

Role of color Doppler ultrasound in the diagnosis of nonpalpable testes

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Purpose Color Doppler ultrasound has been used for the diagnosis of torsion of testes. The purpose of this study was to evaluate the sensitivity of this noninvasive tool in detecting impalpable testes.

Patients and methods Twenty-five children with nonpalpable testes were treated at the Department of Pediatric Surgery, Institute of Medical Science, Banaras, between 2007 and 2009. Color Doppler ultrasound was used for detecting the position, size, and vascularity of nonpalpable testes. These patients were subsequently reevaluated by laparoscopy.

Results Out of 25 cases, 15 cases were unilateral and 10 cases were bilateral (a total of 35 nonpalpable testes). The color Doppler ultrasound study successfully localized 30 of the 35 nonpalpable testes, which were confirmed by subsequent laparoscopic examination. The sensitivity

of color Doppler in locating testes was 85.71% (95% confidence interval=0.64–0.97).

Conclusion Color Doppler ultrasound is an effective noninvasive method for the initial diagnosis of impalpable testes and for planning its subsequent management. *Ann Pediatr Surg* 7:146–147 © 2011 Annals of Pediatric Surgery

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Keywords: color Doppler ultrasound, laparoscopy, nonpalpable testes

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Introduction

Undescended testes are the most common disorder of male external genitalia in children. The incidence of cryptorchidism is reported to be between 3.4 and 5.8% in full-term male neonates 1. Undescended testes may be palpable or nonpalpable. Nonpalpable testes comprise 20% of all undescended testes 2. Testes may be nonpalpable when they are canalicular and do not emerge beyond the external ring, or when they are located intra-abdominally. Some of these nonpalpable testes can be atrophic because of intrauterine torsion 3.

Although the diagnosis of palpable undescended testes is straightforward, impalpable testes are a diagnostic dilemma. The current recommended method for diagnosis of impalpable testes is laparoscopy. Previous methods including ultrasonography, computed tomography (CT) scan, arteriography, and magnetic resonance imaging (MRI) have been tried with limited success rate [4].

Color Doppler ultrasound (CDUS) is a simple and non-invasive diagnostic tool. It has been used for the diagnosis of torsion of testes [5,6]. However, there does not exist any large study in the literature indicating its effectiveness for the detection of nonpalpable testes.

The aim of this study was to evaluate the sensitivity of CDUS in detecting impalpable testes.

Patients and methods

This prospective study was carried out at the Department of Pediatric Surgery, Institute of Medical Science, Banaras Hindu University, Varanasi, between 2007 and 2009. Permission was taken from the Ethical Review Board. A written consent was taken from all parents of

patients. A total of 25 patients with undescended testes (nonpalpable) were included in this study.

Nonpalpable testis was diagnosed on the basis of history and clinical examination. Patients with palpable testes were excluded from the study. Color Doppler was performed in all cases, followed by laparoscopy. Further, findings on laparoscopy were compared with those of CDUS.

A 95% confidence interval for the sensitivity of CDUS was estimated considering a positive result on CDUS as the binomial variable.

Results

Out of 25 patients, 15 patients presented with unilateral nonpalpable testes and 10 patients presented with bilateral nonpalpable testes (a total of 35 nonpalpable testes). Ages of the patients varied between 10 months and 13 years (mean: 7 years). Most of the unilateral and bilateral nonpalpable testes were in patients between 1 and 6 years of age [10 unilateral cases (40%) and eight bilateral cases (32%)].

CDUS successfully localized 21 testes in the abdomen and nine in the inguinal canal (six of fair size and three atrophic). It could not localize five of the 35 nonpalpable testes. (Table 1). The sensitivity of CDUS in locating nonpalpable testes was 85.71% (95% confidence interval = 0.64–0.97).

Out of five testes not visualized by CDUS, laparoscopy detected two testes near the deep ring, two located higher in the abdomen near the iliac fossa, and one could not be located. Out of three inguinal atrophic testes detected by CDUS, laparoscopy and exploration of the inguinal canal detected one testis of normal size inside the inguinal canal, one that was atrophic, and one could not be detected (Table 2).

Table 1 Site of nonpalpable testes by color Doppler ultrasound

Inguinal canal	6	17.2%
Low abdominal (<3 cm from the deep ring)	15	42.8%
High abdominal (>3 cm from the deep ring)	6	17.2%
Inguinal atrophic testes	3	8.5%
Not visualized	5	14%
Total	35	100%

Table 2 Site of nonpalpable testes by laparoscopy

Inguinal canal	7	20%
Low abdominal (<3cm from the deep ring)	17	45.5%
High abdominal (>3 cm from the deep ring)	8	22.8%
Inguinal atrophic testes	1	2.8%
Not visualized	2	5.7%
Total	35	100%

The sensitivity of color Doppler ultrasound was evaluated. A 5% confidence interval for the sensitivity of color Doppler was estimated considering the positive test result on color Doppler as the binomial variable.

Discussion

The incidence of cryptorchidism is reported as being between 3.4 and 5.8% in full-term male neonates [1]. By 1 year, incidence decreases to 0.8%. Nonpalpable testes constitute approximately 20% of undescended testes on clinical examination [2]. As palpation is quite subjective, the diagnosis mostly depends on examiner experience and ability.

The diagnosis and management of nonpalpable testis is problematic. Several methods such as ultrasonography, color Doppler, CT, MRI, venography, and laparoscopy have been used to detect nonpalpable testes. In the study by Weiss *et al.* [7] ultrasonography helped to identify only 13% of nonpalpable testes. In his review in 2002, Elder [8] concluded that ultrasonography was unnecessary to assess boys with nonpalpable testes, and most of the recent studies concur with this statement. CT and MRI proved to be nonspecific and do not preclude surgical intervention [9]. CT scan may be helpful in bilateral impalpable testes to document their location, but this tool is expensive, emits radiation, and sometimes is difficult to perform in young children [10]. Similarly, MRI is not routinely used to localize nonpalpable testes because it is not sensitive for intra-abdominal testes and requires anesthesia in young children. It is also expensive [11].

Color Doppler has been mainly used for the diagnosis of testicular tumors and varicocele [6], but its role in the diagnosis of nonpalpable testes has not yet been ascertained. In one study CDUS performed for acute scrotum was 88.9% sensitive and 98.8% specific. In 1992, Martinoli *et al.* [13] showed that CDUS imaging is effective in detecting both funicular and testicular vessels. Among these, capsular (25 of 25) arteries were easily identified. Waveform analysis allowed to differentiate veins from arteries within testes and to distinguish suprastesticular from intratesticular arteries [12].

In this study, patients with nonpalpable testes were evaluated by CDUS, followed by diagnostic laparoscopy

to confirm the finding of CDUS. In the same sitting, orchidopexy was performed (abdominal or inguinal) according to the position of the testes by means of either a single-stage or a two-stage operation.

The addition of flow information by CDUS represents the most exciting recent advancement in the localization and evaluation of patients with cryptorchidism. Although CDUS is highly accurate in adults, pediatric patients present a greater challenge as its sensitivity in the detection of testicular blood flow is limited by the small size of pediatric testes and by the slow rate of blood flow [13]. In his review in 2005, Gangopadhyay *et al.* [13] detected 66 cases of nonpalpable testes out of 256 (26%) patients of undescended testes detected by Doppler ultrasound. Although color Doppler is useful to detect nonpalpable testes noninvasively, it is seldom used to locate nonpalpable testes.

In this study, CDUS proved to be a valuable tool in detecting nonpalpable testes, especially in children with retroperitoneal and stunting cryptorchidism.

Conclusion

The diagnosis of nonpalpable testes may be a difficult task. Preoperative evaluation by CDUS proved to be an effective noninvasive tool for localizing nonpalpable testes in approximately 85% of cases. Color Doppler could play an important role in the assessment of increment in growth and vascularity of testes after surgery.

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Conflicts of interest

There are no conflicts of interest.

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