

**Original article:**

## **Varicoceles : co-relation of clinical examination with Color Doppler Sonography at a tertiary care hospital**

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### **Abstract**

**Introduction:** Varicocele is an abnormal dilatation of veins of pampiniform plexus. It is one of the major causes of male infertility. Color doppler ultrasound is an excellent and reliable tool for diagnosis of varicoceles.

**Methods:** A prospective study of 50 patients presented in the department of surgery with complaint of infertility and suspicion of varicocele on clinical examination. High frequency color doppler ultrasound was performed on the patients. Observations were collected in a prescribed Performa for analysis.

**Results:** The varicocele was noted in 27 cases (54%) out of 50. There were total 39 patients who presented with complaint of infertility. Out of these 39 patients 27 cases (69.2%) had varicocele. Out of 27 cases 24 (88.8%) had unilateral and 03 (11.2%) case had bilateral varicocele. Of unilateral cases 21 cases (87.5%) were on left side and 03 (12.5%) case was on right side. On the basis of diameter of dilated veins the varicoceles were divided into three grades: - Grade I- 2.5mm to 3.9 mm, Grade II- 4.0 to 5.0 mm and grade III- more than 5.0 mm. Increase in diameter on valsalva was seen in all the patients. Grade I was present in 11 (40.8%) patients, grade II and grade III were seen in 8 (29.6%) patients each.

**Conclusions:** Varicoceles presents as one of the main cause of male infertility. There early diagnosis and prompt treatment may lead to significant improvement in the treatment of infertility. Color Doppler Ultrasonography plays an important role in the early diagnosis of varicocele. Ultrasound can even detect the cases which were not diagnosed clinically.

**Key words:** Varicoceles, Infertility, Color Doppler ultrasound.

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### **Introduction:**

Abnormal dilatation and tortuosity of veins of the pampiniform plexus in scrotal region is termed as varicocele. It is most often seen on left side and classically described in surgical literature as “bag of worms” appearance. They are usually prominent when standing and resolves on lying down position.

Varicocele can be diagnosed by using high frequency ultrasound equipments using color flow and doppler techniques.

Sonography is simple to perform, rapid, noninvasive relatively inexpensive, easily reproducible, widely available investigation and does not involve irradiation of gonads. The development of high-

frequency, real time scanners have enhanced the diagnostic accuracy of scrotal sonographic examinations. The scrotum and its contents are best evaluated by using high resolution transducers with frequencies of 5-10 MHz with a linear-array transducer. In addition, Doppler sonography, both duplex and color, can be used to evaluate blood flow in the scrotum in normal and pathologic states<sup>1</sup>. Diagnosis of varicocele is important since it has been found in as many as 21-39% of men attending infertility clinics. Small varicoceles may have the same impact on fertility as large lesions. Recognition of the dilated veins is usually made by physical examination. The lack of accuracy of diagnosis based only on visualization and palpation is obvious and many small lesions may escape detection. Varicoceles are commonly classified as small, moderate, or large, according to a subjective grading of venous size and reflux. Retrograde venography is an objective and precise diagnostic method, but it is invasive and cannot be used for screening. Several noninvasive methods have been proposed for improving the diagnosis of varicocele, mainly for small lesions in which recognition of venous dilation and reflux is problematic.

#### **Materials and methods :**

This was a prospective study of 50 patients who presented with clinical diagnosis of scrotal varicocele and was referred from Department of Surgery to the Department of Radiodiagnosis for Sonographic examination. All consecutive patients were included in the study. Subjects were either in patients or out patients of referring consultant.

Prior to subjecting patients for ultrasound examination, patient details, detailed clinical history was obtained along with physical examination. The verbal informed consent was also taken before the

examination. Gray scale sonography and color Doppler examination was carried out with linear array high frequency (6-7-9 MHz) probe while evaluation of patients. For real time gray scale sonography a short focus, high frequency (6-7-9 MHz) linear array transducer was used with adequate amount of acoustic gel. The time gain compensation and overall gain was adjusted to provide optimal gray scale information.<sup>2</sup>For color Doppler Ultrasonography color gain maximizes for optimal sensitivity and Doppler scale decreased to its lowest value to maximize the sensitivity to slow flow. Wall filter set as low as possible.<sup>2</sup>

Patient lied in supine position with penis draped over anterior abdominal wall. Scrotum was supported by towel draped beneath it or cradle in the examiners glove hand. A minimum of pressure was applied in a patient with scrotal tenderness <sup>2</sup>. The privacy of patient was maintained while examination. For gray scale and color Doppler sonography standard longitudinal and transverse views of each testis and epididymis was obtained. A transverse view of both testes on same image permit direct comparison of subtle echo texture changes. In addition oblique view was obtained in vascular plane of testis. The contralateral normal testis was used as control for gain settings and comparison.<sup>2</sup>

Scanning was also done with patient in lying down and upright position and with or without performing Valsalva maneuver for detection of varicocele. Additional scans of spermatic cord in region of scrotal neck and inguinal canal region were obtained in special circumstances: Undescended testis, torsion of testis, Inguino scrotal hernia, and varicocele. To detect any compressive cause of varicoceles abdominal sonography was performed in every case.

## Results

The varicocele was noted in 27 cases (54%) out of 50. There were total 39 patients who presented with complaint of infertility. Out of these 39 patients 27 cases (69.2%) had varicocele. Out of 27 cases 24 (88.8%) had unilateral and 03 (11.2%) case had bilateral varicocele. Of unilateral cases 21 cases (87.5%) were on left side and 03 (12.5%) case was on right side. A varicocele was considered to be present by high-frequency grey scale ultrasonography, if 2 or more veins could be identified, with at least 1 vein having diameter greater than 2.5 mm. On the basis of diameter of dilated veins the varicoceles were divided into three grades: - Grade I- 2.5mm to 3.9 mm, Grade II- 4.0 to 5.0 mm and grade III- more than 5.0 mm. Increase in diameter on valsalva was seen in all the patients. Grade I was present in 11 (40.8%) patients, grade II and grade III were seen in 8 (29.6%) patients each.

The high frequency gray scale findings were similar to that of study done by **Wolverson et al<sup>3</sup>** and **Ruben Orda et al<sup>4</sup>**. **Wolverson et al<sup>3</sup>** in there study studied 13 patients with varicocele and compared there findings with 10 normal subjects. **Ruben Orda et al<sup>4</sup>** studied 20 young men with varicocele and 18 young men as control. They described various grades of varicocele on the basis of size of main left spermatic vein. A varicocele was considered to be present by color Doppler ultrasonography, if accentuation of flow was identified within the pampiniform plexus during Valsalva maneuver as described by **Horstman et al<sup>5</sup>**. All cases presented with abnormal semen analyses which were similar to the study done by **Gonda et al<sup>6</sup>**. The High frequency ultrasonography and Color Doppler is 100% sensitive method in detecting the varicocele. In comparison to study done by **Gonda et al<sup>6</sup>**, he had only one false negative case

of subclinical varicocele, however in the present study there was no case of subclinical varicocele; it may be due to late presentation of patient in our study then in their study.

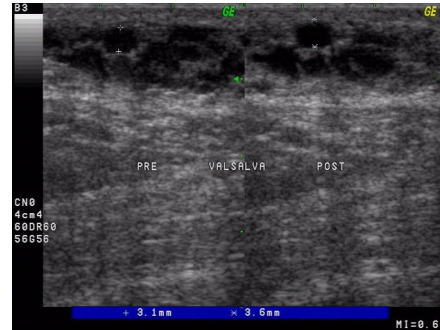


Fig 1. Grade I varicocele with increase in diameter on valsalva

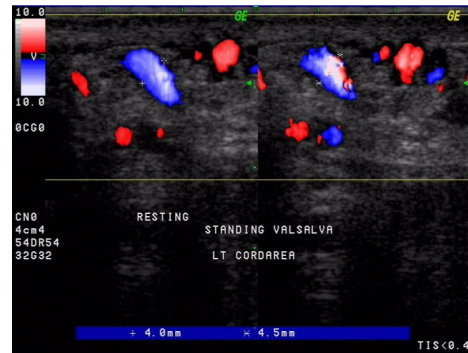


Fig 2. Grade II varicocele with increase in diameter on valsalva

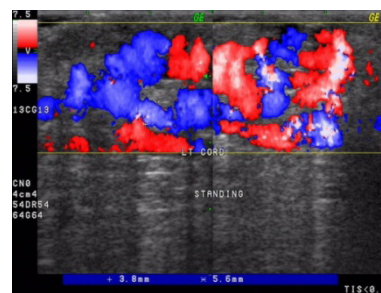


Fig 3. Grade III varicocele with increase in diameter on standing

## Discussion

In 1983, **Michael K Wolverson et al<sup>3</sup>**, conducted real-time sonography of the scrotal veins in 13 (19-40 yrs) patients who were clinically suspected cases of

varicocele and in 10 (20-55 yrs) normal controls. They used a high-resolution real-time scanner (BioSound) with a midrange frequency of 8 MHz transducer. They confirmed the vascular nature of varicocele by direct visualization of blood flow within the dilated veins. In normal individuals the caliber of normal vessels ranged from 0.5 to 1.5 mm with most being 1 mm or less in supine position. In the upright position, the caliber of vessels appeared a little greater and a principal draining vein up to 2 mm in diameter was often seen. In individuals with varicocele several tortuous, anechoic structures were identified in the anatomic configuration of the spermatic vein. The caliber of vessels in cross sections varied from 1.5 to 5 mm. Slight caliber increase and sudden acceleration of flow in the dilated veins was noted with abdominal compression or the Valsalva maneuver in the supine position. The number and size of vessels even in small varicocele differs markedly from appearance of normal vessels in control. Other cystic lesions could be differentiated from varicocele with no flow phenomenon was seen within them at high gain setting. They concluded that sonography provides an alternative to other noninvasive tests for detection of a small varicocele, especially in the infertile patients.

In 1987 **Ruben Orda et al<sup>4</sup>** evaluated ultrasonographic real time imaging and measurement of spermatic vein in inguinal canal in two groups of patients- 20 young men with varicocele and 18 men as control group using B mode gray scale ultrasound with 5 MHz and 10 MHz high resolution transducers. In varicocele group the preoperative values were- the mean diameter of dominant vein in left spermatic cord during normal respiration in erect position 4.5 mm and 5.7 mm during valsalva maneuver, post operative values were- during relaxation the mean

venous diameter was 2 mm and during valsalva maneuver 2.8 mm. In control group the mean diameter of main vein during relaxation was 2.2 mm and 2.7 mm on valsalva maneuver. They classified the varicocele group according to the size of left main spermatic vein into three groups:-

1. Small varicocele- mean diameter 2.5 - 4.0 mm in relaxed standing position.

During valsalva maneuver increase by 1 mm.

2. Moderate varicocele- mean diameter 4.0 – 5.0 mm in relaxed standing position.

During valsalva maneuver increase by 1.2 to 1.5 mm.

3. Large varicocele- mean diameter >5.0 mm in relaxed standing position.

During valsalva maneuver increase by >1.5 mm.

They concluded that ultrasonographic imaging and measuring of spermatic cord vein at inguinal canal level can be recommended as an accurate screening procedure for 1. Diagnosis of varicocele 2. Clinical classification 3. Assessment of treatment result. However further studies are necessary to determine the sensibility of this method for detecting very small or subtle varicocele.

In 1987 **Roger L Gonda et al<sup>6</sup>** studied 50 patients with infertility using high resolution small part scanner with 8 MHz focused annular array transducer and compared the ability of high resolution sonography and radionuclide scrotal scanning to detect sub clinical varicocele. On sonographic study he interpreted as positive if the veins of the pampiniform plexus were exceeding 2 mm in diameter and if some increase in the caliber of the vessels was observed on Valsalva maneuver. Of 50 patients 10 were normal on both and 20 elected not to have surgery or lost to follow up so they were excluded from the study. Incidence of false negative and false positive study could not be determined.

Therefore the study group consists of 20 patients (26 to 35 years), all of whom had surgical correction. Out of 20 positive patients 12 were having unilateral (left) varicocele and 8 were having bilateral varicoceles, so out of 28 surgically positive varicocele sonography was positive in 27 (96%) and radionuclide scrotal scanning in 14 (43%). They concluded that:-

- (1) There appears to be a strong correlation between infertility and the presence of a sub clinical varicocele.
- (2) High resolution sonography is a noninvasive, relatively inexpensive technique that uses no ionizing radiation, requires no IV contrast injection, and appears to be very sensitive in the diagnosis of sub clinical varicocele.
- (3) Sonography is superior to radionuclide scanning in the diagnosis of sub clinical varicocele.
- (4) All patients who present with infertility and an abnormal seminal analysis should undergo high-resolution sonography to determine the presence of varicocele, especially those men with a normal physical examination of the scrotum.

In 1988 **Gretchen A W Gooding**<sup>7</sup> evaluated 300 patients in a prospective manner to identify abnormalities of spermatic cord referred for scrotal abnormalities. The patients were scanned with a high resolution, 10 MHz, mechanical linear array transducer. 56 out of 300 were having specific abnormality related to cord- varicocele in 35 (left varicocele 46%), post operative hematoma in 10, thickened cord from epididymis or torsion in 5, inguinal hernia in 3, fatty deposition in 2, lipoma in 2, abscess in 1 and hydrocele in 2.

In 1989 **Bradford A Yeager et al**<sup>8</sup> performed a retrospective review of scrotal sonography in 198 out of 204 patients to assess the role of sonography in management of patients with extratesticular

abnormalities. The sonography was performed with a 7.5 MHz linear array transducer or a 10 MHz small parts transducer. Out of 198, 94 (47%) had unilocular hydrocele, 36(18%) had varicocele and 88 (44%) had Epididymal cysts. The accuracy of scrotal sonography approaches 100% in diagnosis of extratesticular abnormalities. They concluded that in extratesticular abnormalities scrotal sonography confirms the clinical impression, monitors the progress of conservative treatment and guide the surgical approach.

In 1991, **William G Horstman et al**<sup>9</sup>, described color Doppler ultrasonography as an increasingly important tool in evaluation of scrotum, specially in acute scrotal disorders using 7.5 and 5 MHz transducer. They showed scrotal inflammatory lesions seen as hypervascularity of epididymis or testis. The gray scale examination can be normal and involvement can be focal. Testicular torsion appeared as complete absence or marked decrease in number of visible vessels in the testis. In case of testicular tumors, tumors small than 1.5 cms were hypovascular and more than 1.5 cms were hypervascular. Varicocele mostly occurs on left side and major criteria for diagnosis of varicocele was detection of dilated peritesticular vascular structures which demonstrated augmented venous flow during valsalva maneuver. They concluded that color Doppler ultrasonography allow for evaluation of both morphology and perfusion and enables accurate diagnosis in cases of most common scrotal disorders in which gray scale findings are absent or non specific.

In 1998 **P G O'Donnell et al**<sup>10</sup> reported a case of ultrasonic appearance of intratesticular varicocele, an extremely rare entity. Intratesticular varicocele can be diagnosed on ultrasound as a multiple poorly

reflective, tubular structures with moving low level echo within and color Doppler showed their vascular nature with striking color in filling of these vessels at rest and on Valsalva maneuver. The history of undescended testis and subsequent orchidopexy in there patient contributed to the etiology of the intratesticular varicocele.

In 1999 **K M Das et al**<sup>11</sup> described the conventional and Doppler sonographic appearance of intratesticular varicocele and determined their occurrence. Intratesticular varicocele was identified in 18 (1.7%) of 1040 patients with variety of testicular complaints. Ultrasound examination was performed with 7.0 MHz transducer. The diagnosis of intratesticular varicocele was made on identification of a tubular or oval structure with a diameter of 2 mm or greater in and around the mediastinum testis with venous flow and a positive response to the Valsalva maneuver. Intratesticular varicoceles were bilateral in 7 (39%) of which 5 (28%) with infertility and unilateral in 11 patients. Left testis was involved in 13 patients and right in 12. Ipsilateral extratesticular varicocele was associated with 11 (44%) of the 25 intratesticular varicocele. Of 12 right sided Intratesticular varicoceles 10 were isolated without associated extratesticular varicocele. They concluded that intratesticular varicocele is a rare condition occurring in fewer than 2% of symptomatic patients, it has characteristic sonographic appearance but variation exists in clinical presentation, distribution and association with extratesticular varicocele. Further work is required on pathogenesis, presentation and treatment.

In 2003 **Nevbahar Akcar et al**<sup>12</sup> studied intratesticular arterial resistance and testicular volume in infertile men with subclinical varicocele.

58 infertile men were examined by gray scale and color Doppler sonography using a 7.5 MHz transducer for presence of varicocele, testicular volume ( $A \times B \times C \times 0.52$ ) and arterial resistance. 27 men (19 – 48 yrs, mean 35) had left side varicocele (96% - subclinical) and 31 men (25 – 51 yrs, mean 33) without varicocele served as control. For subclinical varicocele, the criterion of at least 2 veins with diameter of at least 2 mm and diameter less than 3.6 mm was accepted. Mean volume of right and left testes of study subject were 14.8 ml and 14.6 ml respectively and in control were 14.2 ml and 13.6 ml respectively. Mean RI values for right and left testes of study subject were 0.61 and 0.58 respectively and in control were same as study subject. They concluded that sub clinical varicocele is not associated with ipsilateral testicular atrophy and does not affect intratesticular arterial RI.

In our study the varicoceles were divided into three grades from grade I to III. In comparison with clinical examination, grade I varicoceles were detected more on color doppler sonography, however with grade III varicoceles most were detected with clinical examination and were further confirmed by Ultrasonography.

#### **Conclusion:**

Varicoceles presents as one of the main cause of male infertility. There early diagnosis and prompt treatment may lead to significant improvement in the treatment of infertility. Color Doppler Ultrasonography plays an important role in the early diagnosis of varicocele. Ultrasound can even detect the cases which were not diagnosed clinically. Hence we suggest prompt use of Color Doppler Ultrasonography in the cases with clinical suspicion of varicoceles and in cases of male infertility.

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