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Distal Male Genital Tract Abnormalities Detected by Transrectal Ultrasonography Screening in a Group of Low Semen Volume Infertile Men

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Abstract

Introduction: The exact prevalence of small ejaculate volume among infertile men is still unknown and the frequency of its etiological causes has not yet been well defined in the literature. TRUS is the most commonly used screening test to detect different causes of distal male genital tract abnormalities.

Objective: To detect distal male genital tract abnormalities by TRUS screening of infertile men with low semen volume.

Patients and Methods: This cross sectional prospective study included 59 low semen volume infertile men, 37 azoospermic (AZ) and 22 oligo/asthenozoospermic (OAZ). Seminal fructose, FSH and total testosterone were estimated and expressed prostatic secretion and post-ejaculatory urine analyses were done for each participant. All participants were screened by TRUS.

Results: TRUS screening detected findings suggestive of ejaculatory duct obstruction (EDO) in 17 (28.8%) patients (9 AZ and 8 OAZ), vasal aplasia (VA) in 10 (16.9%) patients (9 AZ and 1 OAZ), chronic prostatovesiculitis (CPV) in 9 (15.3%) patients (6 AZ and 3 OAZ), hypoplasia of prostate and seminal vesicles in 3 (all AZ) and retrograde ejaculation in 2, one from each group. TRUS criteria suggestive of obstructive etiology were found in 48.6% and 40.9% in the AZ and OAZ groups respectively. Normal TRUS findings were found in 18 (30.5%) of the total, 9 (24.3%) AZ and 9 (40.8%) OAZ.

Conclusion: Distal male genital tract abnormalities, especially the obstructive ones, are common in low semen volume infertile men. EDO was the most common abnormality detected followed by VA then CPV. When TRUS combined with other clinical and laboratory findings, it is a good screening test to detect distal male genital tract abnormalities.

Key Words: *Low semen volume – Small ejaculate volume – TRUS.*

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Introduction

INFERTILITY is a common problem affecting about 15% of couples at their reproductive age **[1,2]**. Azoospermia has a prevalence rate of approximately 1% among all men and 10 to 15% among infertile men **[3,4]**. An adequate ejaculate volume is an important parameter in the standard semen analysis as adequate volume is necessary for carrying the spermatozoa through the female genital tract and for providing a suitable medium for their survival **[5]**. Most of the ejaculate volume is a secretion from the seminal vesicles and their abnormalities and/or ejaculatory ducts abnormalities are associated with small ejaculate volume **[6]**. The exact prevalence of small ejaculate volume is still unknown and the frequency of its etiological causes has not yet been well defined in the literatures **[5]**. However some reported an incidence of low semen volume of less than 1% among male partners of infertile couples **[4]**.

Apart from the method and timing of collection, small ejaculate volume can be artifactual. This includes complete retrograde ejaculation, failure of emission or anorgasmia. In these conditions the ejaculate is completely absent **[5]**. True causes of small ejaculate volume include ejaculatory duct obstruction (EDO) **[5,7]**, vassal aplasia (VA) with abnormalities of the seminal vesicles **[8,9]**, chronic prostatovesiculitis (CPV) **[6]**, hypogonadism with hypoplasia (HP) of prostate and seminal vesicles **[10]** and partial retrograde ejaculation (RE) **[11-13]**.

Obstruction of the seminal ducts accounts for 40% of cases of azoospermia **[14]**. Obstruction of the male genital ducts, may be congenital or acquired, and can occur at the level of epididymes, vasa deferentia or ejaculatory ducts. Genital infections and iatrogenic trauma are common causes of

obstructive lesions [9]. EDO can be complete or partial, due to a congenital (cystic) or an acquired cause [5,7]. VA can be unilateral or bilateral [8,9].

Ultrasound and magnetic resonance imaging are noninvasive techniques used to detect distal male genital ducts abnormalities [15]. TRUS is the most commonly used screening test to detect these abnormalities. In addition to its diagnostic purposes TRUS findings can assist in decision making during operative intervention for treatment of obstructive azoospermia [16]. Endo-rectal magnetic resonance imaging provide detailed map, if TRUS is not conclusive, for diagnosis and for guiding the operative interventions in these cases [17]. In this study detection of distal male genital tract abnormalities by TRUS screening of low semen volume infertile men was done.

Patients and Methods

After approval of the Ethics committee, Faculty of Medicine, Cairo University, and informed consent, this cross sectional prospective study was performed on low semen volume infertile men attending the Andrology Clinic of the University Hospital.

Each potentially eligible participant was subjected to history taking, general and genital examinations. History taking included personal, infertility, medical (including prior genitourinary infections), sexual and surgical histories. General examination for the development of secondary sexual characters, eunchoidal characters, gynecomastia, signs of other diseases and scars of previous surgeries was performed. Genital examination of testes, epididymis and spermatic cord was done.

After 2-5 days of abstinence, each infertile man provided a semen sample in a sterile container, by masturbation, for semen analysis [18] at the andrology laboratory of the university hospital. Instructions were given, how to get a complete sample and in cases of doubt a condom sample was required for assessing the semen volume. At least two semen analyses were required. Exclusion criteria were artifactual causes of low semen volume and normal semen volume. Inclusion criteria were low semen volume infertile men. Included participants were grouped into two groups. Group 1 included AZ participants and group 2 included the OAZ.

A panel of investigations was done for each participant and included quantitative seminal fructose, post orgasmic urine analysis, expressed prostatic secretion analysis, serum FSH and morning testosterone levels estimation and TRUS.

Quantitative seminal fructose was performed in a single laboratory using the photometric method. The normal level is ≥150mg%. The post orgasmic urine sample was examined for the presence of spermatozoa and fructose. A digital prostatic examination was done, with message for expressed prostatic secretion. Pus cells >10/hpf in the prostatic secretion was considered abnormal.

Both FSH and testosterone were estimated using immulite and radioimmunoassay respectively. Normal range for FSH is 1.5-14m IU/ml and for testosterone is 2.6-15.93ng/dl. An ultrasound unit with a 7 MHZ high frequency end and side fire bi-planar transducer for per rectal examination was used for TRUS screening. With a period of abstinence less than 24 hours, after receiving an enema with the urinary bladder at least half full, TRUS was performed in both transaxial and sagittal planes. The prostate was imaged in both planes, the seminal vesicles and the vasa in the transaxial, whereas the ejaculatory ducts were imaged in the sagittal one. Dimensions and volume were calculated for the prostate and its echogenicity, calcifications, cyst or any lesion were recorded. Symmetry, length, width, echogenicity, calcifications of both seminal vesicles and diameter of vasa were recorded. The course of the ED was traced from their intraprostatic junction obliquely and downward to the verumontanum and the diameter was measured when possible.

Reference values for normal TRUS were considered [19]. TRUS finding suggestive of EDO are dilated seminal vesicle (>1.5cm), dilated ejaculatory duct (>2mm), a hypoechoic tubular structure traversing the prostate towards the verumontanum, presence of calcification or stones along the course of ejaculatory ducts or in the region of verumontanum and/or presence of a midline or lateral cyst that masks or displaces the EDs and hiding their visualization. Presence of vassal dilatation (>0.5cm) supports the diagnosis. According to TRUS findings, this subgroup was further subdivided into cystic and none cystic, unilateral and bilateral. TRUS finding suggestive of VA is the absence of vassal ampulla ± absence of seminal vesicles. TRUS finding suggestive of CPV is the presence of heterogenous echogenicity and/or calcification of the prostate and seminal vesicles. TRUS finding suggestive of HP is small sized prostate and seminal vesicles. TRUS findings suggestive of RE is dilated bladder neck. The statistical analysis included numbers, arithmetic mean, standard deviation and percentages.

Results

The number, age range (mean) and percentage of TRUS abnormalities detected in participants in each and both groups are represented in Table (1). Semen volume was 0.7±0.3 and 1±0.3 cc in group 1 and 2 respectively. In group 2 the spermconcentration was 17.6±20.5 Milion/cc. TRUS criteria suggestive of obstructive etiology were found in 48.6% and 40.9% in the AZ and OAZ groups respectively.

Table (1): Number, age range (mean) and percentage of TRUS abnormalities detected in participants in each and both groups.

	LSV azoospermia group			LSV OAZ group			Both groups	
	N	Age (Mean)	%	N	Age (Mean)	%	N	%
EDO	9	20-45 (31.7)	24.3	8	22-52 (35)	36.4	17	28.8
VA	9	20-35 (26.1)	24.3	1	24	4.5	10	16.9
CPV	6	30-52 (39.8)	16.2	3	24-43 (35.5)	13.6	9	15.3
HP	3	20-30 (24.7)	8.1	0	0	0	3	5.1
RE	1	30	2.7	1	25	4.5	2	3.4
TATF	28	20-52 (25.4)	75.7	13	22-52 (23.9)	59.2	41	69.5
Normal	9	24-50 (35.9)	24.3	9	21-35 (28)	40.8	18	30.5
Total	37	20-52 (31.9)	100	22	21-52 (31.5)	100	59	100

LSV. : Low semen volume.
OAZ : Oligoasthenozoospermia.
EDO : Ejaculatory duct obstruction.
VA : Vassal aplasia.
CPV : Chronic prostatovesiculitis.
HP : Hypoplasia.
TATF : Total abnormal TRUS finidings.
RE : Retrograde ejaculation.

The laboratory findings in different subgroups are represented in Table (2). Laboratory findings showed low semen fructose level in EDO, VA, HP and RE, highest pus cells in EPS in cases of CPV and highest level of FSH and lowest level of testosterone in HP. All participants in group 2 had asthenozoospermia.

In EDO subgroups 9 participants had laboratory criteria of complete EDO whereas only 13 participants had low seminal fructose. Numbers of abnormal TRUS findings in EDO are represented in Table (3). Cystic lesions were mullerian duct cysts as TRUS guided aspiration of the cysts were negative for sperms and dye injection showed no communication with the wolffian duct structures.

TRUS findings in VA subgroups are represented in Table (3). All participants with VA had low semen Fructose level. TRUS finding for vassal aplasia matched with clinical findings in 100% of patients. In group 1, 5 participants with CBAVD had bilateral absence of seminal vesicles whereas the rest had right atrophic seminal vesicle and normal left seminal vesicle. Participants with CUAVD had ipsilateral atrophic/absent seminal vesicle and one of them (azoospermic with left absent vas) had right EDO and midline prostatic cyst.

Nine participants had TRUS criteria of CPV, 6 from group 1 and 3 from group 2. In these patients pus cells in EPS were high whereas Seminal fructose was low. Three participants had TRUS criteria of hypoplasia of prostate and seminal vesicles. All of them had bilateral small testes, high FSH, low testosterone, low seminal fructose (Table 2), small prostatic volume (8.6±0.5ml) and small seminal vesicles (width: 0.4±0.09cm and length: 1.6±0.4 cm). TRUS finding matched with clinical and laboratory finding in these patients. Two participants had wide bladder neck on TRUS examination suggestive of retrograde ejaculation. One was azoospermic and had post-orgasmic urine analysis positive for fructose and the other one, oligozoospermic, had the analysis positive for spermatozoa and fructose. TRUS missed a third person with laboratory evidence of retrograde ejaculation as the bladder neck appeared normal.

Table (2): Laboratory findings detected in participants in subgroups.

	LSV, azoospermia (group 1)				LSV, OAZ (group 2)			
	EPS	SF	FSH	T	EPS	SF	FSH	T
EDO	12±12	50±11	5.1±5.1	5.5±1.7	6.1±4	105±47	5.2±1.7	8±3
VA	9±4	51±50	4.9±24	5.5±2.3	10±0	100±0	2.9±0	5±0
CPV	30±24	162±100	6.8±5.3	5.6±1.8	29±22	147±49	16±17	8±5.9
HP	6±1.7	65±52	55.9±5.6	1.1±0.5	0	0	0	0
RE	8±0	50±0	2.1±0	7.5±0	10±0	90±0	3.9±0	6.7±0
Nor	7.5±1.6	250±79	15.4±5.9	4.8±1.1	7±3	224±42	7±6.5	5.6±0.5
Total	12±16	127±109	9.6±9.5	4.9±2.0	10±11	162±71	7±6.9	7±2.8

LSV : Low semen volume. FSH : Follicle stimulating hormone. CPV: Chronic prostate-vesiculitis.
OAZ: Oligo and/or asthenozoospermia. T : Testosterone. HP : Hypoplasia.
EPS : Expressed prostatic secretion. EDO: Ejaculatory duct obstruction. RE : Retrograde ejaculation.
SF : Seminal fructose. VA : Vassal aplasia. Nor : Normal. Tot : Total.

Table (3): Abnormal TRUS findings in EDO and VA subgroups.

	Azoospermia	OAZ
TRUS criteria of bilateral EDO	2	3
TRUS criteria of Unilateral EDO	4	4
TRUS criteria of Cystic EDO	3	1
CBAVD	7	0
CUAVD	2	1

OAZ : Oligoasthenozoospermia.
TRUS : Trans-rectal ultrasonography.
EDO : Ejaculatory duct obstruction.
CBAVD: Congenital bilateral absent vas deference.
CUAVD: Congenital unilateral absent vas deference.

Discussion

Male infertility is a common problem. Semen analysis is an initial step in the evaluation of infertile men. Low semen volume is frequently overlooked when other semen abnormalities are present. Diagnosis of distal male genital tract abnormalities is an important issue as good results can be obtained, in many cases, when they are properly managed.

In the current study abnormal TRUS criteria, especially of obstructive etiology, were a common finding in the studied population and this agreed with Wang et al. **[20]** and Kuligowska et al. **[21]**. These results indicated that distal male genital tract abnormalities are common in infertile men with low semen volume.

According to TRUS findings, participants were classified into 6 subgroups, EDO, VA, CPV, HP, RE and normal TRUS findings.

In the current study EDO was the most common TRUS abnormality detected. Prostatic cyst was found in 4 out of 17 which is comparable to the results of El-Assmy et al. **[22]**.

In the current study 4 azoospermic participants had laboratory criteria of complete EDO **[3,5,23]** but TRUS findings of unilateral obstruction indicating that TRUS underdiagnosed EDO on one side. Also, 4 participants with TRUS criteria of EDO had normal semen fructose level indicating that TRUS over diagnosed cases of EDO. These findings agreed with Engin et al. **[24]**. Giovanni et al. **[25]** indicated that TRUS evidence of EDO was highly diagnostic only when the semen volume is <1.5ml and partial EDO may be present in the absence of a TRUS evidence of obstruction. Also, Engin **[26]** concluded that seminal vesiculography cannot help in the diagnosis of partial EDO and seminal vesicle scintigraphy **[27]** should replace seminal vesiculography.

VA was the second most common TRUS abnormality detected. Five participants with CBAVD had the seminal vesicles bilaterally absent but the remaining 5 with VA had atrophic and/or normal seminal vesicle on one side. This agreed with the results of Chiang et al. **[28]**. All participants with CBAVD or CUAVD had at least one atrophic seminal vesicle and this anticipated as all participants had low semen volume. In this study two participants with CUAVD were azoospermic, one of them had a prostatic midline cyst causing contralateral EDO whereas the other one a functional cause can explain his azoospermia.

In this research TRUS evidence of CPV was reported in 9 participants (15.3%) of both groups and this agreed with Li and Tan **[29]**. All participants with clinical and laboratory evidence of CPV had TRUS criteria of CPV indicating the accuracy of TRUS in diagnosing CPV a finding confirmed by Condorelli et al. **[30]** and Lotti and Magi **[16]**. TRUS can be helpful in diagnosing cases of long standing CPV with normal pus cells in semen. In CPV

fibrosis and destruction of the secretory epithelium of the prostate and seminal vesicles may preclude the fertility even with absence of pus cells in standard semen analysis.

In this study, 3 participants had TRUS evidence of HP. This correlated well with the clinical and laboratory findings of hypogonadism. Although TRUS can accurately diagnose HP, it is more practical to depend on the clinical and laboratory findings for the diagnosis.

In this study TRUS criterion of RE (widening of bladder neck) was proved only in 2 out of 3 with postorgasmic urine analysi positive for spermatozoa and/or fructose. This indicated that TRUS was not accurate in diagnosing RE, however this abnormality can be easily diagnosed by postorgasmic urine analysis.

Conclusion:

Distal male genital tract abnormalities, especially the obstructive ones, are common in low semen volume infertile men. EDO was the most common abnormality detected followed by VA then CPV. When TRUS combined with other clinical and laboratory findings, it is a good screening test to detect distal male genital tract abnormalities.

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Conflict of interest: None.

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الملخص العربى

الهدف من البحث: اكتشاف أى خلل فى الجزء البعيد (الطرفى) من الجهاز الذكرى التناسلى بواسطة التصوير بالموجات فوق الصوتيه من خلال الشرج فى الرجال الذين يعانون من عدم الانجاب و قلة حجم السائل المنوى.

الطريقة المتبعه فى البحث: شملت هذه الدراسه ٥٩ مشارك (٣٧ يعانون من عدم وجود حيوانات منوية فى السائل المنوى و٢٢ يعانون من قلة الحيوانات المنوية فى السائل المنوى). و قد تم اخذ التاريخ المرضى وعمل تحليل للسائل المنوى مرتين و كذلك تحليل فركتوز فى السائل المنوى وتحليل البول بعد الشبق لاختبار وجود حيوانات منوية او فركتوز وتحليل افرازات البروستاتا و تحليل الهرمون المحفز للتبويض وهرمون التستوستيرون فى الدم وتصوير من خلال الشرج بالموجات فوق الصوتيه لكل مشارك.

النتائج: اشارت نتائج التصوير من خلال الشرج بالموجات فوق الصوتية الى وجود علامات انسداد قناة القذف المنوية فى ١٧(٢٨.٨٪) مشارك (٩ انعدام الحيوانات المنوية و ٨ قلة الحيوانات المنوية) و حالات الغياب الخلقى للحبل المنوى فى ١٠ (١٦.٩٪) مشاركين (٩ انعدام الحيوانات المنوية و مريض قلة الحيوانات المنوية) و حالات الالتهاب المزمن بالبروستاتا والحويصلة المنوية فى ٩ (١٥.٣٪) مشاركين (٦ انعدام الحيوانات المنويه و٣ قلة الحيوانات المنوية) وحالات صغر (تقزم) حجم البروستاتا والحويصله المنوية فى ٣ مرضى (جميعهم انعدام الحيوانات المنويه) وحالات الارتجاع الجزئى للسائل المنوى فى المثانه فى مشاركين. اوضحت مقاييس الفحص الشرجى بالموجات فوق الصوتية المشيره الى وجود سبب انسدادى فى ٤٨.٦٪ و٤٠.٩٪ فى مرضى انعدام الحيوانات المنوية وقلة الحيوانات المنوية على الترتيب. وقد وجدت نتائج طبيعية فى ١٨(٣٠.٥٪) من العدد الكلى ٩ (٢٤.٣٪) فى انعدام الحيوانات المنوية و ٩ (٤٠.٨٪) فى قلة الحيوانات المنوية.

الخلاصة: اثبتت الدراسة ان وجود خلل فى الجزء البعيد (الطرفى) من الجهاز الذكرى التناسلى وبالذات الخلل الانسدادى منتشر فى الرجال الذين يعانون من عدم الانجاب مع قلة حجم السائل المنوى. وقد وجد ان علامات انسداد قناة القذف المنوية هو الاكثر انتشارا تليها حالات الغياب الخلقى للحبل المنوى ثم حالات الالتهاب المزمن بالبروستاتا والحويصلة المنوية. يعتبر الفحص بالموجات فوق الصوتيه عن طريق الشرج طريقه جيده لتشخيص تلك الحالات وبالذات عندما تساعد بالفحص والنتائج المعملية.