Role of Transrectal Ultrasonography in the Evaluation of Azoospermic Men With Low-Volume Ejaculate

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Objective. The purpose of this prospective study was to evaluate the incidence of distal ejaculatory system defects with transrectal ultrasonography (TRUS) among patients evaluated for azoospermia.

Methods. Forty-two patients with low-volume ejaculate and azoospermia were evaluated by physical examination, serum follicle-stimulating hormone and luteinizing hormone level determination, karyotyping, selective screening for cystic fibrosis mutations, and TRUS. Results. On physical examination, in 29 patients (69%), either 1 (12 patients) or both (17 patients) of the vasa deferentia could not be palpated. In the group of 17 patients with bilateral involvement of the vasa deferentia, the ultrasonographic imaging universally showed bilateral absence or hypoplasia of the seminal vesicles with bilateral agenesis of the vasa deferentia and nonvisualization of both ejaculatory ducts. In the patients with a unilateral abnormality on physical examination, the ultrasonographic imaging showed absence of the ipsilateral seminal vesicle in 7 patients and the hypoplastic seminal vesicle in 5. In the group of 13 patients with normal physical examination findings, a variety of obstructive causes were diagnosed by TRUS examination. Conclusions. According to this study, TRUS appears to be a sensitive method for evaluating the anatomy of the distal ejaculatory system. Its safety and low costs make it a good alternative to the other invasive and expensive methods. Key words: azoospermia; testicular sperm retrieval; transrectal ultrasonography.

The use of assisted reproductive technology for the treatment of azoospermia has dramatically changed the options for conception in affected couples. Therefore, the evaluation and diagnosis of the azoospermic patient has gained more clinical importance. Generally, there are 2 major causes of azoospermia: obstructive and nonobstructive (primary testicular failure). Primary testicular failure is a more common cause of azoospermia than obstruction, and quite often its etiology remains obscure. Nonetheless, the only therapeutic option for such patients is testicular sperm retrieval followed by in vitro fertilization and intracytoplasmic sperm injection.

Obstruction of the ejaculatory system, conversely, has a more distinct etiology. The obstruction may involve several anatomic sites, which may substantially determine the therapeutic approach and the prognosis of the patient. Therefore, adopting accurate and noninvasive diagnostic tools is of major importance in these patients.
Until recently, the workup of men with normal serum follicle-stimulating hormone (FSH) levels and normal testicular size included testicular biopsy to confirm the diagnosis of an obstructive state. The major flaw of this approach, however, is the inability to localize the level of obstruction and distinguish between pre- and post-testicular levels. Because the seminal vesicles produce fructose, the concentration of this substance can serve as an indicator of a partial obstruction of the ejaculatory duct (low fructose concentration) or absent or totally obstructed seminal vesicles (fructose-negative semen). Additionally, vasography has been used as the method of choice for determining the ejaculatory ductal patency and localizing the obstruction level. Although this technique is relatively accurate, it requires either general or local anesthesia, exposure of the testicles to radiation, and the risk of postoperative vasal obstruction.

Over the past years, transrectal ultrasonography (TRUS) has played a more important role in the diagnosis of male infertility disorders. Such a modality is a risk-free, inexpensive procedure, which provides a clear picture of the male ductal system. In this article, we present our experience with TRUS in the evaluation of azoospermic patients with low-volume ejaculate.

Materials and Methods

Forty-two fructose-negative azoospermic patients were included in the study. The diagnosis of low-volume ejaculate (<1 mL; range, 0.4–1 mL; mean ± SD, 0.64 ± 0.32 mL) in this group of patients was confirmed by 2 separate semen analyses before they were included in the study. The patient's evaluation included careful history documentation, physical examination, testicular volume determination using a Prader orchidometer, serum testosterone, FSH, and luteinizing hormone level determination, postejaculation urinalysis, and karyotyping.

Transrectal ultrasonography was performed with the patient in the left lateral decubitus position with a Bruel & Kjaer (Nærum, Denmark) machine and a biplanar high-resolution 7.5-MHz transducer. The terminal vasa deferentia, seminal vesicles, ejaculatory ducts, and prostate were examined in a systemic manner in axial and sagittal planes. All the measurements were recorded in 3-dimensional sections. Normal diameters of the seminal vesicles were 1 cm in width and 4.5 cm in length (Figure 1). The seminal vesicles were defined as hypoplastic when the diameters were less than 50% of the normal dimensions.

Transrectal ultrasonography is part of the normal protocol in our hospital.

Results

Our study population consisted of 42 patients with a mean age of 29 ± 5.6 years (range, 25–40 years). The mean testicular volume was 24.5 ± 2.5 cm$^3$ (range, 22–30 cm$^3$). Results of the hormonal profile, including testosterone, FSH, and luteinizing hormone, were in normal ranges. On physical examination, in 29 patients (69%), either 1 (12 patients) or both (17 patients) of the vasa deferentia could not be palpated. The findings on the physical examination were confirmed by TRUS. In the group of 17 patients with bilateral involvement of the vasa deferentia, ultrasonographic imaging showed bilateral absence or hypoplasia of the seminal vesicles with bilateral agenesis of the vasa deferentia and nonvisualization of both ejaculatory ducts. In 14 of these men with congenital agenesis of the vas deferens (CAVD), mutations were found ($\Delta F506$, 8 patients; W1282X, 6 patients), whereas urinary ultrasonographic studies revealed the absence of a kidney in 3 patients.

In the other group of 12 patients with a unilateral abnormality on physical examination, the ultrasonographic examination showed the absence of the ipsilateral seminal vesicle in 7 patients and a hypoplastic seminal vesicle in the other 5 (Figure 2). In 10 individuals from this group of patients, however, contralateral abnormalities were also
found. These included contralateral seminal vesicle cysts (5 patients; Figure 3), calcification of the seminal vesicle (3 patients; Figure 4), and ejaculatory duct obstruction by calculus (2 patients; Figure 5). In the other 2 patients, no contralateral abnormality that could account for the low ejaculate volumes and obstructive azoospermia was detected.

In the group of 13 patients with normal physical examination findings, a variety of obstructive causes were diagnosed after TRUS examination. The findings included midline cysts in the periurethral location (4 patients), bilateral cysts of the seminal vesicles (4 patients; Figure 6), cystic dilatation of the ejaculatory ducts with calcification (3 patients; Figure 7), and bilateral cystic dilatation of the seminal vesicles and ejaculatory ducts (2 patients; Figure 8).

Discussion

For many years, vasography has been used as the method of choice for diagnosis of distal male reproductive system obstruction. This diagnostic procedure, however, has several flaws. It is an invasive technique, may cause iatrogenic injury to the vas deferens, and exposes the patients to the risks of anesthesia and irradiation.2 Recently, several authors have proposed the use of magnetic resonance imaging with endorectal coils. The advantage of this method is that there is no need for expert performers, but its use is limited by cost and availability.5

For these reasons, most clinicians have abandoned these diagnostic procedures and usually use the noninvasive imaging method of TRUS. It appears, however, that the sensitivity of this new diagnostic technique is not fully established yet.

In this study, we evaluated the diagnostic value of TRUS by selecting azoospermic patients with low-volume ejaculate in whom it was most likely to show abnormalities of the ejaculatory ductal system. Therefore, we excluded patients with hypogonadism and functional disturbances of ejaculation and emission. In this selected group of patients, with low-volume ejaculate and negative fructose analysis results in semen, we were able to define specific anatomic abnormalities in all of them.

It appears, therefore, that for such a patient group, TRUS may be a very sensitive diagnostic tool. We have found that the seminal vesicles are the most common site for congenital and acquired abnormalities. This fact is obvious because an obstruction in any distal site inversely affects the seminal vesicle on the same side. Transrectal ultrasonography is especially valuable in patients without any abnormal findings on physical examination because in all of those patients, we were able to determine and locate the underlying cause.

The major etiologies for low-volume ejaculate in our patient group included CAVD, seminal vesicle aplasia or hypoplasia, and ejaculatory duct obstruction. By definition, CAVD is a non–surgically correctable defect. The majority of these men were found to have a mutation corresponding to the cystic fibrosis gene. It is thought that these patients are homozygous for the cystic fibrosis gene mutation, with CAVD as the only manifestation of cystic fibrosis.6,7 Such patients may be successfully treated by testicular sperm aspiration or microscopic epididymal sperm aspiration.8
Seminal vesicle cysts are rare but frequently associated with renal anomalies, including ipsilateral renal dysgenesis, duplication of the renal collecting system, ectopic insertion of the ureter, and ectopic location of the kidney. Seminal vesicle cysts are also found in patients with adult polycystic kidneys. Because in only 60% of the patients is there a relevant family history, all patients with bilateral cysts should undergo full evaluation for renal anomalies.

Midline cysts are classified into 2 general categories: those that contain sperm and those that do not. The latter are generally called utricles or müllerian duct cysts. The difference between them is based on distinct embryologic origin, with the utricles being of endodermal origin and müllerian duct cysts being of mesodermal origin and with the former located near the verumontanum and the latter located near the prostatic base. Cysts that contain sperm are less common than müllerian cysts and are classified as wolfian cysts. In any case, midline cysts may cause obstruction of the ejaculatory ducts by either lateral deviation or compression.

Bilateral ejaculatory duct obstruction is not a common cause of male infertility. The ejaculatory ducts arise within the prostatic base, pass through the central zone of the prostate, and open into the posterior urethra proximal and lateral to the verumontanum. As a result, abnormalities of neighboring organs may cause obstruction, which may present itself as proximal dilatation. Venereal diseases and genitourinary tuberculosis remain the main causes of acquired ejaculatory duct obstruction in developing countries, whereas the most common causes in modern countries are previous inguinal or scrotal surgery and previous transurethral endoscopic surgery. Seminal vesicle and ejaculatory duct calculi are also occasionally seen in association with obstruction. It remains uncertain whether the calculi primarily cause the obstruction and the resulting dilatation or whether they arise in an already obstructed system.

Overall, according to this study, it appears that TRUS is a sensitive method for evaluating the anatomy of the distal ejaculatory system, especially in azoospermic patients without any abnor-
nal findings on physical examination. In view of the various obstructive etiologies detected, TRUS using high-frequency and high-resolution transrectal probes may nowadays replace all the other diagnostic methods.\(^3,4,15\)

In conclusion, TRUS may be considered the ideal method for evaluating the distal ductal system. It is safe, inexpensive, and easy to perform, and it usually enables us to identify potentially correctable abnormalities in patients with low-volume ejaculate azoospermia.

References


