Original Article

Role of ultrasonographic findings with clinical and laboratory findings in identification of intra and extra testicular causes of male infertility.

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Abstract

Background: It has been estimated that almost 7% of men in their reproductive age are sub-fertile or infertile due to pre-testicular, testicular or post-testicular problems

Objective: Materials & Methods: This prospective study was carried out in 100 male patients attending the outpatient department of Infertility clinic of Department of Surgery, Jawaharlal Nehru medical college and hospital over a period of 18 months.

Results: We have found an uneven distribution of testicular volume among various sonographic conditions. Although testicular volume was below normal in all abnormal sonographic conditions. Patients with normal sonographic scans had largest testicular volume. Most sonographic abnormalities including varicocoele, atrophic testes, epididymal cyst were common in 25-30 years age group. Absent testes, testicular microlithiasis and bulky seminal vesicle were not found in any specific age groups as the numbers of patients of those sonographic abnormalities were quite less.

Conclusion: This study emphasizes that colour Doppler ultrasonography is a very sensitive investigation in detecting various abnormalities that were often missed by repeated clinical examinations.

Keywords: ultrasonographic findings, clinical and laboratory findings, intra and extra testicular, male infertility

INTRODUCTION

Genetic abnormalities account for about 15% of all causes of male infertility. With the newer advances in technology in terms of image quality and resolution and ultrasound which employs high-frequency sound waves to produce images, is now widely used in the assessment of male reproductive problems. [1, 2] Gray-scale and colour Doppler Ultrasonography can provide useful information in the assessment of male genital tract abnormalities not necessarily related to only infertility but in fact testicular malignancy and male accessory gland infection can also be detected. [3,4]

Colour Doppler ultrasound imaging of the male genital tract has a relevant impact not only on reproductive health but also on male health in general. Whereas scrotal colour Doppler ultrasound has been commonly used in reproductive medicine for several years only recently Transrectal Ultrasound (TRUS) has assumed a growing importance in the imaging of male infertility extending the examination to the prostate, seminal vesicles and deferential ampullae. [1,2,5]

Scrotal ultrasonography with high-frequency transducers and colour-Doppler imaging have proved to be very reliable adjuncts to clinicalexamination in assessing intra-testicular and extra-testicular abnormalitiesincluding testicular microlithiasis, tumours, varicocoele, hydroceles and
epididymal abnormalities. With ultrasound, scrotal abnormalities have been found in 38%-59% of infertile men.

The purpose of this study, therefore is to evaluate prospectively the role of ultrasonography in indigenous population to identify various scrotal and extra-scrotal factors causing male infertility and there correlation with clinical and radiological findings.

MATERIAL AND METHODS

This prospective study was carried out on 100 patients attending the outpatient department of infertility clinic of Department of Surgery, detailed history and examination was taken. The patients suspected to have scrotal pathology were subjected to colour Doppler sonography in the Department of Radiodiagnosis, AMU, Aligarh. The study was approved by institutional ethics and research advisory committee.

Study subjects

Patients were selected only when two consecutive semen samples that were taken at least 5 days apart were found to be abnormal and/or if the patient had never attained fatherhood.

Inclusion criteria
All male patients aged between 20-50 years, clinically diagnosed with infertility or sub- fertility having abnormal semen parameters asaccording to WHO 2010 guidelines and/or if patients had never attained fatherhood were taken for study.

Exclusion criteria:
1. Patients not giving consent to be a part of the study.
2. Patients having any acute scrotal pathology.
3. Patients having any associated serious systemic conditions.
4. Patients having incomplete medical records.
5. Patients having HBsAg and HIV status positive.
6. Patients who were referred to other centre after clinical, laboratory and radiological investigation.

Sample size
A total of 100 patients were taken for study that were recruited through Infertility clinic of Department of Surgery over a period of 18 months. They were thoroughly assessed by history, clinical examination, laboratory and radiological investigations. Age of patients ranged between 20- 50 years. A written consent was taken from both patients and their spouse to participate in the study. Assessment of the genitals was done with reference to examination of the penis including the location of the urethral meatus, palpation of the testes and measurement of their size, presence and consistency of the vas and epididymis, presence ofvaricocoele, secondary sexual characteristics including body habitus, hair distribution and pattern of breast development and at last digital rectal examination. A detailed systemic examination was done.

Semen collection and analysis
After 3-5 days of ejaculatory abstinence, semen samples were collected in a sterile plastic container by the process of masturbation from the subjects. Semen samples were collected in the laboratory room in a clean, dry, biologically inert container. In case of oligozoospermic or azoospermic patients, three semen samples were collected on different days with at least four days abstinence. After that gross and microscopic analysis was done and findings were noted.

Transrectal ultrasound
Transrectal ultrasonography in the infertile men was done to evaluate patency of the distal ductal system (vas deferens) and internal genital organs. Sonography of all patients were done using a real time endocavitory probe (GE, 3.5 MHz). Image documentation was done with multiformat camera.

The procedure was fully explained to patient in details and consent was taken. Subjects were asked to remove their inner garments. Left lateral position was the most comfortable position forsubjects in our study and this was done. Two leggings were used to cover the legs for patient's and the examiner's convenience. The patients were explained the technique of the scanning. For transrectal ultrasound, the ultrasound transmission gel was applied to the endorectal transducer and it was covered with a sterile probe cover or a sterile condom. Scanning begins inthe axial plane and the base of the prostate and seminal vesicles were visualized first. Seminal vesicles were identified bilaterally, with the ampullae of the vas on either side of the midline. The seminal vesicles are convoluted cystic structures that are darkly anechoic. Measurements were taken. Length of the seminal vesicle was taken using dotted lines along the curvature of the organ in its midline. Width was taken at the midpoint.Volume was calculated using the in-built calculator in the scanning machine. Vas deferens was visualized and the diameter of the vas deferens was measured. Next, the base of the prostate was visualized. Volume assessment of the prostate is an important and integral part of this procedure. The length and breadth of the prostate were taken on the longitudinal axis of the prostate. Thickness was taken on the transverse axis. The ellipsoid volumeformula was then applied, as follows: length × breadth × thickness × 0.52. This was available in the in-built calculator of volume in the software on the scanning machine prostatic scanning was done in various slices.

A logic-500 (GE WIPRO) ultrasound machine was used. The patient was scanned using linear colour Doppler multi-frequency probe.

For scrotal ultrasound patient is instructed to shave the parts and come for scanning. An ultrasound examination of the scrotum was done percutaneously to investigate the testis and cord structures. The examination was done in both supine and upright position.

Technique
The transducer (7-9 MHZ) was prepared with a sonogel (coupling gel).The transducer was held in the right hand and direct contact scan was performed with gentle rotation and angulations of the transducer. Both sagittal and transverse images were obtained. A transverse scan demonstrating both testes for comparison was obtained. Additional views were also obtained in coronal and oblique planes, with the patient upright and performing valsalva manoeuvre. Enlargement of veins was assessed.

Diameter of veins was measured both in resting posture as well as in valsalva manoeuvre. Presence of varicose veins if any was noted and gradations of varicosity were done.

Colour flow Doppler examination was performed to evaluate testicular and epididymal blood flow.

The length and breadth of the testis was taken in the longitudinal axis of the testis. Thickness was taken on the transverse axis. Testicular volumes were calculated by using the empirical formula of Lambert: length × breadth × thickness × 0.71. This was available in the in-built calculator of
volume in the software on the scanning machine. Then, the testis and para-testicular area, mediastinum testis, epididymal head, epididymal body and epididymal tail were examined sequentially. Spermatic cord and vasculature were also studied.

Statistical analysis

The obtained data were subjected to statistical analysis using statisticalsoftware SPSS version 20.0. Data were expressed as mean± standard deviation and Statistical significance was analyzed by Chi-square test. Spearmen's correlation test was performed to assess the linear relationship between parameters.

RESULTS

In our study a total of 49 (49%) patients were in the age group of 25-30 years and 29 (29%) patients were in the age group of 20-24 years and 10 (10%), 6 (6%), 3 (3%), 3 (3%) patients were in the age group of 31-35, 36-40, 41-45, 46-50 years respectively.. In our study out of 100 patients, 61 (61%) patients belonged to urban localities and 39 (39%) patients belonged to rural localities. In our study total number of patients that belonged to service class were38 (38%) and followed by laborer that constituted 22 (22%) patients, number of business class individuals were14(14%), farmers constituted 9(9%) patients, patients in others class were17 (17%) respectively

Table1: Male infertility according to occupation

Serial number	Occupation	Number of patients	Percentage
1	Farmer	9	9%
2	Labourer	22	22%
3	Service and Sedentary jobs	38	38%
4	Business	14	14%
5	Others	17	17%

In our study varicocele was present in 11 (11%) patients, atrophic testes were present in 6 (6%) patients, spermatocele in 3 (3%) patients, absent testes in 2 (2%) patients, 78 (78%) were found clinically normal respectively.
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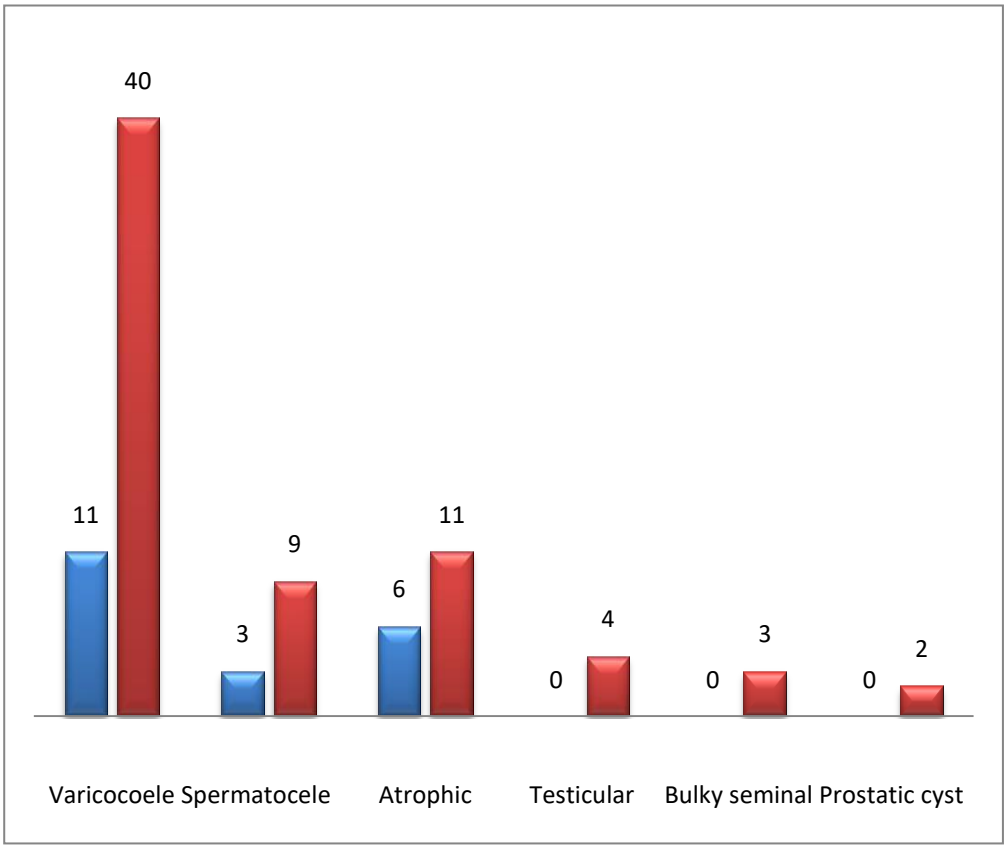
A total number of 40 (35.08%) patients were affected by varicocele, 11(9.65%) patients with atrophic testes, 9 (7.90%) patients with epididymalcyst,2(1.76%) patient with absent testes, 4(3.50%) patients with testicular microlithiasis, 3 (2.64%) patients with bulky seminal vesicle, 2(1.76%) patients with prostatic cyst and 43 (37.71%) presented with an apparent normal scan respectively. In some patientst woor more conditions were present together in those cases each condition was documented separately.

Table2: Colour Doppler sonographic findings

Serial number	Sonographic findings	Number of documentations	Percentage
1	Varicocele	40	35.08%
2	Epididymal cyst	9	7.90%
3	Atrophic testis	11	9.65%
4	Absent testis	2	1.76%
5	Testicular microlithiasis	4	3.50%
6	Bulky seminal vesicle	3	2.64%
7	Normal scan	43	37.71%
8	Prostaticcyst	2	1.76%

Out of total number of patients studied, sonography diagnosed varicocele in 40 (35.08%) patients but only 11 (11%) patients could be suspected clinically, similarly epididymalcyst/spermatocele was present in 9(7.90%) patients by Sonographic studies but only 3 (3%) patients were found clinically, atrophic testes was present in 11 (9.65%) patients bysonographicstudiesbutonly6(6%)patients were found clinically. Testicular microlithiasis, prostatic cyst, bulky seminal vesicle were found only in sonographic studies and were not apparent clinically. In our study sonographic studies found 57%cases as compared to the clinical examination in in which only 22%cases were found.



Comparison between colour Doppler and clinical examination

In our study in grade4 varicocoele mean Sperm counts were15.9million/ejaculate whereas in grade3 varicocoele it was25.37million/ejaculate respectively. In Grade 1 and grade 2 mean sperm counts were 33.15 and 34.2 million/ejaculate. Statistical analysis was performed and Spearmen's test showed a negative correlation coefficient of-0.181 in grade4 varicocoele and -0.035 in grade3 respectively.

In our study in atrophic testes mean sperm count was 3.45million/ejaculate. In varicocoele it was 26.98, in epididymal cyst 25.11, in bulky seminal vesicle 13.0, and in testicular microlithiasis 28.85,in absent testis it was4.0, in patients of prostatic cyst 14.5, in normal sonographic findings mean sperm count was38.98 million/ejaculate respectively.

Statistical analysis showed a significant p-value of 0.003between varicocele and total sperm count/ejaculate, similarly between atrophic testes and total sperm count/ejaculate showed ap value of 0.003.

In our study maximum number of patients presented in range of testicular volume of 16 to 20 cc that was 28, followed by 26 of testicular volume in range of 11 to 15 cc, 20 patients were in range of 21 to 25cc, 8 patients of testicular volume of 26 to 30 cc, 6 patients of testicular volume 6 to 10cc and 0 to 5cc,1 and 5 patients of testicular volume in rangeof31to 35 and 36 to 40cc respectively.

Patients of testicular volume in range of 0 to 5 cc were associated with lowest sperm counts with mean of 1.5millions/ejaculate, similarly patients of testicular volume of 6 to 10 cc had a mean sperm counts of3.83, testicular volume of 11 to 15 cc were associated with mean sperm counts of 17.63, testicular volume of 16-20 had a mean sperm counts of33.43, testicular volume of 21 to 25 cc had a mean sperm counts of 42.74,testicular volume of 26 to30 cc had a mean sperm countsof46.63,testicular volume of 31 to 35 were associated with sperm count of 88million, only one case presented to us with testicular volume in the range31 to 35 cc, testicular volume 36-40 cc had a mean sperm counts of 50.4million**.** Statistical analysis showed significant positive Spearmen's correlationcoefficientof0.617.

In our study, in atrophic testes testicular volume was 6.5 cc, in varicocele mean testicular volume was 19.20 cc, in epididymal cyst 18.78 cc, in bulky seminal vesicle 12.0 cc, in cases of testicular microlithiasis 11.5 cc, in prostatic cyst 10.0 cc, in patients presented with absent testis and apparently normal sonographic findings had a mean testicular volume of 4.0 cc and 19.95cc respectively.

In our study total number of patients of varicocoele in age group of 25-30 years were 22 followed by in the age group of 20-24 years in which there were 13 patients, in atrophic testes in theage group of 25-30 yearsthere were 7patients. Number of patients of epididymal cyst in the age group of 25-30 were 5 respectively.

Table 3: Age wise distribution of sonographic abnormalities

S. No.	Sonographic findings	Age groups					
		20-24 years	25-30 years	31-35 years	36-40 years	41-45 years	46-50 years
1	Varicocoele	13	22	1	2	1	1
2	Atrophictestes	1	7	1	1	1	0
3	Epididymalcyst	3	5	1	0	0	0
4	Testicular microlithiasis	2	0	1	1	0	0
5	Bulkyseminal vesicle	0	1	0	2	0	0
6	Prostaticcyst	0	0	2	0	0	0
7	Absenttestis	0	0	01	1	0	0

DISCUSSION

In our study maximum infertile patients were found in service and sedentary class 38 (38%), who were working in various private and nonprivate organisations probably because of better access to health care services as compared to others groups.

In a Study, Paul Claman[6] highlighted on possible occupations that involved exposure to toxic substances could have a detrimental effects on male fertility potential.

In the study done by Sheiner E et al[7] showed that patients working in environment that exposes them to toxins and pesticides have an impaired semen quality.

In our study most common clinical finding that was noted was varicocoele in 11 (11%) patients followed by atrophic testes in 6 (6%) patients, epididymal cyst in 3 (3%) patients.

In the study done by Sandro C Esteves, Ricardo Miyaoka et al [8] revealed similar results and showed varicocoele as the most common clinical anomaly in infertile patients followed by any infectious and hormonal causes.

Hasan Y. Malkawi, Hussein S. Qublan et al[9] showed similar results and reported varicocoele in 54% patients, epididymal cyst in 11%, testicular microlithiasis in 29% of patients, so maximum number of infertile patients in his study suffered from varicocoele. Hayder M, Hayder Q. et al[9] showed similar results and reported varicocoele in 74%, epididymal cyst in 8%, atrophic testes in 4%, testicular microlithiasis in 4%. This study also depicted that varicocoele was the most common sonographic abnormality found in infertile male patients.

In our study colour Doppler was found to be an important sensitive investigation in identifying various abnormalities in infertile male patients that were even missed on clinical examination. Sakamoto H, Saito K et al[10] showed that colour Doppler had a 59% greater sensitivity as compared to clinical examinations. Pierik FH, Dohle GR et al[11] also found that 60% of patients of varicocoele were missed on clinical examinations and were picked on sonographic examination only.

In the study done by Cocuzza M, Athayde KS et al[12] showed similar results in which he had showed that varicocoele of higher grades adversely affects semen volume and sperm counts. Belker AM[13] also presented with similar results showed adverse effect of varicocoele on overall testicular function. Pastuszak AW, Wang R[14] also concludedsimilar results and stated negative impact on testicular functions by varicocoele, he also stated that higher grades of varicocoele were associated with low sperm counts and overall poor testicular functions.

Low testicular volumes were associated with low sperm counts and as the testicular volume increases sperm count also increases.

Statistical analysis showed (Spearmen's test) a highly significant positive correlation between testicular and sperm counts which was 0.617. Similar results were showed by Arai T, Kitahara S et al[15]. They have also stated that testicular volume had a direct positive correlation with testicular function.

In our study maximum number of patients that attended infertility clinic had testicular volume in range of 16-20 cc, which constituted 28 patients followed by 26 patients with testicular volume in range of 11-15 cc.

In the study done by Tijani K[16] showed mean testicular volume of 15.32 cc in infertile male patients which was closely related to our study.

Tsvetkov D[17] in his study showed similar results and stated possible negative effects of epididymal cyst on overall testicular functions leading to low sperm counts. Xu C et al[18] showed similar results and stated negative effects of testicular microlithiasis on testicular functions leading to worsening of semen parameters. Contrary to our study Catanzariti F et al[19] showed that testicular microlithiasis did not affects sperm parameters.

CONCLUSION

Due to the high incidence of abnormalities detected by colour Doppler ultrasonography we advocate that it should be used as a routine investigation in infertile male patients. Given the prevalence of male infertility, the surgeon's andradiologist's familiarity with its appropriate imaging workup and recognition of the commonly involved pathologic processes is critical. Imaging can detect correctable abnormalities, which can lead to a successful conception and can also reveal potentially life-threatening disorders in the course of an infertility evaluation

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