e-ISSN: 0975-5160, p-ISSN: 2820-2651

Available online on www.ijtpr.com

International Journal of Toxicological and Pharmacological Research 2022; 12 (6); 166-173

Original Research Article

Doppler Ultrasound Versus Three-Dimensional Computed Venography : Diagnostic Accuracy in Varicose Veins

Pranjit Thapa[1], Jyotshna Bhowmik[2], Dibyajyoti Nath[1], Aditi Das[3]

[1]Associate Professor, Dept of Radiology, Silchar Medical College and Hospital, Silchar, Assam, India

[2]PGT, Dept of Radiology, Silchar Medical College and Hospital, Silchar, Assam, India

[3]Assistant Professor, Dept of Radiology, Silchar Medical College and Hospital, Silchar, Assam, India

Received: 15-04-2022 / Revised: 18-05-2022 / Accepted: 20-06-2022

Corresponding author: Dr. Dibyajyoti Nath

Conflict of interest: Nil

Abstract

Introduction: Varicose veins are one of the most widely recognized illnesses of the lower limb venous system. The distribution of varicose veins varies for age, sex and occupation. Mostly because of easy availability, lesser radiation exposure and low- cost, Duplex Ultrasound is most commonly used in the evaluation of varicose veins of the lower limb which provides morphological and hemodynamic information.

Aim : To determine the diagnostic efficacy of Duplex USG and Three Dimensional Rendered Computed Tomography in the evaluation of varicose veins of the lower limb and the distribution of varicose veins for age, sex, and occupation.

Methods: It was an observational study conducted at the Department of Radiology, Silchar Medical collegefrom June 2019 to May 2020 for one year on 50 patients with varicose veins. Duplex Ultrasound was performed on varicose vein cases followed by CT Venography.

Results- Total of 56 limbs were examined of 50 patients, out of 50 patients, 20 were males (40%) and 30 (60 %) were females. It was more common in the age group 55-64 yrs (24%). The prevalence of varicose veins of lower limbs amongst occupations including standing types (48%) is more than that of walking types (32%) and sitting types (20%). CT venography produced excellent images in 21.4%, fair images in 60.7% and poor images in 17.8 % cases.

Conclusion: It was found that in detecting GSV incompetence CT Venography compared to Duplex USG has a sensitivity of 97.7%, a specificity of 90.9%, PPV of 97.7%, NPV of 90.90%, and in detecting SSV incompetence CT Venography compared to Duplex USGhas a sensitivity of 57.14%, a specificity of 95.23%, PPV of 80% and NPV of 86.9%.It was also found that CT venography could detect more number of perforators as compared to Duplex Ultrasound.

Keywords: Doppler Ultrasound, Three Dimensional Computed Venography, Varicose Vein.

Introduction

Varicose veins are one of the most widely recognized illnesses of the lower limb venous system. They are circuitous veins that are usually found in the lower limbs. By and large

more common in women and the elderly, varicose veins affect women and men between the ages of 40 to 80 years [1]. Varicose vein develops primarily on account of the valve incompetence and reflux, most commonly in the great saphenous vein (GSV) or small saphenous vein (SSV) [2]. Initial symptoms and signs localized to the areas of varicose veins include aching or throbbing discomfort, burning, pruritus, dry irritated skin, and skin ulceration. Further advanced chronic venous disease with venous valvular incompetence presents with symptoms and signs such as leg heaviness and fatigue, cramping, hyperpigmentation, edema, fibrotic skin changes (lipodermatosclerosis), and ulceration [3].

Risk factors for varicose veins can be categorized as hormonal, acquired lifestyle and inherited. The impact of estrogen on the risk of varicose veins may explain, in part, the increased predominance among women. Smoking is a significant modifiable risk factor for varicose veins and more severe forms of chronic venous disease, including venous ulceration [4]. Post-thrombotic syndrome after deep vein thrombosis (DVT) may bring about varicose veins in the absence of primary venous disease.

Figure 1: Dilated tortuous veins in the medial aspect of the right leg with pigmentation and venous ulcer around the medial malleolus and right lower leg.

Materials and Methods

It was an observational study conducted at the Department of Radiology, Silchar Medical College from June 2019 to May 2020 for one year on 50 patients with varicose veins. Duplex Ultrasound was performed on varicose vein cases followed by CT Venography. All patients were examined either in 10 degree reverse Trendelenburg position or standing position. The Valsalva's maneuver and distal manual compression were used to evaluate the valvular competence of the saphenofemoral junction and saphenopopliteal junction. All CT findings, such as focal ectasia, diffuse dilatation more than 6 mm, asymmetry, and tortuosity, directly connected to varicosity of GSVs and SSVs that were confirmed insufficient at Doppler sonography were analyzed on volume-rendered images. The incidence of these CT findings in cases of GSV insufficiency was calculated. Using these CT findings, the presence of the GSV or SSV insufficiency was predicted. With duplex sonography as the reference standard, the sensitivity and specificity of CT Venography in the prediction of insufficiency of the GSV

and SSV were calculated. The GSV territory and SSV territory from the thigh to calf were evaluated for the presence of perforating veins at rest with a calf compression used below the perforator to check for the perforator reflux. Dilated perforators for insufficiency were analyzed on Duplex USG and later compared with the number of dilated perforator detected on CT venography.

Results

A total of 50 patients were studied, out of which 44 had varicose veins in only one lower limb, whereas 6 had varicose veins in both the lower limbs. Among 50 patients, 20 were men, and 30 were women; mean age 45.22 years; range, 15 –74 years.

Age -wise distribution of varicose veins of lower limbs

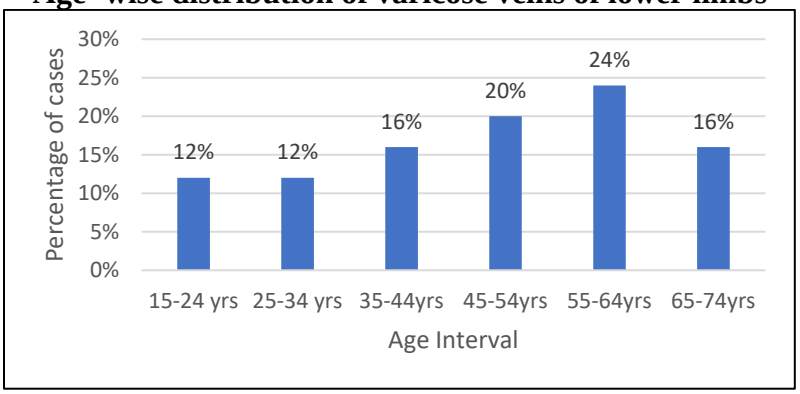

Figure 2: Bar diagram showing the age-wise distribution of the varicose veins of lower limbs.

Sex wise distribution of varicose veins of lower limbs

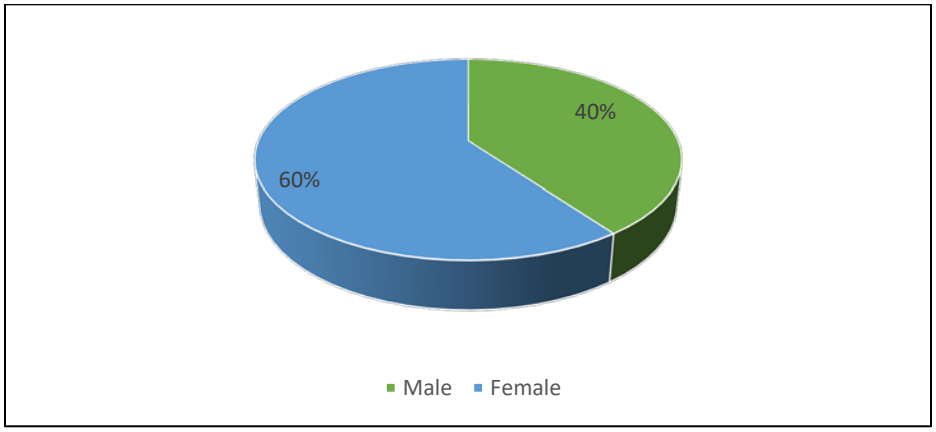

Figure 3: Pie diagram showing the sex-wise distribution of varicose veins of the lower limb.

Table 1: Occupation wise distribution of varicose veins of lower limbs

	Occupation	No. of Patients	Total	Percentage
Standing Types	Defence Personnel	8	24	48%
	Teacher	10		
	Housewife	6		
Walking Types	Daily Wage Worker	10	16	32%
	Farmer	6		
Sitting Types	Clerical Job	4	10	20%

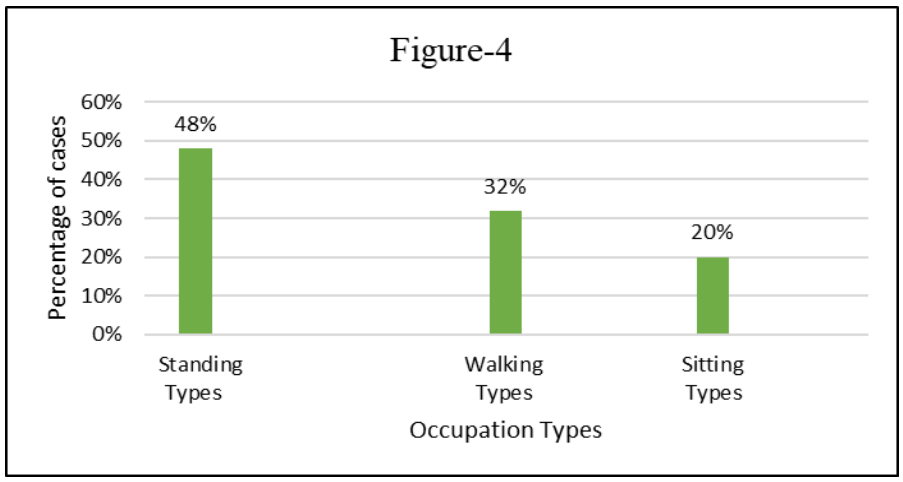

Figure 4: Bar diagram showing the distribution of occupation wise distribution of lower limb varicose veins.

Assessment Of Overall Quality Of 3d Volume-Rendered Images: The overall diagnostic image quality of the 3D volume-rendered images was assessed using a three-grade system: poor quality image signifies that 3D volume-rendered image is unsuitable for visualization of varicose vein channels and perforators; fair quality image signifies that some of the channels and perforators were not clear, but the image was sufficient for visualization of channels and perforators, and excellent quality image signifies that there is vivid visualization of all channels and perforators

Table 2: Image quality

Image quality	No of Limbs
Excellent	12
Fair	34
Poor	10

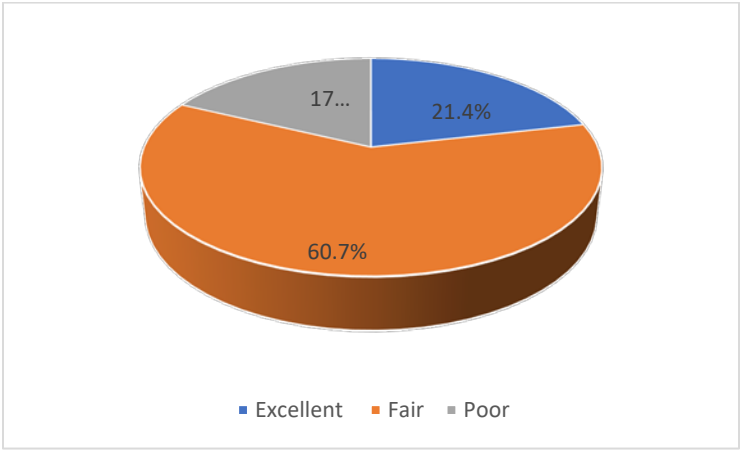

Figure 5: Pie-Diagram showing the distribution of quality of 3D rendered images of CT Venography.

Figure 6: Three - Dimensional Rendered image with dilated tortuous veins on the medial aspect of the right leg with dilated perforator as shown with the arrow

Table 3: Great saphenous-vein incompetence

Great saphenous vein incompetence	Doppler positive	Doppler negative
CT Positive	44(TP)	1(FP)
CT Negative	1(FN)	10(TN)
	45	11

Sensitivity = 97.7%, Specificity= 90.9 %, PPV= 97.77%, NPV= 90.90%

Table 4: Small saphenous vein incompetence

Small saphenous vein incompetence	Doppler positive	Doppler negative
CT Positive	8(TP)	2(FP)
CT Negative	6(FN)	40(TN)
	14	42

Sensitivity =57.14%, Specificity = 95.23 %, PPV=80% , NPV=86.9%

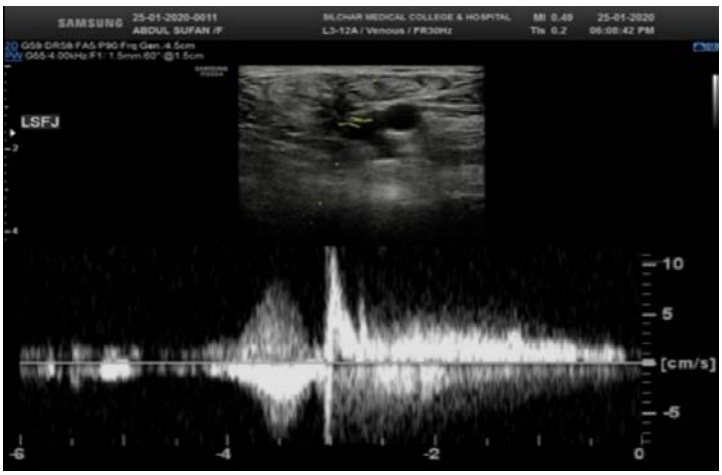

Figure 7: Saphenofemoral junction incompetence with reflux on Valsalva maneuver on spectral Doppler study.

Figure 8: Three - Dimensional rendered image shows focal dilatation and tortuosity of veins noted in the medial aspect of the left upper leg.

Figure 9: Dilated Perforator with abnormal reflux on doing Augmentation tests on the spectral Doppler study.

Statistical analysis to compare the efficacy in the detection of perforators by CT Venography and Duplex USG

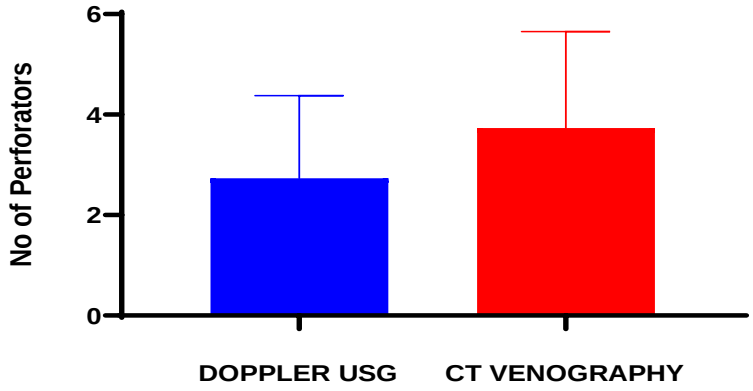

Figure 10: Bar diagram showing the no. of Perforators detected by Doppler USG and CT Venography

In this study, no. of Perforators detected with CT venography is compared with that detected by Doppler USG. It is found that the no. of Perforators detected with CT Venography is greater than that of Doppler USG. Unpaired T- test was used to calculate the p-Value, which is 0.0038in our study and it is <0.05 and hence, is significant.

Discussion

Age incidence

The age range in our present study was between 15-74 years with the mean age of presentation to be 45.22 yrs. From our study it was found out that varicose veins were most common in the age group between 55-64yrs, comprising 24 percent.

A study conducted by Robertson LA *et al* [5] also showed that age incidence is 25.7% in those aged 55-64 years.

Sex wise distribution:

In our present study, there were 20 males and 30 females out of a total of 50 individuals evaluated for varicose veins of lower limbs. So males constituted 40 percent and females constituted 60 percent of the total varicose veins cases. Here, male to female ratio is 1:1.5 which is concordant to the study done by Dodd and Cocket *et al* [6]

Occupation wise distribution of varicose veins of the lower limbs.

This study shows that the prevalence of varicose veins of lower limbs highest amongst occupations in the standing types comprising of a total of 48% which is more than that of walking types and sitting types which is comprising of 32% and 20% respectively, which is similar to the study done by Mekky rt *et al* [7].

Assessment of overall quality of 3D volume -rendered images.

The overall diagnostic image quality of the 3D volume-rendered images were assessed using a three-grade system where out of 56 cases, 10 were of poor (17.8%) image quality; 34 were of fair (60.7%) image and 12 were of excellent (21.4%) image quality that signifies that there is vivid visualization of all channels and perforators.

Similar studies wherein 3D volume-rendered image quality were assessed was done by Lee W *et al* [8] where for comparative analysis, 50 of the 100 patients underwent Doppler sonography, and saphenous vein size and morphologic features on CT were compared with the functional information from Doppler sonography. There were excellent images in 76 cases, fair images in 21 and poor in 3 cases.

Great saphenous-vein incompetence

In our study, CT venography compared to Duplex USG in detecting GSV incompetence has a sensitivity of 97.7%, a specificity of 90.9%, PPV of 97.7%, NPV of 90.90%.

A similar study was done by Lee W*et al* [8] where the sensitivity of CT venography in the prediction of GSV insufficiency was 98.2% (56 of 57 cases), and the specificity was 83.3% (14 of 17 cases).

Small saphenous vein incompetence

In our present CT venography compared to Duplex USG in detecting SSV incompetence has a sensitivity of 57.14%, a specificity of 95.23%, PPV of 80%, NPV of 86.9%.

A similar study was done by Lee W *et al* [8] where CT venography had a sensitivity of 53.3% (8 of 15 cases) and a specificity of 94.9% (56 of 59 cases) in the prediction of insufficiency of the small saphenous vein.

Comparison of the efficacy in the detection of perforators by duplex USG and CT Venography

Here in this study, 56 limbs with varicose veins were examined with Doppler USG and then CT venography for dilated perforators. Unpaired T- test was used to determine whether there is a significant statistical

difference in determining the efficacy of both the tests in evaluating dilated perforators. Here, the p-Value is 0.0038 which is significant when less than 0.05.

Hence it proves that CT venography is better able to detect perforators than in duplex USG.

Acknowledgements

Authors would like to thank the Department of Surgery and Department of Dermatology, Silchar Medical College & Hospital, Assam, India for providing cases of varicose veins from indoor and outdoor services.

Funding: No funding sources

Conflict of interest: None declared

References

1. Hamdan A. Management of varicose veins and venous insufficiency. JAMA. 2012 Dec 26;308(24):2612–21.
2. Bergan JJ, Schmid-Schönbein GW, Smith PDC, Nicolaides AN, Boisseau MR, Eklof B. Chronic venous disease. N Engl J Med. 2006 Aug 3;355(5):488–98.
3. Eklöf B, Rutherford RB, Bergan JJ, Carpentier PH, Gloviczki P, Kistner RL, *et al*. Revision of the CEAP classification for chronic venous disorders: consensus statement. J Vasc Surg. 2004;40(6):1248–1252.
4. Gourgou S, Dedieu F, Sancho-Garnier H. Lower Limb Venous Insufficiency and Tobacco Smoking: A Case-Control Study. Am J Epidemiol [Internet]. 2002 Jun 1 [cited 2020 Aug 16];155(11):1007–15.
5. Robertson LA. Incidence of varicose veins, chronic venous insufficiency and venous reflux in the general population and associated risk factors: the Edinburgh Vein Study follow up.
6. Dodd H, Cockett FB. The pathology and surgery of the veins of the lower limb. E. & S. Livingstone; 1956.
7. Mekky S, Schilling RSF, Walford J. Varicose veins in women cotton workers. An epidemiological study in England and Egypt. Br Med J. 1969;2(5657):591–595.
8. Lee W, Chung JW, Yin YH, Jae HJ, Kim SJ, Ha J, *et al*. Three-Dimensional CT venography of varicose veins of the lower extremity: image quality and comparison with doppler sonography. AJR Am J Roentgenol. 2008 Oct;191(4):1186–91.