Original Research Paper

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Radio-Diagnosis

SONOGRAPHIC EVALUATION OF MALE INFERTILITY IN PATIENTS ATTENDING OUTPATIENT DEPARTMENT AT TERTIARY CARE CENTER – AN OBSERVATIONAL CROSS SECTIONAL STUDY

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ABSTRACT **Background:** Evaluation of male infertility with clinical examination is less sensitive and specific especially for assessment of internal reproductive tract, hence imaging forms an integral part of male infertility evaluation. The aim of this study is to evaluate male infertility using transscrotal and transrectal sonography findings in infertile male patients and compare the findings of varicocele grading and testicular atrophy. **Methodology:** A total of 50 infertile male subjects were selected based on their abnormal seminal analysis. All the participants were subjected to B-mode ultrasonography of testis and prostate to determine obstructive vs non obstructive cause of male infertility, along with history taking, physical examination and laboratory investigations including seminal analysis. In the current study we reported a total of 50 male patients 62 with age ranging from 25-45. **Results:** In our study, 24 (68%) out of 35 patients with testicular atrophy had varicocele showing significant association with average P value of 0.002. 8 patients with post-testicular causes had dilated ductules in the epididymis, with a P value of <0.001. **Conclusion:** This study concluded that varicocele is associated with testicular atrophy and higher the grades of varicocele more severe is the atrophy. Trans rectal and trans scrotal ultrasound play crucial roles in diagnosing and managing various urological conditions. Transrectal ultrasound is more focused on the prostate and surrounding structures, while Transscrotal ultrasound is primarily used for evaluating the scrotum and its contents. Together, these ultrasound techniques provide comprehensive diagnostic capabilities for male reproductive health.

KEYWORDS : Male infertility, Transscrotal ultrasound, Transrectal ultrasound, varicocele, testicular atrophy.

AIM OF THE STUDY:

The aim of the study is to evaluate male infertility using trans scrotal and transrectal ultrasound.

OBJECTIVES:

i.Primary objective: To evaluate male infertility using trans scrotal and transrectal ultrasound.

ii. Secondary objective: To evaluate male infertility using trans scrotal and transrectal ultrasound and evaluate the potential relationship between TSU and TRUS findings.

METHODOLOGY:

Study Type: It is an observational cross sectional study

Sample Size And Study Population: This study includes 50 men (age range, 21–45) attending a tertiary care Centre (Sri Venkateshwaraa Medical College Hospital and research center), Ariyur and diagnosed with infertility. The sample size was calculated using OpenEpi version 3.01

Study Duration: The study was done over 18 months, from 2022 to 2024.

Inclusion Criteria:

Male patients with infertility fulfill the following criteria

- Patient aged between 21 and 45 years.
- Patients with abnormal semen parameters as per WHO 2021 criteria.

Exclusion Criteria:

- Males with normal semen analysis.
- Suspected ejaculatory dysfunction.
- Diabetic patient
- Patient on anti-hypertensive / anti-psychotics/ Anti-depressant/ HPA axis suppressing drugs.
- History of spine cord injury.
- History of retroperitoneal surgery or bladder neck surgery.
- History of erectile dysfunction.
- Patient not consenting to the procedure
- Painful anal condition which requires analgesia (includes but is not limited to stricture, fissure-in-ano, external hemorrhoids, and recent anal surgery)

Data Collection Procedure:

All patients were further evaluated with TSU and TRUS. Scans was performed in Mindray Resona i9 with multifrequency linear probe and endocavity probe. For TSU, the case will lie supine with the penis resting on the suprapubic region, and gel is applied to the scrotum, supported by a towel placed between the thighs. Bilateral testes, epididymitis, tunica vaginalis sac, and vas deferens, were examined methodologically.Testis volume was calculated with the formula L x H x W x 0.71 (length*height*width*0.71). Variation >25% between two testicular volumes was considered abnormal; a volume <10.5 cc was considered atrophic. Epididymis and rete testis were assessed for dilated ductules. The pampiniform plexus of veins will be examined with duplex ultrasound with the patient in erect and supine posture with Valsalva maneuver and with spontaneous breathing. Maximum diameter with Valsalva is measured. Varicocele was considered to be present if the veins were ≥ 3mm and the reflux persisted for ≥ 2 sec. Varicocele was graded according to the Sarteschi classification. A seminal tract obstruction was suspected if there is a normal-sized testis, low semen volume, or dilated ductules in the epididymis, cord. For transrectal ultrasound, after explaining the procedure and obtaining verbal consent, the patients were positioned in a left lateral decubitus position with a partially filled bladder. Examinations were done using an Endo cavity transducer (V5-9) with a condom cover and adequate lubrication. TRUS scan is done to evaluate the prostate region in longitudinal, transverse and oblique views.The seminal tract was considered dilated when Vas deferens >6mm, seminal vesicle AP diameter >15mm & Ejaculatory duct (ED) diameter >2mm. Prostates were examined for the presence of any cyst along the course of ED. The findings of the sonograms were tabulated and analyzed.

DATA ANALYSIS:

Data entry done in Microsoft Excel and SPSS version 29 was used to analyze the collected data. Descriptive statistical analysis was conducted, presenting results for continuous measurements as **Mean** and **Standard Deviation**, and for categorical measurements as **Percentages**.Statistical significance was evaluated at a 5% level ($P < 0.05$). ***Fisher's exact test /*Chi-square test** is to evaluate the

significance of study parameters on a categorical scale between two groups. A two-tailed independent **Student's t-test** was conducted to assess the significance of study parameters on a continuous scale between two groups. **ANOVA (Analysis of Variance)** was used to evaluate the significance of study parameters on a continuous scale among three groups.

Ethical Considerations:

Informed written consent was obtained from all patients. Patients were included in the study only after obtaining informed consent. Institute ethical committee approval was sought and obtained before the study was begun.

IMAGES:

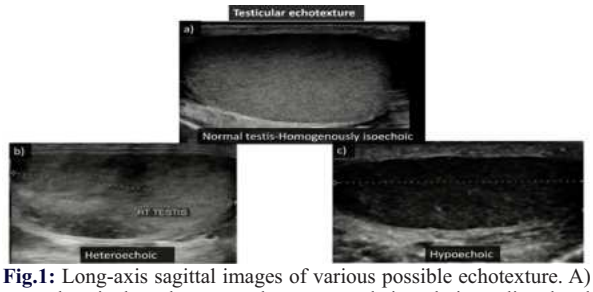


Fig.1: Long-axis sagittal images of various possible echotexture. A) normal testicular echotexture- homogenously isoechoic medium level echoes akin to normal thyroid gland. B) Heteroechoic testicular echotexture s/o old insult. C) Hypoechoic testicular echotexture s/o undeveloped testis.

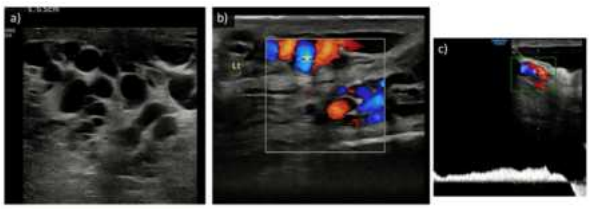


Fig.2: Varicocele a) dilated tubular channels in the cord, diameter measuring more than 2 mm. b) dilated channels showing color fill on color Doppler s/o reflux. C) dilated channels on spectral Doppler show persistent reflux

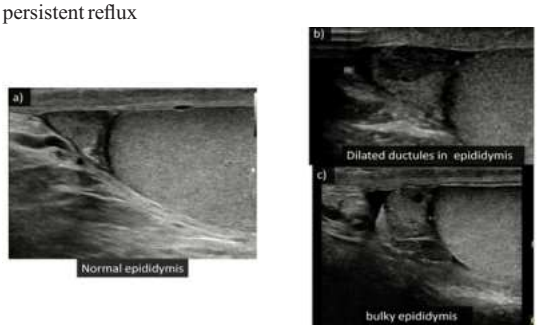


Fig.3: a) Normal epididymis- isoechoic to the testis and triangular in appearance. B) Dilated ductules in the epididymis, which suggests an upstream obstruction. C) Bulky epididymis which suggests an upstream obstruction or epididymitis.

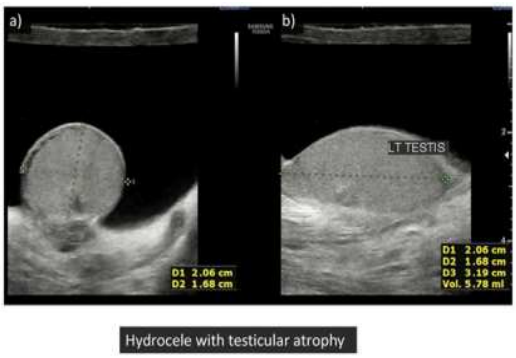


Fig.4: Hydrocele a) & b) large anechoic collection in the tunica vaginalis sac s/o hydrocele. There is also a decrease in the volume of testis, possibly secondary to long-standing hydrocele.

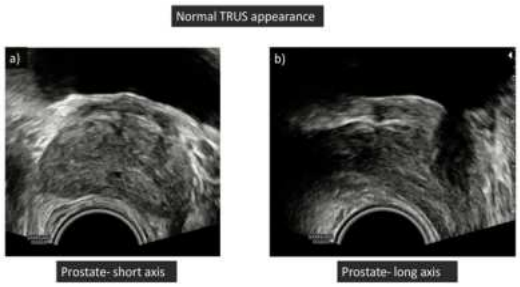


Fig.5: Normal appearance of the prostate on short (a) and long axis (b)

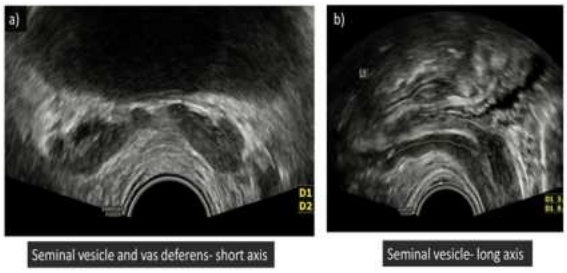


Fig.6: Normal appearance of seminal vesicle in short and long axis. On short axis (a), bilateral seminal vesicle with bilateral vas deferens has the appearance of a bow tie. On the long axis(b), appears tubular and lobulated.

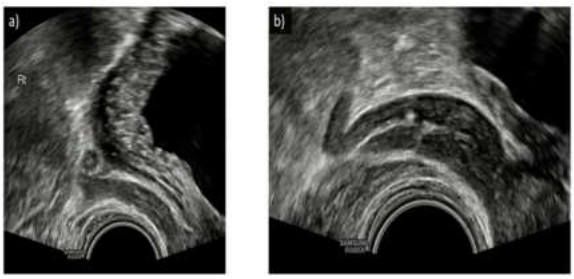


Fig.7: Normal vas deferens in short(a) and long axis(b).

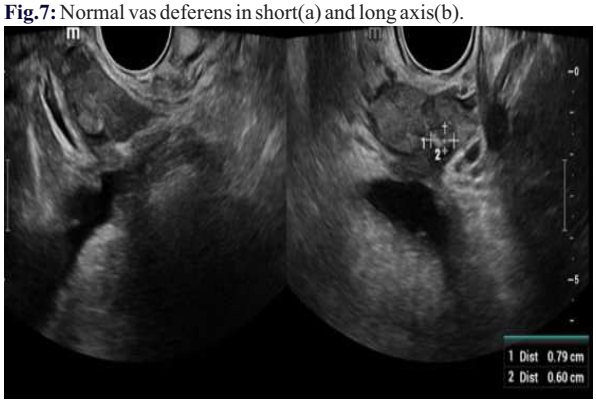


Fig.8: TRUS showing calcification in the prostate.

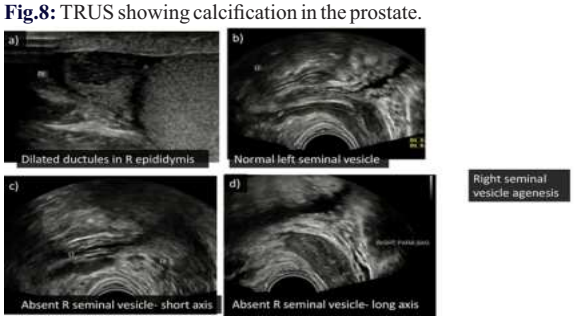


Fig.9: A case of right seminal vesicle agenesis. A) Dilated ductules in the right epididymis. B) Long axis of left seminal vesicle in the left para sagittal location. D) Para sagittal image along the right side of prostate, which shows and absent seminal vesicle. C) Short axis above the prostate, which shows normal left seminal vesicle and left vas deferens, whereas on the right side seminal vesicle and vas deferens are absent.

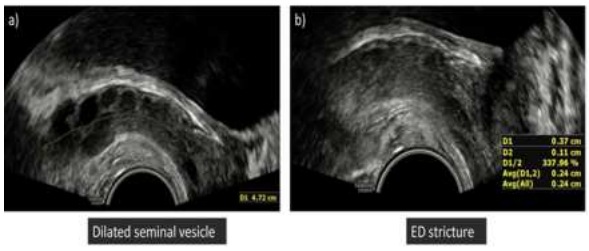


Fig.10: A case of ED stricture causing obstructive infertility. A) Long axis image of dilated left seminal vesicle. B) Dilated left ED with sudden tapering s/o ED stricture.

RESULTS:

Table 1: Age Wise Distribution

AGE	No of Patients	%
Below 25	2	4
26-30	12	24
31-35	16	32
36-40	16	32
41-45	4	8
Total	50	100

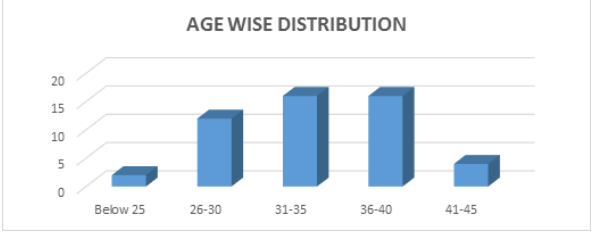


Table 2: Infertility Type (P/S)

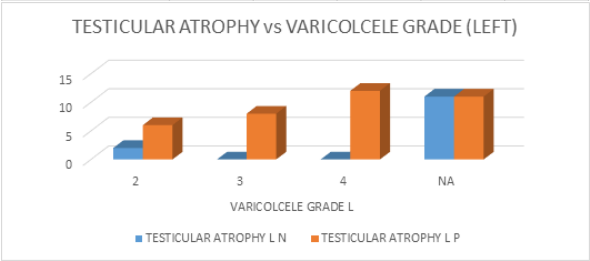
INFERTILITY TYPE (P/S)	No of persons	Percent
Primary	41	82.0
Secondary	9	18.0
Total	50	100.0

Table 3: Sperm Analysis

SPERM ANALYSIS	No of Patients	%
As (Asthenospermia)	10	20.0
Ast(Asthenoteratozoospermia)	1	2.0
Azo (Azoospermia)	6	12.0
Oas (Oligoasthenospermia)	20	40.0
Ol (Oligospermia)	13	26.0
Total	50	100.0

Table 4: Testicular Atrophy Left * Varicolcele Grade Left

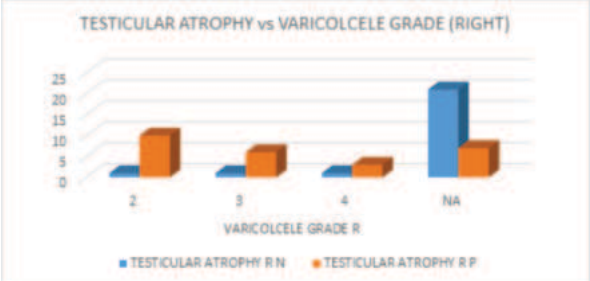
		VARICOLCELE GRADE LEFT				Total
		2.	3.	4.	NA	
TESTICULAR ATROPHY L	N	2	0	0	11	13
	P	6	8	12	11	37
Total		8	8	12	22	50



Chi-Square Tests			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	13.617[a]	3	0.003

Table 5: Testicular Atrophy Right Vs Varicolcele Grade Right

		VARICOLCELE GRADE R				Total
		2.	3.	4.	NA	
TESTICULAR ATROPHY R	N	1	1	1	21	24
	P	10	6	3	7	26
Total		11	7	4	28	50



Chi-Square Tests			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	18.885[a]	3	<0.001

RESULTS:

Varicocele has a significant positive association with testicular atrophy. Also, the higher the varicocele grades, the greater the testicular atrophy on the left side.

DISCUSSION:

Infertility is a common upcoming problem wherein approximately 8% of men of reproductive age seek medical attention for infertility problems. As such, the male partner must be systematically evaluated in every investigation of an infertile couple. Because 80% of couples can achieve pregnancy within the first year of attempting, a couple should only be diagnosed as infertile after one year of regular sexual activity without using a contraceptive method. The investigation is initiated earlier when risk factors are present, including advanced maternal (>35 years) or paternal age (>45years), a history of urogenital surgery, cancer, cryptorchidism, varicocele, orchitis, use of gonadotoxins or genital infections, etc.

For healthy young couples, the probability of achieving pregnancy per reproductive cycle is approximately 20 to 25%. The cumulative probability of conception is 60% within the first 6 months, 84% within the first year, and 92%within the second year of fertility-focused sexual activity. Infertility is a common clinical problem affecting 13 to 15% of couples worldwide. The prevalence varies throughout different countries, being higher in the underdeveloped nations where limited resources for diagnosis and treatment exist. This study aims to study the imaging features of male infertility in this part of the subcontinent, with a special focus on the comparison of TSU and TRUS findings in obstructive infertility.

Testicular Volume:

Testicular volume is positively correlated with the seminogram and predicts the possibility of sperm retrieval.(1) In our study, 33

patients(71%) had testicular pathology, and 4 patients with both testicular and post testicular pathology. Out of these 23 patients had atrophic testis. In a study by Umashankar et al (2), 66% of the patients with testicular cause had atrophy, which is comparable to our study.

Varicocele:
Varicocele is defined as abnormal dilatation and elongation of the internal spermatic veins and pampiniform plexus of the spermatic cord. Even though most adult varicoceles (>80%) do not affect male infertility. (3) Several studies suggest that a man with varicocele is at risk of subsequent loss of testicular function and fertility, regardless of normal semen analysis documentation of previous fertility.

At the same time, varicocele is the most common correctable cause of male infertility, present in 40% of men with primary infertility and up to 70% of men with secondary infertility. The WHO has reported that 1 in 4 men with abnormal semen parameters have a varicocele, compared with 1 in 10 men with normal semen parameters (WHO, 1992). Significant improvement in semen parameters after varicocele repair has been achieved in more than 50% of affected men.(5)

In our study, 24 (68%) out of 35 patients with testicular cause had varicocele. In the study by Umashankar et al, 38% of the patients in the testicular group had varicocele. In a study by Sakamoto et al, involving 545 infertile patients 57.5% had a varicocele.(3)

Secondary TSU Finding In Obstructive Azoospermia:
Although the use of advanced ART for the treatment of azoospermia has dramatically changed the options for conception in affected couples, it is still important to distinguish obstructive azoospermia from nonobstructive azoospermia (primary testicular failure). This is because obstructive azoospermia may be amenable to surgical or interventional correction. On the other hand, in men with primary testicular failure, it may be reasonable to proceed directly to an advanced assisted reproductive technique such as ICSI. Primary testicular failure is a more common cause of azoospermia than obstruction, and quite often its etiology remains obscure. Obstructive azoospermia, conversely, has a more distinct etiology, which may be congenital or acquired. So, it is essential to differentiate between obstructive and non-obstructive etiology.

Our study attempts to find the relationship between TSU findings and obstructive infertility. In our study, all 8 patients with post-testicular causes had dilated ductules in the epididymis, with a P value of <0.001. In the study by Jing et al, (7) the diagnostic performance of imaging assessment of the seminal tract in differentiating obstructive from nonobstructive azoospermia was significant (P = .02). So, the presence of dilated ductules should be considered an indication for TRUS examination.

TRUS Abnormalities:
In men with the clinical and laboratory findings of suspected seminal tract blockage, scrotal sonography should be the initial diagnostic procedure performed. If they have findings of nonobstructive azoospermia such as varicocele or testicular pathology they will be managed according to the standard protocol for the management of these pathologies. If the patients have findings of proximal obstructive azoospermia they can be managed surgically by vasoepididymostomy. If the scrotal US is normal or they have findings of distal obstructive azoospermia, they should be evaluated by TRUS.

In our study, 8(20%) out of 40 patients had post testicular etiologies. The etiology in these cases were ED cyst (37%), ED calculus (37%), ED stricture(25%), and U/L seminal vesicle agenesis(12%).

In the study by Umashankar et al, 37% of patients had post-testicular etiologies. In the study by Kuligowska et al (8), the various abnormalities in patients with low-volume ejaculate and azoospermia were as follows:

FINDING	% OF PATIENT
No abnormalities	25.4%
Congenital absence of VD	34.1%
Bilateral occlusion of VD, SV and ED by calcification or fibrosis	15.6%
Unilateral absence of VD	11.2%
Obstructive cyst	9.4%
Ductal obstruction due to calculi	4.4%

CONCLUSION:
Male infertility is a complex condition with colorful implicit causes and treatments of which varicocele remains the most common reversible cause. While colourful innovative gadgets are in use, supported reproductive technologies are ever available, the value of the evaluation of male infertility remains overlooked. As long as one motile sperm per oocyte is retrieved, all forms of male infertility can be overcome by ICSI. However, when a man does not receive correct Uro- Radiologic examination that is the time he does not understand infertility causes and loses a chance to rectify it. Identification of structural abnormalities by TRUS aids in planning surgical interventions like transurethral resection of ejaculatory ducts or other corrective surgeries. Subfertility might be a threat factor for testicular tumors, and TM, constantly seen with testicular tumors, might be associated with infertility. Both TRUS and TSU play crucial roles in diagnosing and managing various urological conditions. TRUS is more focused on the prostate and surrounding structures, while TSUS is primarily used for evaluating the scrotum and its contents. Together, these ultrasound techniques provide comprehensive diagnostic capabilities for male reproductive health. Early opinion and applicable treatment are crucial to ameliorating issues.

Recommendation:
Transcrotal US examination should be routine in infertile men and if no abnormalities are linked, also transrectal US examination will prop in the opinion of obstructive pathologies.

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Ethical Consideration:
This article followed all ethical standards for carrying out research. Data availability statement: The authors concern that the data supporting the findings of this study are available within the article.

Disclaimer:
The views and opinions expressed in this article are those of the authors and do not necessarily reflect the official policy or position of any affiliated agency of the authors.

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