Original Article

Ultrasound Evaluation of Testicular Vein Diameter in Suspected Cases of Varicocele: Comparison of Measurements in Supine and Upright Positions

UR Ebubedike, SU Enukegwu[1], AM Nwofor[2]

Department of Radiology, Nnamdi Azikiwe University Teaching Hospital, NAUTH Nnewi, [1]St Bridget's Xray Centre Benin City, [2]Depatment of Surgery, Nnamdi Azikiwe University Teaching Hospital, NAUTH, Nnewi, Nigeria

Received: 23-Oct-2019;
Revision: 16-Feb-2020;
Accepted: 15-Apr-2020;
Published: 03-Jul-2020

Abstract

Background: Scrotal ultrasonography has high sensitivity in the detection of intra-scrotal abnormalities. Various ultrasonographic parameters such as the spermatic cord diameter, venous diameter, and venous retrograde flow in either supine or upright positions with or without Valsalva maneuver have been investigated to assess patients suspected of having varicocele. **Aims:** This study aimed at comparing testicular vein diameter in supine and upright positions using ultrasonography. **Methodology:** This is a prospective multicenter study conducted between September 2018 and June 2019. Eighty-two consenting suspected cases of varicocele, 20 years and above, referred for scrotal ultrasonography were included in this study. **Results:** The study population had a mean age of 42.9 + 14.89 (SD) with a range of 20–96 years. The highest number of participants fell within the age range of 30–39 years 23 (28%). Varicocele was demonstrated in 96.3% of the patients. More patients showed sonographic evidence of varicocele in the upright position, on the right 50 (61%) as well as left 50 (61%). Bilateral varicocele had a higher frequency in the upright position 45 (54.9%), while supine was 23 (28%). Upright position had the widest diameter in 72% of participants on the right and 82% on the left. The upright position also showed higher average vein diameter of 2.6 mm and 2.9 mm on the right and left, respectively, while it was 2.2 mm and 2.3 mm for right and left in the supine position. **Conclusion:** The upright position is more predictive of varicocele in scrotal ultrasound examination for suspected cases of varicocele. We recommend an upright position where one position is to be used.

Keywords: *Scanning positions, scrotal ultrasound, testicular vein, varicocele*

Introduction

The role of ultrasound evaluation of scrotal pathologies as well as its availability has made sonography a primary diagnostic tool.[1] Other imaging modalities which can be used to evaluate scrotal pathologies include CT, MRI, and angiography. The use of ionizing radiation, high cost, and unavailability make them inaccessible in resources poor societies like Nigeria, whereas ultrasonography is readily available, cheap, and noninvasive and uses nonionizing radiation. Scrotal ultrasonography has high sensitivity in the detection of intra-scrotal abnormalities[2] and it is an imaging modality of choice in differentiating testicular from para-testicular lesions in adults and children.[2-4]

Varicocele is a common abnormality characterized by retrograde blood flow in the internal spermatic vein. This abnormal flow is caused by incompetence or absence of venous valves.[5] Varicocele has been found in approximately 15% of the general population and in

Address for correspondence: Dr. UR Ebubedike, Department of Radiology, Nnamdi Azikiwe University Teaching Hospital, NAUTH Nnewi, Nigeria.
E-mail:amakaukah@yahoo.com

Access this article online

Quick Response Code:

Website: www.njcponline.com

DOI: 10.4103/njcp.njcp_579_19

How to cite this article: Ebubedike UR, Enukegwu SU, Nwofor AM. Ultrasound evaluation of testicular vein diameter in suspected cases of varicocele: Comparison of measurements in supine and upright positions. Niger J Clin Pract 2020;23:1004-7.

20%–40% of infertile men.[6-8] The clinical diagnosis of varicocele is routinely made by physical examination in a warm environment. However, various ultrasonographic parameters such as the spermatic cord diameter, venous diameter, and venous retrograde flow in either supine or upright positions with or without Valsalva maneuver have been investigated to assess patients suspected of having varicocele.[9-12]

The first part of the examination is the B mode evaluation which allows a demonstration of the presence of enlarged venous structures. Different authors use different criteria for defining a varicocele detected ultrasonographically.[8-10] However, there are no generally accepted criteria for the diagnosis of varicocele by this method.[8] The diagnosis of varicocele can be made with detection of vessels larger than 3 mm;[8] however, Gonda *et al*.[13] reported that ultrasound has a 95% sensitivity for the detection of a varicocele using a 2 mm cut off for vein diameter. Several authors have examined groups of patients to establish qualitative and quantitative color Doppler ultrasound (CDU) criteria but the criteria were heterogeneous and poorly defined.[14-16] Some studies also examined patients using color Doppler in supine position, while others did so for patients in standing position.[14,16-22] Some have also compared vein measurement in either position with/without Valsalva maneuver.[21] Measurement of testicular vein diameter is usually done in supine position in our environment. In this study, we compared vein diameter measurement in supine and upright positions.

Methodology

This is a prospective multicenter study conducted between September 2018 and June 2019. Eighty-two consenting suspected cases of varicocele, 20 years and above, referred for scrotal ultrasonography were included in this study. Patients with previous scrotal surgery were excluded. For confidentially, patients were assigned numbers. They were also free to withdraw from the study at any time.

These patients were scanned by two radiologists in both supine and upright positions using two ultrasound scanners: an Aloka Prosound SSD–2500 SX machine and a CHISON digital ultrasound system Model Ivis 60, both having linear transducer (freq. 7.5 MHZ) and color Doppler capability. The examination was performed in a warm room. While in supine position, the penis rests on the lower abdomen and scrotum is supported by a towel between the thighs. The scrotal contents, i.e., testes, para-testicular area, mediastinum testes, epididymal head, body, and tail, were examined sequentially along the course of the proximal genital tract but with emphasis on the measurement of widest vein (pampiniform plexus) diameter at the level of the epididymal head using B-Mode.

Data analysis

Statistical analysis of the data was done using the statistical package for the social science (SPSS) software version 21.0 for windows.

Results

The study population had a mean age of 42.9 ± 14.89 (SD) with a range of 20–96 years. Figure 1 shows that the highest number of participants fell within the age range of 30–39 years 23 (28%), while the least age frequency was 1 (1.2%) for 60 to 69 years, also for 80 years and above. Varicocele was demonstrated in 96.3% of the patients. Table 1 shows the number of participants with varicocele in the supine and upright position for the left and right as well as bilateral. More patients showed sonographic evidence of varicocele in the upright position 50 (61%) on the right and 50 (61%) on the left. In addition, bilateral varicocele had a higher frequency in the upright position 45 (54.9%), while supine was 23 (28%). The average vein diameter in supine position on the right was 2.2 mm with a range of 1–3.8 mm, while it was 2.3 mm on the left with a range of 1–4.3 mm. The average vein diameter in upright position on the right was 2.6 mm with a range of 1–4.8 mm, while it was 2.9 mm on the left with a range of 1.3–5.3 mm. On the right, upright position had the widest diameter in 72% of participants and on the left, it was 82%.

There was positive correlation between the measurements of the vein diameter in the supine and upright positions for the right and left, respectively (Pearson's correlation, $r > 0$). It was low on the right, $r = 0.274$ ($r < 0.3$) and moderate on the left, $r = 0.698$ ($r = 0.3$ to 0.7). There was no high ($r > 0.7$) or perfect correlation ($r = 1$). Figures 2 and 3 are scatter plots showing the pictorial representation of the correlation.

Table 1: Different Ultrasound scan positions and frequency of varicocele (*n*=227)

Position	Frequency	Percentage
Supine(R)	25	30.5
Supine(L)	34	41.5
Upright(R)	50	61.0
Upright(L)	50	61.0
Supine(Bilateral)	23	28.0
Upright(Bilateral)	45	54.9

(R-right, L-left)

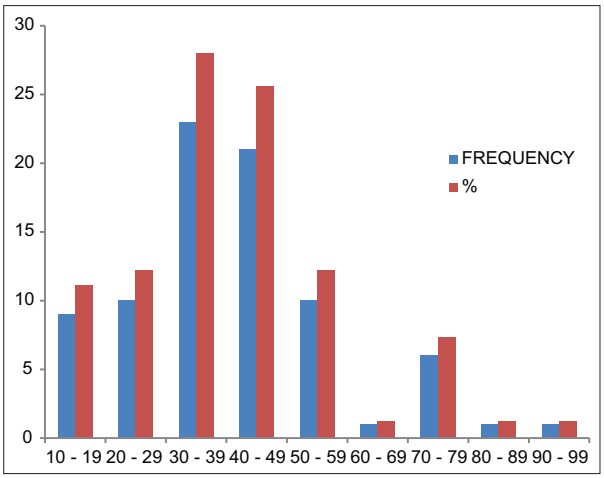

Figure 1: Age distribution of participants

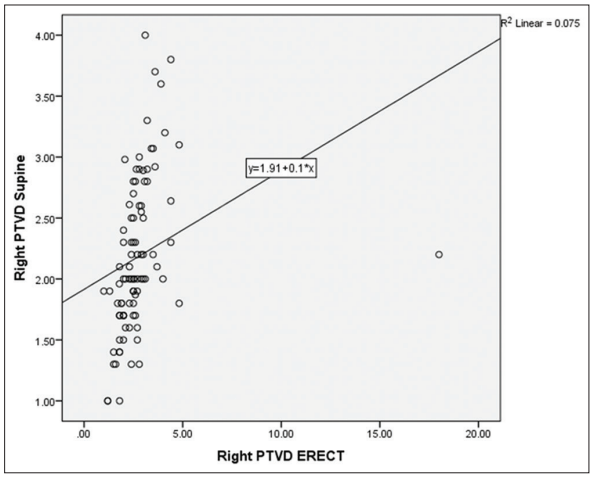

Figure 2: Scatter plot showing the right peri-testicular vein diameters (PTVD) in upright and supine positions

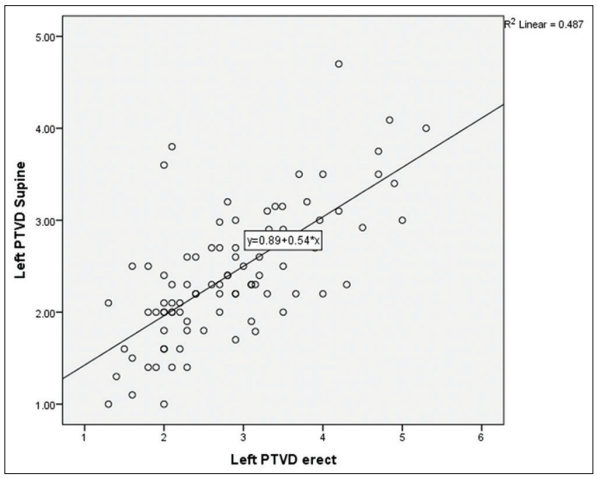

Figure 3: Scatter plot showing the left peri-testicular vein diameters (PTVD) in upright and supine positions

Discussion

Ultrasound has been accepted as the modality of choice for the evaluation of varicocele. The controversy lies in the position for measurement of testicular vein diameter, level of measurement as well as Cut-off point of vein diameter. Most of the patients were in their fourth and fifth decade of life in agreement with the work of Elkhadir *et al*.[23] These age groups accounted for 53.6% of the studied population; this is higher than the 44% recorded by Elkhadir *et al*.[23] though their study was generally on scrotal abnormalities. The higher percentage in this study may be due to men in this age bracket being the most active reproductive age group and are more likely to be investigated for infertility/fertility related cases.

When a patient with a varicocele is examined at rest, multiple elongated, tortuous anechoic structures are seen above, around, or beneath the testicle.[24] The vessel caliber thresholds used by different authors to define varicocele vary from 2 to 3 mm.[25] Based on 2 mm Cut-off point, the widest vein diameter within the pampiniform plexus at rest was measured for varicocele in this study.[26] Gonda *et al*.[13] also reported a 95% sensitivity for the detection of a varicocele, using a 2 mm cut off for vein diameter.

Pilatz *et al*.[7] also compared mean of venous diameter between different clinical grades and concluded that clinical varicocele can be predicted with high accuracy based only on the vein diameter though the Cut-off point values were higher, >2.45 mm at rest or > 2.95 mm with Valsalva all in supine position. Our study revealed higher percentage of varicocele in the studied population when examined in upright position for the right and left hemi-scrotum. This is similar to findings by Karami *et al*.[27] which defined upright position as the best position for examination of patients suspected of having varicocele as well as epididymal head as the best site. There was higher incidence of the left varicocele in this study as expected due to drainage of left spermatic vein into the left renal vein at a 90-angle, compared to the right spermatic vein, which drains directly into the inferior cava.

This study also revealed a low correlation between the vein diameter measured in supine and upright positions. If measurements in both positions were similar, the value of the correlation coefficient would have been very close to one.

Conclusion

The upright position is more predictive of varicocele in scrotal ultrasound examination for suspected cases of varicocele. We recommend an upright position where one position is to be used.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

References

1. Prajapati N, Madhok R, Tapasvi C, Prasad U, Rastogi S. High frequency and color Doppler ultrasound evaluation of scrotal and testicular pathologies. Int J Res Health Sci 2014;2:153-61.
2. Hamm B. Differential diagnosis of scrotal masses by ultrasound. Eur Radiol 1997;7:668-79.
3. Diamond DA, Paltiel HJ, DiCanzio J, Zwakowski D, Bauer SB, Atala A, *et al*. Comparative assessment of pediatric testicular volume. Orchidometer versus ultrasound. J Urol 2000;164:1111-4.
4. Dewbury KC. Scrotal ultrasonography: An update. BJU Int 2000;86;1:143-52.
5. Gat Y, Bachar GN, Zukerman Z, Belenky A, Gornish M. Varicocele: A bilateral disease. Fertile Steril 2004;81:424-9.
6. Sakamolo H, Saito K, Shichizyo T, Ishikawa K, Igarashi A, Yoshida H. Color Doppler ultrasonography as a routine clinical examination in male infertility. Int J Urol 2006;13:1073-8.
7. Pilatz A, Altinkilic B, Kohler E, Maconi M, Weidner W. Color Doppler ultrasound imaging in varicoceles: Is the venous diameter sufficient for predicting clinical and subclinical varicocele? World J Urol 2011;29:645-50.
8. Liguori G, Trombetta C, Garaffa G, Bucci S, Gattuccio L, Salame L, *et al*. Color Doppler ultrasound investigation of varicocele. World J Urol 2004;22:378-81.
9. Cina A, Minnetti M, Pirronti T, Vittoria SM, Canade A, Oliva G, *et al*. Sonographic quatitative evaluation of scrotal veins in healthy subjects: Normative values and implications for the diagnosis of varicocele. Eur Urol 2006;50:345-50.
10. Caskurlu T, Tasci AI, Resim S, Sahinkanat T, Ekerbicer H. Reliability of venous diameter in the diagnosis of subclinical varicocele. Urol Int 2003;71:83-6.
11. Hoektra T, Witt MA. The correlation of internal spermatic vein palpability with ultrasonographic diameter and reversal of venous flow. J Urol 1995;153:82-4.
12. Hussein AF. The role of color Doppler ultrasound prediction of the outcome of microsurgical sub-inguinal varicocelectomy. J Urol 2006;176:2141-5.
13. Gonda RL Jr, Karo JJ, Forte RA, O' Donnell KT. Diagnosis of subclinical varicocele in infertility. AJR Am J Roentgenol 1987;148:71-5.
14. Kocakoc E, Serhatlioglu S, Kiris A, Bozgeyik Z, Ozdemir H, Bodakci MN. Colour Doppler sonographic evaluation of interrelations between diameter, reflux and flow volume of testicular veins in varicocele. Eur J Radiol 2003;47:251-6.
15. Kim WS, Choi DY, Han YT. Scrotal Doppler ultrasonography in the assessment of varicocele. Korean J Urol 1998;39:1070-6.
16. Wolverson MK, Houttuin E, Heiberg E, Sundaram M, Gregory J. High resolution real-time sonography of scrotal varicocele. AJR Am J Roentgenol 1983;141:775-9.
17. Trum JW, Gubler FM, Laan R, van der Veen F. The value of palpation, varicoscreen contact thermography and colour Doppler ultrasound in the diagnosis of varicocele. Hum Reprod 1996;11:1232-5.
18. Nashan D, Behre HM, Grunert JH, Nieshlag E. Diagnostic value of scrotal sonography in infertile men: Report on 658 cases. Andro logia 1990;22:387-95.
19. Rifkin MD, Foy PM, Kurtz AB, Pasto ME, Goldberg BB. The role diagnostic ultrasonography in varicocele evaluation. J Ultrasound Med 1983;2:271-5.
20. Orda R, Sayfan J, Manor H, Witz E, Sofer Y. Diagnosis of varicocele and post operation evaluation using inguinal ultrasonography. Ann Surg 1987;206:99-101.
21. Kim YS, Kim SK, Cho IC, Min SK. Efficacy of scrotal Doppler ultrasonography with the valsalva maneuver, standing position and resting valsalva ratio for varicocele diagnosis. Korean J Urol 2015;56:144-9.
22. Pauroso S, Dileo N, Fulle I, Di Segini M, Alessi S, Maggini E. Varicocele: Ultrasonographic assessment in daily clinical practice. J Ultrasound 2011;14:199-204.
23. Elkhadir AM. Ultrasonography diagnosis of scrotal pathologies. IO Srphr Org 2015;5:1-4.
24. Woodward PJ, Schwab CM, Sesterhenn IA. From the archives of AFIP: Extratesticular scrotal masses: Radiologic-pathologic correlation. Radiographics 2003;23:215-40.
25. Kim ED, Lipshultz LJ. Role of ultrasound in the assessment of male infertility. J Clin Ultrasound 1996;24:437-53.
26. Aubaid HN, AL-Garawyet R, Hammed MH. Sonographic findings in scrotal swellings. J Kerbala Univ 2014;12:93-105.
27. Karami M, Mazdak H, Khanbabapour S, Adibi A, Nasr N. Determination of the best position and site for colour Doppler ultrasonographic evaluation of the testicular vein to define the clinical grades of varicocele ultrasonographically. Adv Biomed Res 2014;3:17.