


Scrotal Ultrasound Is Not Routinely Indicated in the Management of Cryptorchidism, Retractable Testes, and Hydrocele in Children

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Abstract

Cryptorchidism, or undescended testes, is the most common congenital genitourinary anomaly. A failure or delay of treatment may result in reduced fertility or an increased risk of testicular cancer. The American Urological Association (AUA) recommends that a scrotal ultrasound (SUS) not be performed in the preoperative management of cryptorchidism. This study investigated how likely pediatricians were to perform SUS despite the AUA guidelines. We retrospectively studied 243 patients referred to a single pediatric urology practice for clinically diagnosed testis pathology including undescended testis, hydrocele, and retractile testis over a 4-year period (January 1, 2015, to December 30, 2018). A total of 72 patients (29.6%) underwent a SUS ordered by their pediatrician prior to the pediatric urology visit. Pediatricians should be aware that SUS performed prior to pediatric urological evaluation does not alter management and is associated with a significant financial cost in patients with cryptorchidism or hydrocele.

Keywords

pediatrics, pediatric urology, undescended testes, hydrocele, retractile testes, ultrasound

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Introduction

Cryptorchidism, or undescended testis, refers to the failure of the testis to descend into the scrotum and is the most frequent congenital genitourinary anomaly in the male newborn.^{1–5} The incidence is 1% to 8% in full-term infants and up to 45% in preterm infants and is associated with low birth weight for gestational age.^{1–9} Retractable testes have completed their descent into the proper scrotal location yet may be subsequently found in the suprascrotal position due to an overactive cremasteric reflex.^{4,6} The American Urological Association (AUA) recommends that a scrotal ultrasound (SUS) not be performed in the management of cryptorchidism as it does not localize nonpalpable testes and does not alter the surgical approach in these patients.^{10,11}

Hydrocele, a collection of serous fluid between the layers of the tunica vaginalis surrounding the testis, is noted in approximately 10% of male infants and usually resolves without treatment by age 1 year.¹² Similar to cryptorchidism, the diagnosis is based on history and

clinical examination, not by SUS.¹³ The International Pediatric Endosurgery Group determined that SUS is routinely not recommended in the management of hydrocele.¹³ As SUS is not advised prior to pediatric urological evaluation for undescended testes, hydrocele, and retractile testes, we have included all 3 conditions in our current study.

In this article, we present a retrospective evaluation of all infants and children who were referred for a pediatric urology consultation over a 4-year period to assess undescended testes, hydrocele, or retractile testes. We wanted to determine whether there were any special characteristics of the infants and children who had SUS prior to the

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Table 1. Pediatric Urology Visit for Undescended Testes, Hydrocele, and Retractable Testes at Our Institution.

Features	Number of Patients (n = 242)	
	Group 1: No Scrotal Ultrasound Prior to Pediatric Urology Visit (n = 170 [70.2%])	Group 2: Scrotal Ultrasound Prior to Pediatric Urology Visit (n = 72 [29.8%])
Diagnosis		
Undescended testes	83 (48.8%)	46 (64%)
Hydrocele	59 (34.7%)	24 (33%)
Retractable testes	28 (16.5%)	2 (3%)
Mean age at first pediatric urology visit	3.79 years (0-16.9 years)	4.08 years (0.24 months to 16.9 years)
Surgery for undescended testes or a hydrocele	102 (60%)	54 (75%)
Mean age at surgery	5.08 years (3 months to 17.9 years)	4.94 years (7.6 months to 16.8 years)

pediatric urology evaluation. The infants and children who underwent SUS for undescended testes, hydrocele, or retractile testes prior to pediatric urology consultation were compared with those who did not. The recommended guidelines for the diagnosis, treatment, and long-term management of cryptorchidism and hydrocele are discussed.

Materials and Methods

Under an Institutional Review Board (IRB)-approved protocol, we retrospectively reviewed the medical records of infants and children who were referred to our pediatric urology clinic at our Institution over a 4-year period (January 1, 2015, to December 30, 2018) with the diagnosis of undescended testes, hydrocele, or retractile testes. All infants and children were referred by their pediatricians. The infants and children were divided into 2 groups: (1) patients who did not undergo SUS prior to pediatric urology referral and (2) patients who underwent a SUS ordered by their pediatrician before their evaluation at our clinic. Infants and children who had SUS for testalgia were excluded from the study. A pediatric radiologist reviewed all SUS.

The patients were evaluated by 2 advanced practice registered nurses and 2 pediatric urologists, the latter who performed surgery. The pediatric urologist determined whether the infants and children necessitated surgical intervention for either undescended testes or hydrocele. Most infants older than 6 months who had cryptorchidism underwent an orchiopexy. Surgery for infants and children with hydrocele was usually delayed until after 1 year of age as there was a possibility that the hydrocele may resolve.

Ethical Approval and Informed Consent

The University of Louisville Institutional Review Board determined that our study did not meet the “Common

Rule” definition of human subjects’ research. Therefore, this project did not require IRB review. The IRB number was 18.1198. As the patients presented in this study were less than 18 years of age, written permission was obtained from the patients’ mothers.

Results

Reasons for Pediatric Urology Referral

A total of 243 infants and children were referred to our pediatric urology clinic for undescended testes, hydrocele, or retractile testes (Table 1). A total of 171 patients (70.4%) who did not have the SUS comprised Group 1, while 72 patients (29.6%) who did have a SUS prior to the pediatric urology evaluation were in Group 2. The mean age at the first pediatric urology visit was 3.77 years (0-16.9 years) and 4.08 years (0.24 months to 16.9 years) for Groups 1 and 2, respectively.

Surgery for Either Undescended Testes, Hydrocele, or Retractable Testes

A total of 30 infants and children were referred to our pediatric urology clinic with the diagnosis of retractile testes but, on physical examination, were discovered to have undescended testes. Therefore, they were subsequently included in the “undescended” category.

In Group 1, a total of 103 (59.6%) infants and children underwent surgical intervention for either undescended testes or hydrocele, with a mean age of 3.76 years (3 months to 14.5 years). Surgery was performed before 12, 18, and 24 months in 16 (15.5%), 28 (27.2%), and 35 (34.0%) patients, respectively. In Group 2, 54 infants (75%) had surgery for 1 of these 2 conditions, with a mean age of 4.95 years (7.6 months to 12.5 years). Surgery was done before 12, 18, and 24 months in 8 (14.8%), 14 (25.9%), and 20 (37.0%) patients, respectively.

Table 2. Surgery for Undescended Testes or Hydrocele at Our Institution.

Diagnosis	Number of Patients (n = 242)			
	Group 1: No Scrotal Ultrasound Prior to Pediatric Urology Visit (n = 170)		Group 2: Scrotal Ultrasound Prior to Pediatric Urology Visit (n = 72)	
	Surgery for Undescended Testes or Hydrocele	Type of Surgery	Surgery for Undescended Testes or Hydrocele	Type of Surgery
Undescended testes	Yes: 76 (68.5%)	Orchiopexy: 68 (89.5%)	Yes: 37 (77.1%)	Orchiopexy: 34 (91.9%)
	No: 35 (31.5%)	Hydrocelectomy: 4 (5.2%) Orchiectomy: 2 (2.6%) Meatoplasty/orchiopexy: 1 (1.3%) Diagnostic laparoscopy/inguinal exploration: 1 (1.3%)	No: 11 (22.9%)	Orchiectomy: 3 (8.1%)
Hydrocele	Yes: 26 (44%)	Hydrocelectomy: 25 (43.3%)	Yes: 17 (70.8%)	Hydrocelectomy: 15 (88.2%)
	No: 33 (56%)	Orchiopexy: 1 (1.7%)	No: 7 (29.2%)	Orchiopexy: 2 (11.8%)

Table 3. American Urological Association Guidelines for Cryptorchidism.

1. Obtain a gestational history for males at initial evaluation
2. Palpate testes for quality and position at each well-child visit
3. Refer males to a surgeon if the testes do not descend by 6 months of age (corrected for gestational age)
4. Refer boys to a surgeon with the possibility of newly diagnosed (acquired) cryptorchidism after 6 months (corrected for gestational age)
5. No ultrasound or other imaging for boys with cryptorchidism prior to surgical referral
6. In boys with retractile testes, assess position of testes annually to monitor for ascent

Types of Pediatric Urological Surgery for Undescended Testes or Hydrocele

In Group 1, 76 (67.9%) patients underwent surgery for undescended testes and 27 (45%) for hydrocele, with orchiopexy (68 [89.5%]) and hydrocelectomy (26 [43.3%]) as the most common surgeries for each diagnosis, respectively (Table 2). In Group 2, 37 (77.1%) patients had surgery for undescended testes and 17 (70.8%) for hydrocele, with orchiopexy (34 [91.9%]) and hydrocelectomy (15 [88.2%]) as the most frequent surgeries for each diagnosis, respectively.

Discussion

The history and physical examination are the primary methods of diagnosing both cryptorchidism and hydrocele. Undescended testes are palpable in 70% to 80% of cases and bilateral in 20% to 30% of cases.^{2-4,7} The US Department of Health and Human Services guidelines recommend against US, computed tomography (CT), and magnetic resonance imaging (MRI) for cryptorchidism as these imaging modalities do not contribute clinically beneficial information.¹ The European Society for

Pediatric Urology and European Association of Urology concur that US should not be performed for cryptorchidism.¹¹ Although SUS is noninvasive, it is time-consuming, costly, and lacks the diagnostic accuracy to detect the presence of testes.^{2,4} The sensitivity and specificity to localize nonpalpable testes are 45% and 78%, respectively.^{6,7,14,15} Elder reported that only 12 of 33 testes palpable on physical examination could be identified by US.¹⁰ The high cost and exposure to ionizing radiation associated with CT scans prevent their use.^{2,6} While MRI scans have a greater sensitivity and specificity than US, the high cost, low availability, and anesthesia requirement make them undesirable.

In 2014, the AUA proposed guidelines for cryptorchidism aimed at primary care providers (PCPs; Table 3).² Surgical intervention for cryptorchidism should be complete by 12 to 18 months of life.^{2-5,7} Interestingly, it has been reported that pediatricians in practice fewer than 20 years and those in nonacademic practice are more likely to order US.^{1,14,15} Tasian and colleagues described that pediatricians believe that imaging reliably identifies a nonpalpable testis that reassures the family and assists the surgeon with operative planning.¹⁵ It has also been reported that children who undergo US have a 3-month

delay in definitive surgery.¹⁴ Aggarwal and colleagues provided educational updates to referring providers of infants and children with cryptorchidism insisting that SUS are not recommended for this condition.¹⁶ These authors noted a significant decrease in the proportion of patients having an unnecessary US following the implementation of these educational guidelines.

The surgical treatment of cryptorchidism depends on the location and presence of testes.⁴ With a 92% to 95% success rate and a 1% rate of complications, orchiopexy is the most common surgery for palpable undescended testes, which repositions the testes into the scrotum.²⁻⁷ Diagnostic laparoscopy is the preferred procedure for nonpalpable testes.⁶ Early surgery for cryptorchidism is strongly recommended to minimize the long-term risks of infertility and testicular cancer.^{2,4-6,8,16,17} Men with bilateral cryptorchidism have greatly reduced fertility compared with men with unilateral cryptorchidism and the general male population.^{3,18} Hormonal therapy such as human chorionic gonadotropin and gonadotropin-releasing hormone has not shown to induce testicular descent and may lead to testicular damage with reduced spermatogenesis.^{2-4,6,19}

While early surgery for cryptorchidism before 18 months of age has been extensively encouraged worldwide,^{4,6,20,21} several studies reported a failure to achieve this goal.^{5,17,19,20} Marchetti and colleagues described that 70% of patients with cryptorchidism underwent orchiopexy at 22.8 months of age, while only 13% infants had this procedure before 12 months.¹⁹ Williams and colleagues described that only 68% of their patients older than 2 years had undergone orchiopexy, reflecting a greater than 6-month delay according to the guidelines.⁵ Kokorowski and colleagues reported that only 18% of patients underwent orchiopexy by age 1 year and 43% by 2 years.¹⁷ These authors attributed the patient race, insurance status, and hospital where the surgery is performed as the primary factors in determining when surgery is performed. The number of well-care visits, continuity of the PCP, and implementation of guidelines for both PCPs and parents have been shown to be beneficial in achieving timely surgery for cryptorchidism.^{21,22}

Despite the AUA guidelines advocating against US in the preoperative management of cryptorchidism, almost 30% of the infants and children in our study underwent US prior to their referral to our pediatric urology clinic. We surmise that pediatricians were trained to wait a few years until the testes descend, were unaware of the AUA guidelines, believed that the testes may descend without pediatric urological evaluation, or assumed that SUS would be beneficial in the decision-making process. Furthermore, there was a considerable delay in referring patients with cryptorchidism and hydrocele to our clinic

and for undergoing surgery. The mean age of infants and children initially examined in our office and at surgery was 3.9 years and 4.4 years, respectively, which is significantly greater than the recommended age of 18 months for surgery. Surgery was performed before 24 months in only 34.0% of patients in Group 1 and in 37% of patients in Group 2. Interestingly, 75% of patients who had a SUS prior to the pediatric urology visit had surgery for these conditions compared with 60% of patients who did not have a SUS. Not all children who were referred to our pediatric urology clinic had undescended testes. It is possible that true undescended testes were referred for SUS, which may account for a higher percentage of surgeries in these patients. The decision to perform surgery was based on the physical examination and not on the referring diagnosis or US findings. Similar to other studies, orchiopexy was the most common surgical procedure for undescended testes in our study.

Retractile testes are often difficult to differentiate from other types of undescended testes and are often treated differently.^{9,19} Retractable testes are able to be manually brought into the scrotum without tension during physical examination and remain in the scrotum after release. They commonly do not undergo surgical intervention although require annual assessment to confirm their appropriate location in the scrotum as they may ascend (Table 3).^{2,3,6,19} In Shnorhavorian and colleagues' survey of PCPs in the United States, 53% of PCPs indicated that they had minimal to no exposure to pediatric urology during training and that two thirds refer patients with retractile testes to surgical specialists.⁹ While 30 infants and children evaluated in our pediatric urology clinic had a referring diagnosis of retractile testes, all of these patients actually had undescended testes following physical examination.

According to the International Pediatric Endosurgery Group guidelines, the history and clinical examination are the most important factors in differentiating hydrocele from inguinal hernia.¹³ In cases of hydrocele, a fluctuant painless scrotal swelling is often noted, which may or may not be reducible (Figure 1A). Transillumination reveals a fluid-filled scrotum (Figure 1B), and palpation above the swelling is usually possible. While an US may be needed in older boys with indeterminate pain, this test is routinely not recommended in the management of hydrocele. Hydroceles in infancy may spontaneously resolve without treatment up to 2 years of age.¹³ A hydrocelectomy to remove the fluid and sac may be performed for congenital hydrocele after the age of 2 years due to persistent enlargement of the fluid collection and potential risk of incarceration or strangulation later in life.¹³ Of the 84 infants and children with hydroceles

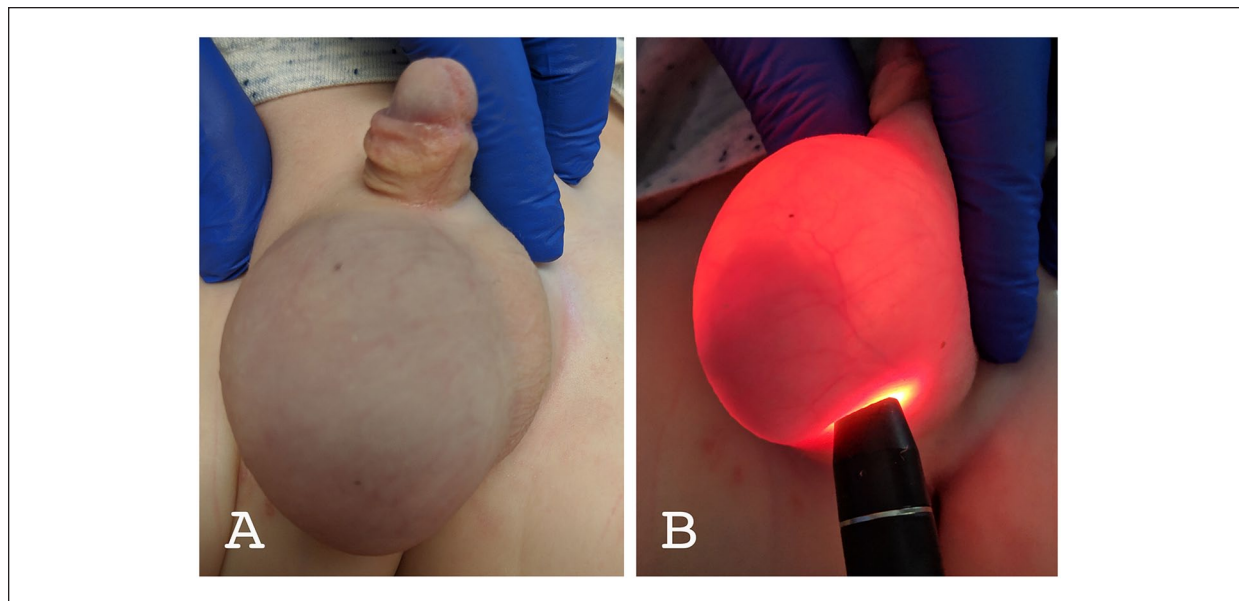


Figure 1. (A) Hydrocele marked by a fluctuant painless scrotal swelling. (B) Transillumination reveals a fluid-filled scrotum.

who were evaluated at our clinic, 41 patients (48.8%) had a hydrocelectomy.

While SUS is not routinely indicated in the management of cryptorchidism, some physicians advocate that a detailed physical examination coupled with US is recommended to evaluate undescended testes.^{23,24} The wide availability, high repeatability, low cost, and noninvasive nature of US made it an ideal method for examining the scrotum. This diagnostic tool is capable of inspecting the testis before and after surgery and alerts the physician, parents, and patients about testis development and alterations that may suggest deterioration or malignancy.²³ Furthermore, US is able to detect lesions that are inaccessible to physical examination. Advances in US have enhanced the resolution of gray scale images of pediatric testis that permits assessment of the internal structure of undescended and mobile testis.²³

In Jedrzejewski and colleagues' study of the use of US to evaluate testicular volume and structure before and up to 3 years after orchiopexy in children, they reported that abnormalities in testicular structure such as hypoechoic and inhomogeneous patterns were seen in 20% of patients on initial examination.²³ These authors concluded that SUS may be used to accurately compare the structure and growth of the testes before and after orchiopexy.

More advanced US techniques such as color and spectral Doppler may provide a better assessment of the testes, including testicular torsion and detecting nonpalpable testes.^{23,25} Additionally, shear wave elastography and superb microvascular imaging are excellent methods of

monitoring the stiffness or vascularity of the testes.^{23,26-28} The former test diagnoses and monitors interstitial fibrosis in undescended testes prior to and after orchidopexy as well as predicts the severity of histologic damage,²⁷ while the latter tool evaluates vascularity of undescended testes before and after surgery.^{26,28} Despite the valuable contributions of US, due to the timely nature of performing orchiopexy and cost constraints, the decision to perform surgery is based foremost on the physical examination.

The strength of our study includes the large number of male infants and children who were referred to our pediatric urology clinic for cryptorchidism and hydrocele. We have shown that a substantial quantity of pediatricians continues to order US for their patients with cryptorchidism and hydrocele despite the widespread guidelines advising against this practice. The retrospective nature is the limitation of our study. Additionally, our Institution does not provide the actual costs of testing and procedures; therefore, we were unable to present the financial aspect of SUS.

Conclusion

Scrotal ultrasound should not be performed in the preoperative management of cryptorchidism and hydrocele as it delays referral to the pediatric urologist, is an unnecessary expense, and serves no diagnostic benefit. Additionally, early surgical intervention for cryptorchidism mitigates the risk of potential infertility and testicular cancer. Increased educational and communication efforts between pediatricians, pediatric urologists, and parents of males

with cryptorchidism and hydrocele are necessary to disseminate and adhere to the recommended evidence-based guidelines for cryptorchidism and hydrocele to encourage more timely and cost-effective care.

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Author Contributions

LS contributed to the conception, design, acquisition, analysis, and interpretation of data and drafted the manuscript. JW, DP, and ER contributed to the conception, design, acquisition, analysis, and interpretation of data. All of the authors critically revised the manuscript and gave their approval of the final manuscript.

Declaration of Conflicting Interests

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Informed Consent

As the patients presented in this study were less than 18 years of age, written permission was obtained from the patients' mothers.

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