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"The Role of Ultrasound in The Evaluation of Male Infertility"

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Abstract
Background: Infertility affects 8-12% of couples of reproductive age worldwide, with a significant prevalence in India, where primary infertility ranges from 3.9% to 16.8%. Male factors contribute to 40-50% of infertility cases. Proper diagnostic workup for male infertility is crucial to avoid unnecessary invasive procedures for the female partner. Traditional evaluation methods, including clinical assessment, semen analysis, and scrotal ultrasonography, have limitations in accurately identifying and classifying the underlying causes of male infertility.
Methods: A prospective observational study was conducted from December 2022 to February 2024 at the Department of Radiodiagnosis, M.G.M. Medical College and M.Y. Hospital, Indore, India. A total of 100 male patients with infertility were recruited. The study involved a thorough ultrasonographic evaluation of the scrotum, including the testes, epididymis, and spermatic cord. Additionally, transrectal ultrasonography (TRUS) was performed to assess the bilateral seminal vesicles, prostate, ejaculatory ducts, and vas deferens to identify any obstructive etiologies.
Results: The majority of the patients were between 31 and 40 years old (53%). Abnormal semen analysis was observed in 62% of patients. Scrotal ultrasound revealed various abnormalities: small testicular volumes (5% right, 3% left), enlarged testicular volumes (6% right, 2% left), varicoceles (12% right, 17% left, 11% bilateral), hydroceles (5% right, 3% left, 11% bilateral), epididymal cysts (7% right, 4% left, 4% bilateral), and epididymitis (6% right, 2% left, 1% bilateral). TRUS findings included seminal vesicle hypoplasia (1%), seminal vesicle cyst (1%), absent vas deferens (1%), prostatic calcifications (2%), dilated ejaculatory duct (2%), and midline prostatic cyst (1%).
Conclusion: This study highlights the diagnostic value of combining scrotal and transrectal ultrasonography in evaluating male infertility. The combined approach provides a comprehensive assessment, distinguishing between obstructive and non-obstructive causes, and guiding appropriate treatment. The results suggest that clinical evaluation, semen analysis, and scrotal ultrasound alone are insufficient to evaluate the complex etiologies of male infertility and should be complemented by TRUS.

Keywords: Male infertility, scrotal ultrasonography, transrectal ultrasonography, obstructive infertility, non-obstructive infertility, diagnostic imaging.

INTRODUCTION:

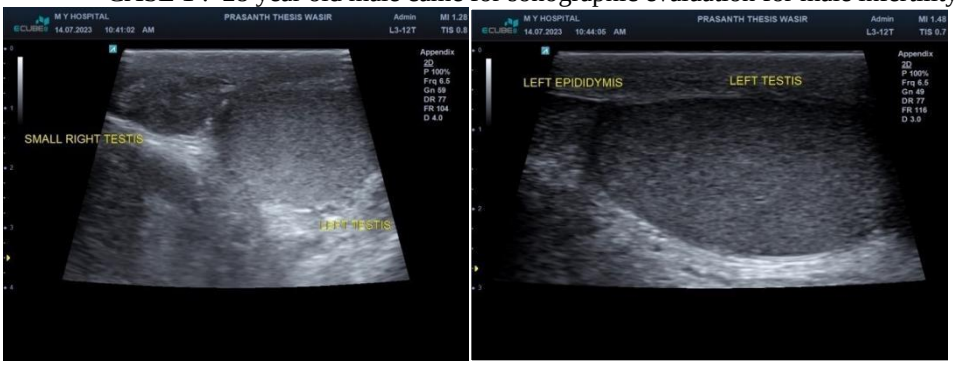
Infertility affects 8-12% of couples of reproductive age globally and is a major health issue. In India, primary infertility prevalence is between 3.9 to 16.8%, with male factors contributing 40-50%. Proper diagnostic workup for male infertility is essential to avoid unnecessary invasive procedures for the female partner.Male infertility has many causes and can be classified into obstructive and nonobstructive aetiologies. These categories include pretesticular, testicular, and post-testicular causes. Traditional evaluation methods include clinical evaluation, semen analysis, and imaging modalities like scrotal ultrasonography and MRI pelvis. The main role of imaging is to identify the correctable causes of male infertility and to determine the level of obstruction incase of obstructive a etiology. Clinical evaluation and semen analysis are used for initial evaluation of male infertility, but they are not sufficient enough to categorize into pretesticular and post testicular causes, neither they are sufficient enough to distinguish between obstructive and non-obstructive causes. .Scrotal Ultrasonography is commonly used to assess male infertility, focusing on testicular causes but limited to only scrotal pathologies. Transrectal Ultrasonography (TRUS) expands the examination to include the distal male genital systems, showing potential in identifying obstructive causes of infertility. Therefore this study was opted to assess the effectiveness of scrotal and transrectal ultrasound in evaluating male factor infertility.

METHODS:

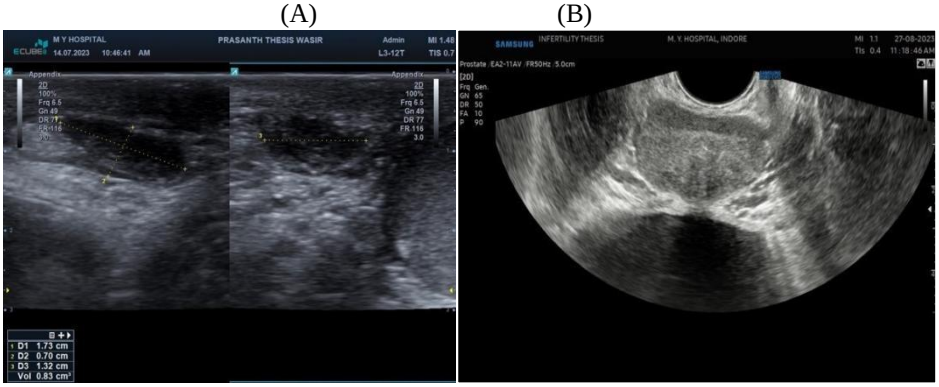
A time bound, prospective observational study, was conducted in the Department of Radiodiagnosis, M.G.M. Medical College and M.Y.Hospital and Super specialty Hospital, Indore, Madhya Pradesh, India after receiving approval from Institutional Scientific and Ethical Committee. The duration of the study was from December 2022 to February 2024. A total of 100 male infertile patients who werereferred to the Department of Radiodiagnosis for ultrasound evaluation ofscrotum were included in the study.

The study recruited patients with a history of infertility for ultrasonographic evaluation of the testis and Para testicularstructures. Position, echotexture, volume and vascularity of both testis, bilateral epididymis and spermatic cord were assessed, Furthermore, a transrectal ultrasound was performed for assessing the bilateral seminal vesicles, prostate ,ejaculatory duct, and vas deferens for identifying any obstructive aetiology.

CASE 1 : 28 year old male came for sonographic evaluation for male infertility.



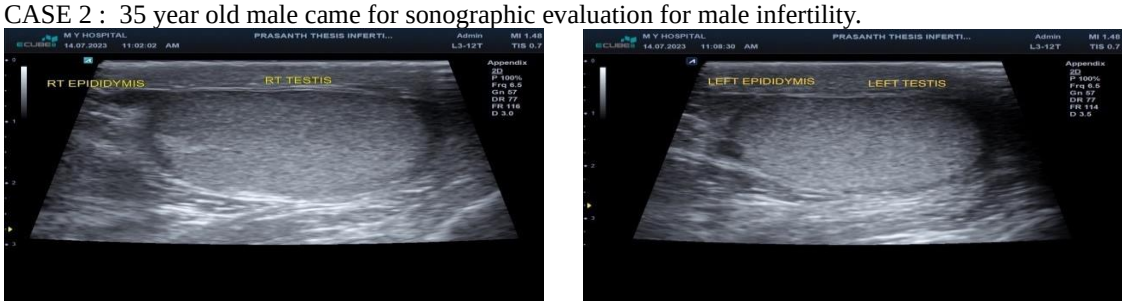
(A) (B)



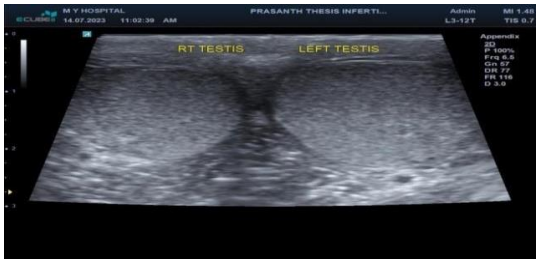
(C) (D)

Figure A – shows small sized right testis.
Figure B – shows normal sized left testis and epididymis.
Figure c - shows atrophied right testis with reduced volume and vascularity.
Figure D- Transrectal ultrasound shows normal bilateral seminal vesicle andprostate.

CASE 2 : 35 year old male came for sonographic evaluation for male infertility.



(A) (B)

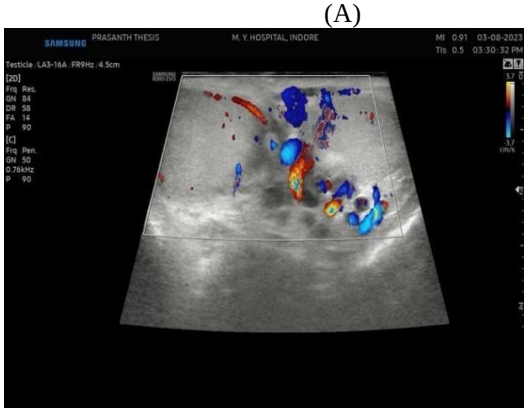


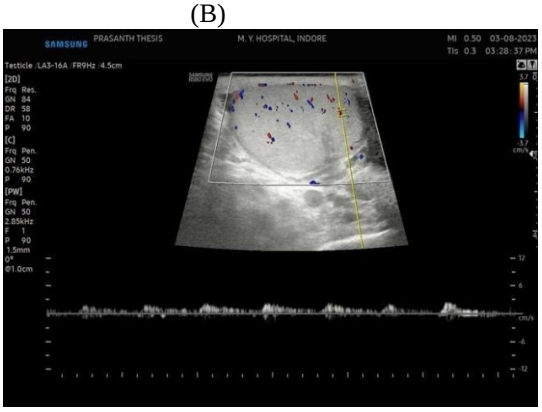
(C) (D)

Figure A – right testis and right epididymis.
Figure B – shows left testis and left epididymis.
Figure C- shows bilateral testis
Figure D – shows unilateral right sided seminal vesicle hypoplasia.

CASE 3 : 33 year old male came for sonographic evaluation for male infertility.

(A) (B)





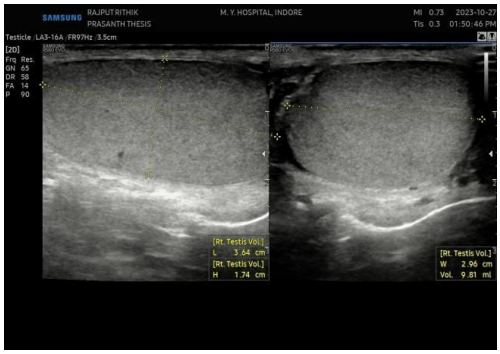
(C) (D)

Figure A- transrectal shows bilateral seminal vesicle and prostate.
Figure B- left side varicocele seen up to superior pole of left testis in supine position.
Figure c – Shows varicocele at inferior pole of left testis in supine position.
Figure D- shows vascularity of left testis.

CASE 4 : 32 year old male came for sonographic evaluation for male infertility.

(A)

(B)



(C)

(D)

Figure A – transrectal ultrasound shows midline prostatic cyst with dilated seminalvesicle
Figure B – transabdominal scan shows dilated left seminal vesicle.
Figure C – shows right testis.
Figure D – show left testis and left epididymis.

RESULTS:

The majority of the patients in this study of 100 men who are under are evaluation of infertility between the age group of 31 and 40, making up 53%of the study population.Abnormal semen analysis was found in 62% of patients and normospermia in 38%. one patients had absent left testis with empty left hemiscrotum. In this study, 1 patient (1%) had bilateral undescended testis.1 patient (1%) had bilateral testicular microlithiasis. 89 patients (89%) had normal right testicular volume , 94 patients (94%) had normalleft testicular volume and 5 patients (5%)had right small testicular volume, only 3 patients(3%) had small left testicular volume , 2 patients (2%) had enlarged left testicular volumes and 6 patients (6%) had enlarged right testicular volumes.on right side 89 patients (89%) had homogenous echotexture, 06patients (06%) had hypoechoic echotexture ,05 patients (05%) had heterogenous echotexture ,on left side 94 patients (94%) had homogenous echotexture, 02patients (02%) had hypoechoic echotexture ,03 patients (03%) had heterogenous echotexture. Vascularity of both testis were assessed, on rightside89patients(89%) had normal vascularity ,06 patients (06%) had reduced vascularity, 05patients (05%) had increased vascularity while on left side 94 patients. 12 patients(12%) had right sided varicocele ,17 patients had left sided varicocele , and11 patients (11%) had bilateral varicocele.8 patients (8%) had unilateral hydrocele with 5 patients(5%) had right hydrocele , 3 patients (3%) had left hydrocele and 11 patients(11%) had bilateral hydrocele.,7 patients (7%) had right epididymal cysts , 4 patients(4%) had left epididymal cysts , 4 patients (4%) had bilateral epididymal cysts, and 06 patients had right sided epididymitis whereas 02patients(02%) on left side and 1 patient (1%) had bilateral multiple microcystic honeycomb appearances.Transrectal ultrasound in this study revealed 1 patient (01%) had right sided seminal vesicle hypoplasia, 1 patient (01%) had left seminal vesiclecyst, 1 patient (01%) had bilateral absent vas deferens, 02 patients (02%)had prostatic calcification with dilated right ejaculatory duct, 1patient (01%)had midline prostatic cyst.

Table1: Distribution of patients according to spectrum of semen analysis findings.

S.no	Semen analysis findings	No.of.patients	Percentage

1	Abnormal semen analysis	62	62%
2	Normospermia	38	38%
	Total	100	100%

Table2: Distribution of sonographic findings in infertile men.

FINDINGS		NO.OFPATIENTS	PERCENTAGE
VARICOCELE	RIGHT	12	12%
	LEFT	17	17%
	BILATERAL	10	10%
	TOTAL	39	39%
HYDROCELE	RIGHT	05	05%
	LEFT	03	03%
	BILATERAL	07	07%
	TOTAL	15	19%
EPIDIDYMALCYST	RIGHT	07	07%
	LEFT	04	04%
	BILATERAL	04	04%
	TOTAL	15	15%
ATROPHY OFTESTIS	RIGHT	4	4%
	LEFT	2	2%
	TOTAL	6	6%
EPDIDYMO-ORCHITIS	RIGHT	6	6%
	LEFT	2	2%
	TOTAL	8	8%
SEMINALVESICLEHYPOPLASIA	RIGHT	1	1%
	LEFT	0	0%
	TOTAL	1	1%
SINGLE SIDED TESTIS	RIGHT	01	01%
	LEFT	00	0%
SEMINALVESICLE CYST	LEFT	01	01%
	RIGHT	00	0%
ABSENTVAS DEFERENS	UNILATERAL	0	0%
	BILATERAL	01	01%
MIDLINEPROSTATIC CYST		1	01%
PROSTATIC PARENCHYMAL CALCIFICATION		2	02%
DILATED EJACULATORY DUCT	RIGHT	2	2%
	LEFT	1	1%
UNDESCENDED TESTIS	RIGHT	0	0%
	LEFT	0	0%
	BILATERAL	1	1%

DISCUSSION:

This study analysed 100 men under evaluation of infertility, Most of the patients in this study of 100 men who are under are evaluation of infertility between the age group of 31 and 40, making up 53%of the study population. Abnormal semen analysis was found in 62% of patients and normospermia in 38%. In this study , the most common sonographic findings are varicocele contributes 39% in which unilateral (left) is more common which contributes to 17%, followed by hydrocele which is 19%, epididymal cystis found in 15 % of patients, epididymo-orchitis founding only 8% of patients. atrophy testis noted in only 6% of patients, Seminal vesicle hypoplasia in 1% of patients, 1% of patients with absent vas deferens ,2% of patients with prostatic calcification with dilated ejaculatory duct, 1% have bilateral testicular microlithiasis, 1% have bilateral undescended testis, 1% have single right sided testis with empty left hemiscrotum and 1% have seminal vesicle

cyst with dilated ejaculatory duct. A systemic and thorough evaluation of infertile men with clinical history, physical examination and laboratory analysis combined with imaging is mandatory to identify root cause of the infertility. Scrotal ultrasound can detect testicular and epididymal cause of infertility and TRUS helps in visualisation of seminal vesicle, prostate and ejaculatory duct. In our study, scrotal ultrasound alone detected cause of infertility in 83 % of patients where Varicocele, hydrocele, testicular atrophy, cryptorchidism, epididymal cyst were the root causes. Trans rectal ultrasound helped in identifying the cause at the level of seminal vesicle, vas deferens and ejaculatory duct. Primary cause of infertility among11 patients were diagnosed on TRUS which was missed on scrotal ultrasound alone.

In our study, Sensitivity of scrotal ultrasound alone was 84 % in identifying the cause, TRUS alone had a sensitivity of 11% and combined scrotal and TRUS had a sensitivity of 94%. Thus, Combined scrotal and transrectal ultrasonography must be included in the primary imaging protocol for evaluation of the male infertility as it increases diagnostic accuracy by identifying more number of pathologies at different level of genital tract, classifying them into obstructive and non-obstructive causes. Semen analysis and clinical evaluation alone are insufficient to make this distinction. Thus Scrotal and TRUS combined imaging has an important complementary role to clinical examination and semen analyses, in demonstrating the precise anatomy, level of abnormality and to differentiate obstructive and nonobstructive aetiology of male infertility.

CONCLUSION:

The results of this study emphasize the diagnostic value of scrotal and transrectal ultrasound in male infertility patients in determining the precise etiology and distinguishing between obstructive and nonobstructive causes, thereby directing suitable treatment pathways and possibly preventing the need for invasive assisted reproductive techniques for the female partner. Hence this study proves that in the evaluation of male infertility clinical evaluation, semen analysis and scrotal ultrasound are not enough to distinguish the complex aetiologies, It should always be combined with transrectal ultrasound (TRUS).

Abbreviations: TRUS-Transrectal ultrasound USG-Ultrasonographic-Congentialbilateralabsenceofvas deferens PGC-PrimordialgermcellsIUL-Intrauterine life.

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