence of hypovascularity or hypervascularity in comparison with the clinically normal site and for the presence of peritesticular hypervascularity.

In female infants, the labia major on both sides were examined for the presence or absence of abnormal soft tissue or cystic swelling, and the contents of any cystic swelling were analyzed.

According to the clinical presentation and ultrasound diagnosis, inguinolabial or inguinoscrotal swelling can be acute or chronic, unilateral or bilateral. Acute swelling which may be associated with vomiting, absolute constipation and abdominal distension may present as a palpable tender swelling in an irritable, crying infant. Chronic swelling may be non-palpable at the time of examination, but it may also be intermittent or palpable without tenderness and is usually not associated with abdominal symptoms.

Features of chronic inguinoscrotal swelling

Depending on the etiology, chronic inguinoscrotal swellings may show the following features:

Inguinoscrotal hydrocele

A non-communicating hydrocele is seen as an anechoic fluid collection confined to the scrotal sac, encasing the testis from all sides except posteriorly. It does not expand to the inguinal region.

An encysted hydrocele of the spermatic cord is seen as an encysted fluid collection in the inguinal region with anechoic fluid inside due to obliteration of the processus vaginalis at its proximal and distal portions [13]. However, when the fluid is turbid and contains echogenic debris, this is suggestive of an encysted hematocele.

The funicular type of hydrocele is associated with a patent funicular process of the spermatic cord and appears as an anechoic localized inguinoscrotal fluid collection, extending from the site of the internal inguinal ring to the supratesticular region without encasing the testis [14].

A communicating hydrocele is seen as an anechoic fluid collection encasing the testis and extending through the inguinal region to the internal inguinal ring due to complete patency of the processus vaginalis. Communicating hydrocele should be ruled out in every case of scrotal hydrocele. This can be done by examining the child while he is crying or by exerting manual compression on the iliac fossa. By doing so, initially undetected fluid in the inguinal region will flow from the intra-abdominal area into the patent processus vaginalis through its narrow opening [13,14].

An abdominal scrotal hydrocele may be seen as an encysted intra-abdominal fluid collection communicating with a scrotal sac hydrocele [15].

Inguinoscrotal hernia

An inguinal hernia can be unilateral or bilateral, direct or indirect. It has been reported to occur with a male-to-female ratio of 6:1. The direct inguinal hernia is uncommon. It is characterized by a protrusion of the hernia sac medial to the inferior epigastric vessels. The indirect inguinal hernia is more common and is characterized by a protrusion of the hernia sac lateral to the inferior epigastric vessels. The hernia sac may contain omentum, fluid or small intestine, in rare cases also the appendix or Meckel's diverticulum [16]. Ultrasonography should be done during straining unless the hernia sac is incarcerated.

Retractile testis

During straining, the testis may be seen moving between the inguinal and the intrascrotal position.

Undescended testis

The testis is located in the inguinal region and cannot move down to the scrotal sac during straining. An undescended testis located in the inguinal region may be wrongly diagnosed as an inguinal hernia.

Table 1 Demonstrate the results of the study.

Male infants			Female infants		
Ultrasound diagnosis	Number of cases	%	Ultrasound diagnosis	Number of cases	%
Hydrocele	35	26	Hernia	8	52
Hernia	30	22			
Undescended testes	30	22	Diffuse hydrocele of canal of Nuck	3	20
Retractile testes	24	17.75	Encysted hydrocele of canal of Nuck	1	7
Incarcerated hernias	5	4	Incarcerated hernia	2	14
Torsion of intra-scrotal testis	2	1.5			
Torsion of undescended testis	1	0.75	Lymphadenitis	1	7
Scrotal wall edema	2	1.5			
Epididymo-orchitis	3	2.25			
Inguinal lymphadenitis	3	2.25			
	135	100		15	100

Features of acute inguinoscrotal swelling

Acute inguinoscrotal swellings in male infants may show the following features.

Incarcerated inguinal hernia

An incarcerated inguinal hernia may be seen as a tender palpable swelling in the inguinoscrotal region. It occurs when omentum, small intestine and/or fluid are trapped in the groin and are irreducible. This type of hernia may be associated with symptoms and signs of intestinal obstruction. When strangulation occurs, no vascular markings will be observed on the walls of the small intestine or within the omentum, and urgent surgical interference will be required.

Intrascrotal testicular torsion

The testis appears enlarged with diffuse hypoechoic texture, absence of intra-testicular vascular markings with peritesticular hypervascularity, mild secondary hydrocele and an enlarged head of the epididymis with heterogeneous texture.

Torsion of undescended testis

On color Doppler study an enlarged hypoechoic, non-vascularized testis is seen in the inguinal region.

Epididymo-orchitis

Epididymo-orchitis is seen as an enlarged hypoechoic testis with diffuse or focal epididymal enlargement associated with diffuse hypervascularity and mild secondary hydrocele.

Inguinal lymphadenitis

Inguinal lymphadenitis may be caused by perineal infection, infection of the ipsilateral limb or the gluteal region or as part of a generalized lymphadenopathy. On ultrasound, it appears as enlarged lymph nodes sized >1.5 cm in maximum diameter with a prominent medulla, a preserved or amputated central hilar echo and diffuse hypervascularity with a normal vascular branching pattern. Sometimes, cavitation within the lymph node suggesting intra-nodal suppuration may be observed.

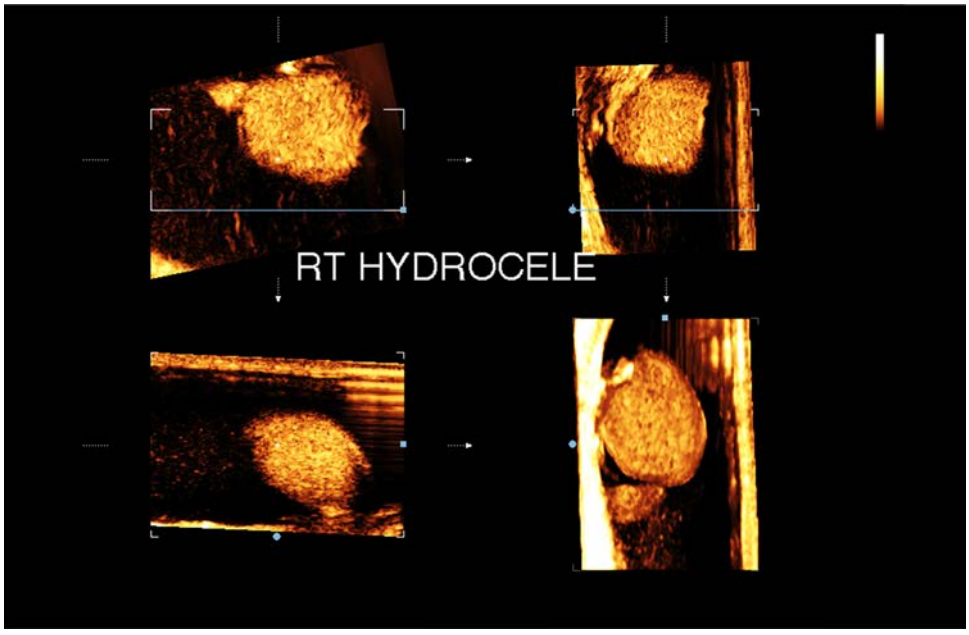

Figure 1 3D ultrasonography with multiplanar image analysis and volume rendering showing non communicating hydrocele.

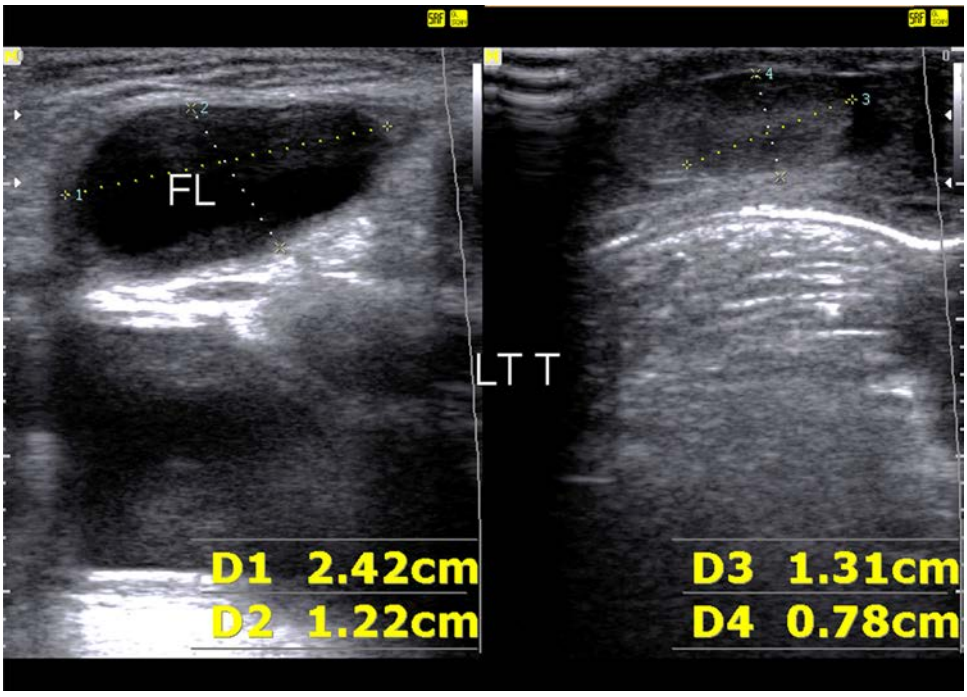

Figure 2 Encysted fluid collection (FL) seen in the inguinal region suggesting of encysted hydrocele of the spermatic cord.

Scrotal wall edema

Ultrasonographic features pointing to scrotal wall edema are a thick skin of the scrotal sac and a dartos muscle with hypoechoic pattern. Scrotal wall edema may be observed after trauma and can be associated with scrotal hydrocele, hematocele or features of testicular trauma (lacerations, contusions or hematomas).

Features of female inguinolabial swellings

Chronic inguinolabial swellings include the following disorders.

Inguinolabial hernia

The hernia sac may contain an ovary, a tube and/or omentum.

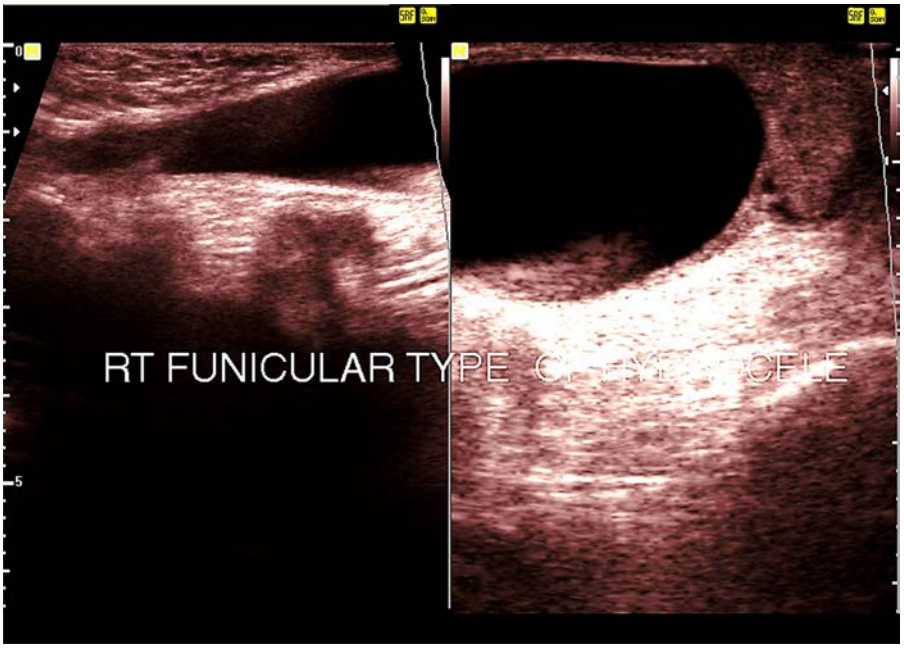

Figure 3 B mode ultrasonography showing funicular type of hydrocele with the funicular process of spermatic cord seen moderately distended with fluid and the testis was displaced to the inferior aspect of the scrotal sac.

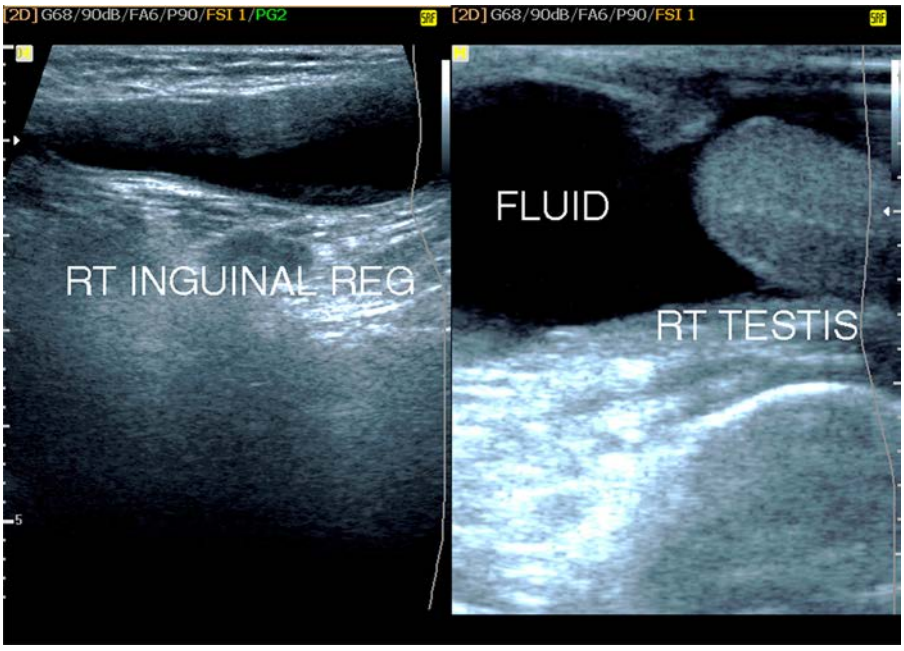

Figure 4 Moderate degree of communicating hydrocele seen encasing the testis in the scrotal sac and extending all through the inguinal region.

Diffuse hydrocele of the canal of Nuck

In cases of diffuse hydrocele of the canal of Nuck, an inguinolabial anechoic fluid collection without herniation of the omental tissue, intestine or ovary is seen. It increases in size during straining.

Encysted hydrocele of the canal of Nuck

This disorder is seen as a localized or encysted fluid collection in the inguinal or labial region, not changing in size during straining.

Acute inguinolabial swellings include the following disorders.

Incarcerated hernia

Incarcerated hernia, when prolonged, may lead to strangulation. Strangulation involving the Fallopian tubes and ovaries is less common than strangulation of the hernia sac involving small intestine, with the latter being considered a surgical emergency.

Inguinal lymphadenitis

Inguinal lymphadenitis in females shows the same features like in male inguinal lymphadenitis.

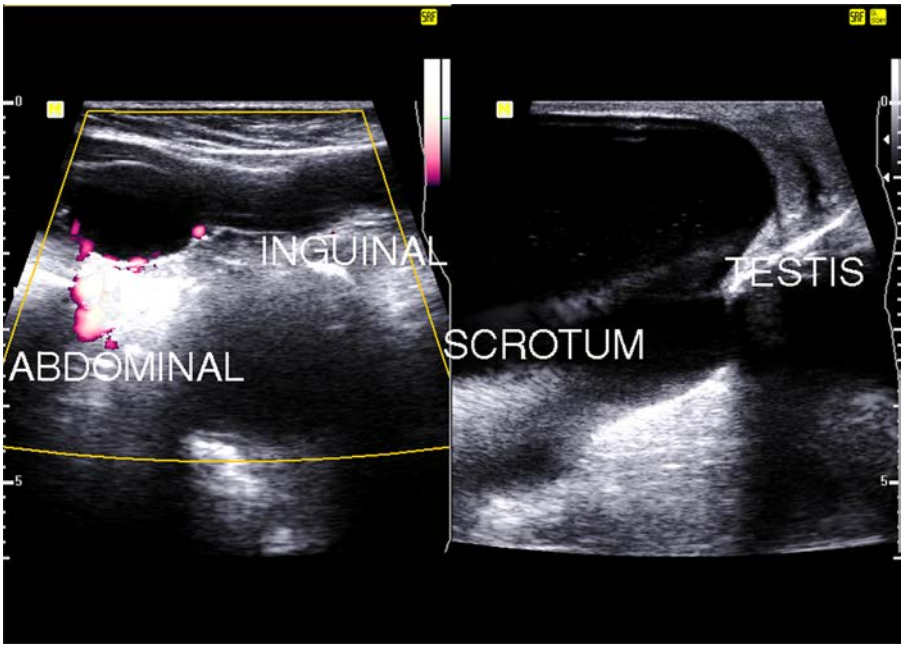

Figure 5 Ultrasonography exam revealed scrotal sac hydrocele communicating with small intra-abdominal cyst through patent processus vaginalis.

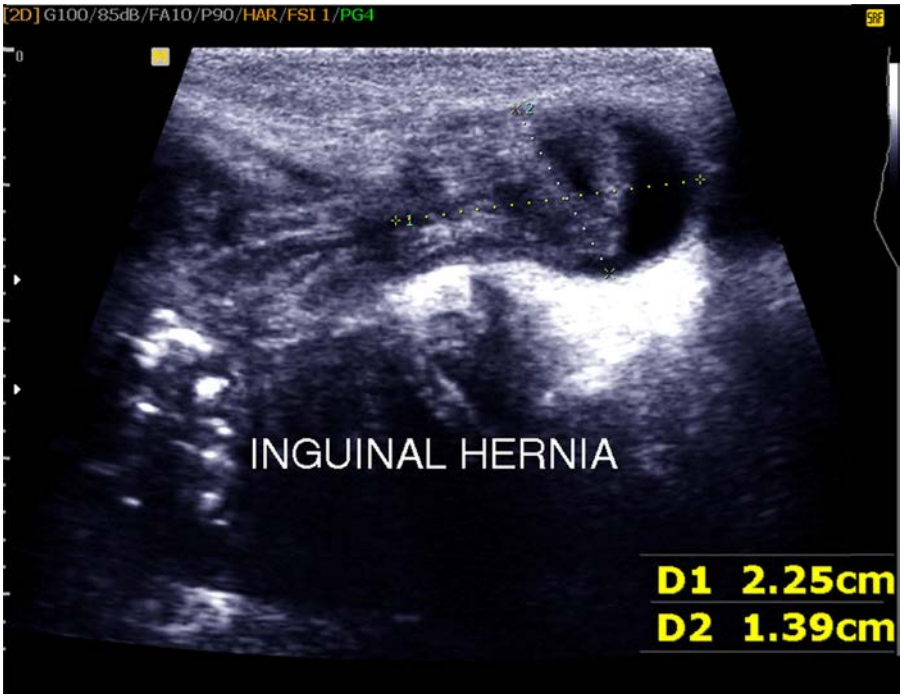

Figure 6 Ulrasonography exam showing hernia sac in the inguinal region with omentum and fluid inside.

The results were collected and analyzed.

We did not aim to compare the results of ultrasonography with the results of the clinical exam. The aim of this study was to assess the efficacy of ultrasound in achieving the optimal line of treatment.

Results

Inguinoscrotal swelling was ultrasonographically diagnosed in 135 male infants (Table 1). Of these, 119 were found to have chronic and 16 acute swelling, while bilateral swelling was found in 14.

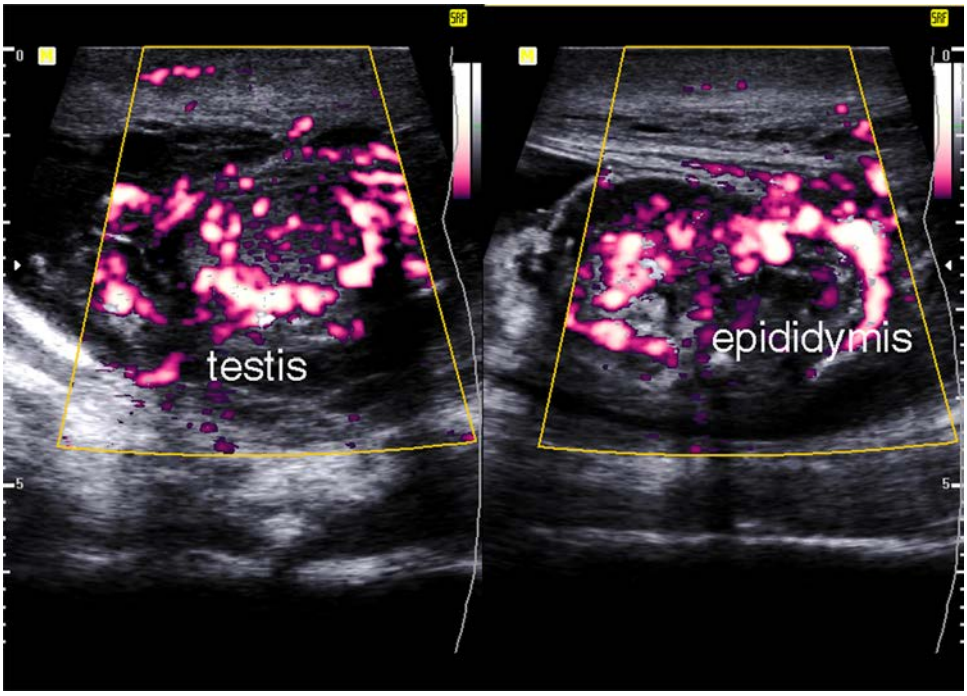

Figure 7 Color duplex sonography showing enlarged hypervascular epididymis and testis suggesting epididymo-orchitis.

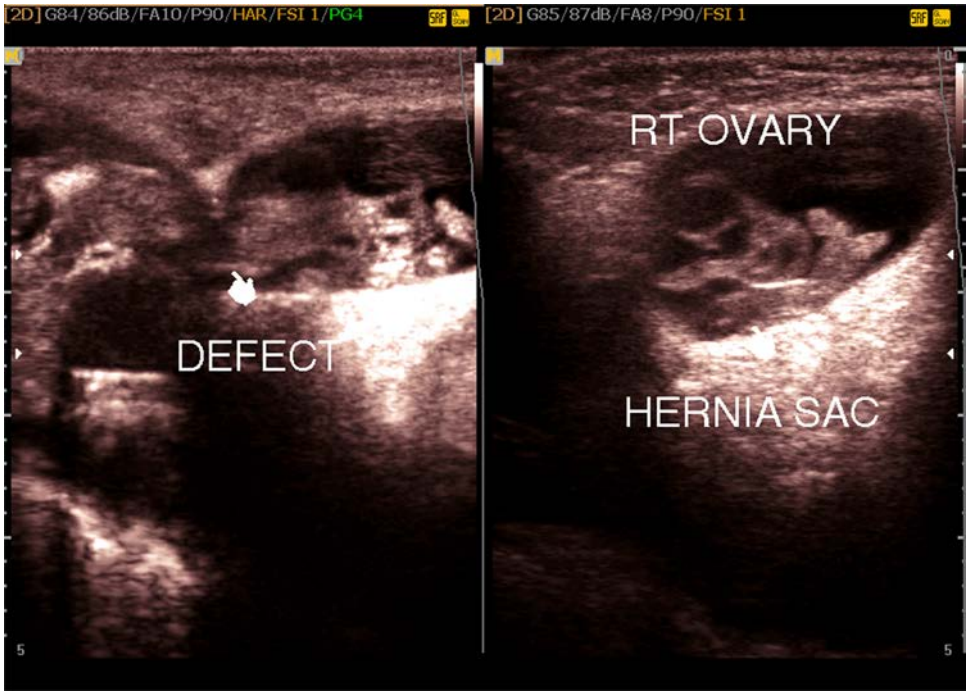

Figure 8 Ultrasound exam revealed female inguinal hernia with an ovary, tube and fluid inside the hernia sac.

Chronic swelling was caused by hydrocele in 35 cases:18 cases with non-communicating hydrocele (Fig. 1), 3 with encysted hydrocele of the spermatic cord (Fig. 2), 5 with the funicular type of hydrocele (Fig. 3), 8 with communicating hydrocele (Fig. 4) and 1 case with abdominal scrotal hydrocele (Fig. 5). Hernia (Fig. 6) and undescended testes were seen in 30 cases each, while retractile testes were found in 24 cases.

Acute swelling included incarcerated or strangulated hernias (5 cases), torsion of an intra-scrotal testis (2 cases), torsion of an undescended testis (1 case), epididymo-orchitis (3 cases) (Fig. 7), inguinal lymphadenitis (3 cases) and scrotal wall edema (2 cases).

Inguinolabial swelling was seen in 15 female infants. Chronic inguinolabial swelling was found in 12 cases, among these 8 cases with inguinolabial hernia (Figs. 8 and 9), 3 cases with diffuse hydrocele of the canal of Nuck (Fig. 10) and 1 case with encysted hydrocele of the canal of Nuck. In one child a testis surrounded by fluid was entrapped inside the hernia sac, suggesting a complete androgen insensitivity syndrome. The other testis was ectopic in the contralateral inguinal region.

Acute inguinolabial swelling was seen in 3 cases, among them 2 cases with incarcerated hernia and 1 case with inguinal lymphadenitis.

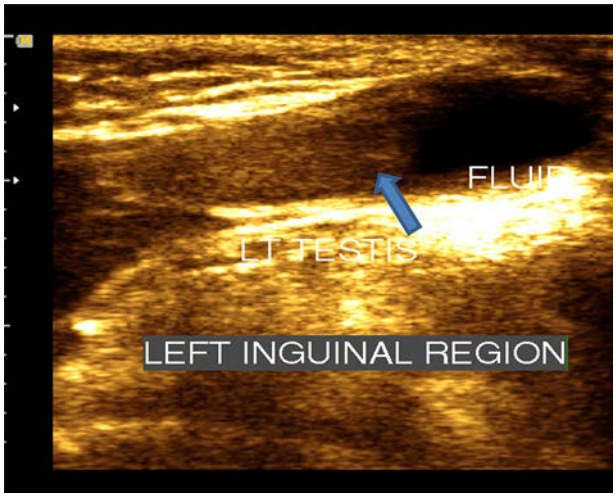

Figure 9 B mode ultrasound showing a female left inguinal hernia sac with fluid and testis inside (arrow) suggesting androgen insensitivity syndrome, the right testis was ectopic in the right inguinal region.

Discussion

Effective management of inguinoscrotal and inguinolabial swelling depends on an accurate diagnosis. However, in many cases, an accurate diagnosis cannot be achieved by clinical evaluation alone. In such cases, imaging modalities such as computed tomography (CT) and magnetic resonance imaging (MRI) may be helpful in establishing the diagnosis. However, they require sedation with the disadvantage of missing intermittent swellings that may appear during straining. Furthermore, apart from exposure to radiation, a major drawback of CT is the need for intravenous administration of contrast media carrying the risk of allergic reactions. MRI, on the other hand, is an expensive tool that is not readily available.

Ultrasonography is an accurate, safe, inexpensive, readily available imaging modality that can help greatly to improve the diagnosis of inguinolabial and inguinoscrotal swelling. It can be used to differentiate between cases requiring surgical management and those which can be treated conservatively or just need to be followed up.

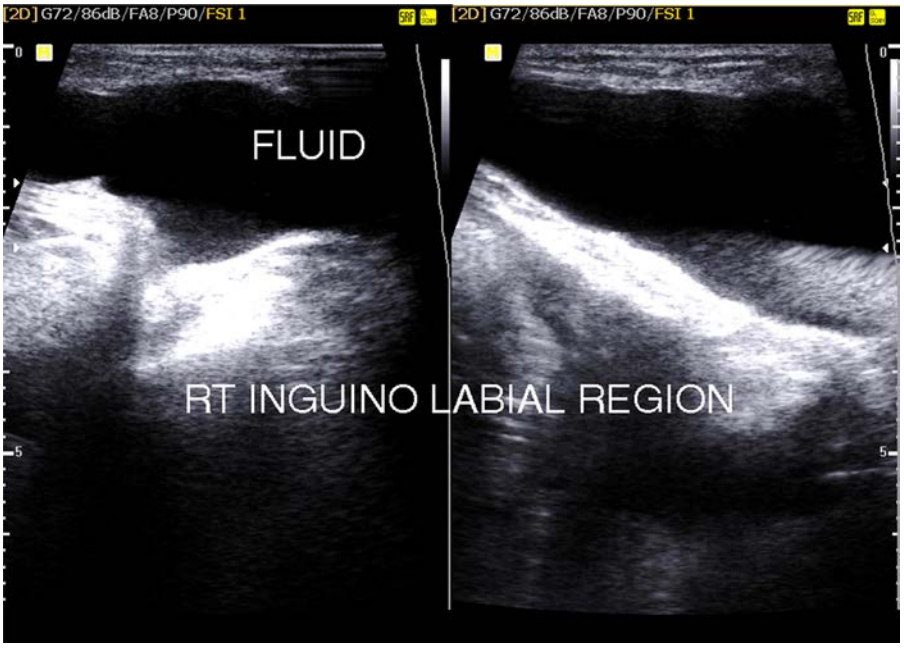

Figure 10 B mode ultrasound showing diffuse hydrocele of the canal of Nuck.

Also, the time of surgical intervention can be determined based on the diagnosis established with ultrasonography: urgent surgery without delay will be necessary in patients with testicular torsion or strangulated hernia, while surgery within 1 or 2 days will be applicable to irreducible hernia after a trial of reduction under sedation. Cases with reducible inguinal hernia should be treated surgically as soon as possible, while surgery can be delayed in patients with communicating hydrocele or hydrocele of the canal of Nuck.

In contrast to clinical evaluation, ultrasonography can easily differentiate between communicating hydrocele or hydrocele of the canal of Nuck and hernia in patients with chronic swelling. This is essential for determining the time of intervention since hernia requires faster intervention than communicating hydrocele. Ultrasonography can also differentiate between a retractile testis and hernia and, thus, deliver important information on the treatment necessary: a retractile testis only needs follow-up while hernia needs surgical repair.

Also in patients with acute swelling, ultrasonography can be used to differentiate between cases requiring surgical management and those that can be treated conservatively or just need to be followed up. Clinical evaluation does not help in differentiating between epididymo-orchitis and testicular torsion. Color duplex sonography, on the other hand, eases differentiation, with hypervascularity pointing to inflammation and absent vascularity to torsion. Inguinal lymphadenitis, torsion of an undescended testis and incarcerated hernia can also be easily differentiated using color Doppler ultrasound, while differentiation may be difficult when performing the clinical exam only.

In cases with incarcerated hernia, ultrasound is a useful tool for evaluating the hernia contents, which is essential for deciding on the appropriate treatment. When the hernia sac contains small intestine, the risk of developing bowel ischemia is high and emergency surgery is required. Incarcerated hernia involving small intestine is more liable to strangulation than hernia involving ovaries, tubes or omentum, because the vascular supply of ovaries and tubes is not usually compromised. Prolonged incarceration may lead to strangulation which can be assessed with color Doppler ultrasound, as this method allows for demonstrating absent vascularity within the walls of the incarcerated viscus.

Ultrasound can be used for follow-up of the cases after medical and surgical treatment to assess the effectiveness of management and to exclude recurrence.

With the risk of metachronous hernia ranging from 10 to 15%, some authors advocate contralateral surgical exploration in all females and young males with unilateral hernia [4]. However, ultrasound can be used to assess the necessity of such intervention.

Doppler ultrasound can also be applied to exclude or confirm the complete androgen insensitivity syndrome (CAIS) in cases with female inguinal hernia. The estimated incidence of hernia in CAIS cases is more than 50%, and in approximately half of them, the hernia is bilateral. In about 1/3 of the cases, the gonads are entrapped in the hernia sac, so the possibility of CAIS should be excluded in all cases with female inguinal hernia. Ultrasonography is helpful in identifying a testis within the hernia sac and in confirming or excluding uterine agenesis [11,12].

Conclusion

Color Doppler ultrasonography is an accurate, safe and readily available imaging modality which can be used for the differentiation between different etiologies of inguinoscrotal and inguinolabial swelling in infants for the sake of reaching an optimum decision on proper management.

Conflict of interest

The author declares that he has no conflict interest.

Informed consent

All procedures performed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975 (revised version of 2000) (5). All parents provided written informed consent to the enrollment of their infants in the study and to the publication of information that could potentially lead to their identification.

References

[1] Elder JS. Disorders and anomalies of the scrotal contents. In: Behrman RE, Kliegman R, Jenson HB, editors. Nelson textbook of pediatrics. 16th ed. Philadelphia: W.B. Saunders Company; 2000. p. 1650–3 [chapter 553].

[2] Fuloria M. The newborn examination: Part II. Am Fam Physician 2001;64(11):1853–60.

[3] Rescorla FJ. Hernias and umbilicus. In: Oldham K, Colombani P, Foglia R, editors. Surgery of infants and children: scientific principles and practice. Philadelphia: Lippincott-Raven Publishers; 1997. p. 1069–76.

[4] Schochat SJ. Inguinal hernias. In: Behrman RE, Kliegman R, Jenson HB, editors. Nelson's textbook of pediatrics. 16th ed. Philadelphia: W.B. Saunders Company; 2000. p. 1185–8 [chapter 346].

[5] Engum SA, Grosfeld JL. Pediatric surgery. In: Townsend CM, Beauchamp DR, editors. Sabiston textbook of surgery. 16th ed. Philadelphia: W.B. Saunders Company; 2001. p. 1499–501 [chapter 67].

[6] D'Agostino J. Common abdominal emergencies in children. Emerg Med Clin North Am 2002;20(1):139–51.

[7] Lloyd DA, Rintal RJ. Inguinal hernia and hydrocele. In: O'Neill JA, Rowe MI, Grosfeld JL, Fonkalsrud EW, Coran AG, editors. Pediatric surgery. 5th ed. St Louis: Mosby; 1998. p. 1071–86.

[8] Yang DM, Kim HC, Lim JW, Jin W, Ryu CW, Kim GY, et al. Sonographic findings of groin masses. J Ultrasound Med 2007;26:605–14.

[9] Manjunatha YC, Beeregowda YC, Bhaskaran A. Hydrocele of the canal of Nuck: imaging findings. Acta Radiol Short Rep 2012;1(April (3)):12.

[10] Patil SN, Bielamowicz K. Female hydrocele of canal of Nuck. J Ark Med Soc 2010;107:38–9.

[11] Deeb A, Hughes IA. Inguinal hernia in female infants: a cue to check the sex chromosomes? BJU Int 2005;96(August (3)):401–3.

[12] Oakes MB, Eyvazzadeh AD, Quint E, Smith YR. Complete androgen insensitivity syndrome—a review. J Pediatr Adolesc Gynecol 2008;21(December (6)):305–10, http://dx.doi.org/10.1016/j.jpag.2007.09.006.

[13] Rathaus V, Konen O, Shapiro M, Lazar L, Grunebaum M, Werner M. Features of spermatic cord hydrocele in children. Br J Radiol 2001;74(September (885)):818–20.

[14] Singh AK, Kao S, D'Alessandro M, Sato Y. Case 164: funicular type of spermatic cord hydrocele. Radiology 2010;257(December (3)):890–2, http://dx.doi.org/10.1148/radiol.10091019.

[15] Miyamoto AT. Abdominoscrotal hydrocele—a congenital genitourinary tract anomaly diagnosed by ultrasound. J Clin Ultrasound 2005;5(December (6)):407–9, http://dx.doi.org/10.1002/jcu.1870050610.

[16] Piedade C, Reis Alves J. Amyand's hernia in a 6-week-old infant: a delayed diagnosis case report. Case Rep Pediatr 2013;2013, 3 p. [Article ID 758171].