

Doppler ultrasound evaluation of pattern of venous incompetence and relation with skin changes in varicose vein patients

Pant HP¹, Sharma S², Bhattarai S¹, Pandit SP³, Maharjan D²

¹Radiology resident, ²Consultant Radiologist, ³Associate Professor, Department of Radiology, NAMS, Bir Hospital

BACKGROUND

Varicosity of lower limb is a common problem in agricultural country like Nepal. Doppler ultrasound is a standard investigation modality for confirmation of diagnosis, evaluation of severity and venous mapping to plan treatment. We aim to find out the epidemiology, common pattern of incompetence, severity assessment by doppler and association of the important doppler variables with skin changes.

METHODOLOGY

Doppler venous study was done in 56 patients from June 2013 to July 2014. Patients with deep vein thrombosis and peripheral arterial disease were excluded. Altogether 56 patients, 96 limbs were studied. Data was entered in preformed proforma. Doppler study was conducted by senior radiologist with linear probes. Data was entered in SPSS software version 16 and statistical significance was calculated using chi square test.

RESULTS

Bilateral limb involvement was seen in 40 patients and unilateral in 16 patients only. Skin related changes were seen in 58 limbs. Saphenofemoral junction incompetence was seen in 79 (82.2%) limbs and was most common pattern of incompetence. Overall, superficial veins were involved in 88 (91.7%) limbs and deep in 30 (31.2%) limbs. Prolonged duration of varicosity (>9 year) ($p=0.000$), bilateral limb involvement ($p=0.024$), reflux in deep venous system ($p=0.002$), larger Greater Saphenous Vein (GSV) size ($p=0.003$), prolonged duration of reflux ($p=0.000$) and perforator incompetence ($p=0.002$) were associated with skin changes. GSV diameter more than 7 mm was associated with reflux significantly ($P=0.002$).

CONCLUSION

Superficial vein incompetence is common pattern compared to deep venous system. Sapheno Femoral Junction (SFJ) incompetence is the commonest pattern. Larger caliber of vein, prolonged duration of reflux, reflux in deep venous system and perforator insufficiency are significantly associated with skin changes.

Keywords: varicose vein, color doppler, saphenofemoral junction incompetence

INTRODUCTION

Varicose vein is a term for dilatation of superficial veins because of reflux in veins due to absent or incompetent valves, which occurs generally in lower limbs because of its dependant position. Venous reflux is defined in veins when the retrograde flow is present for more than 0.5 second. Varicose veins in long term lead to venous hypertension and skin changes; like edema, pigmentation and ulceration. This disease entity is termed as chronic venous insufficiency/disease(CVD). Chronic venous disease is very common problem affecting approximately 15% of men and 25% of women among general population as seen in Western studies¹. There is lack of literatures in our part defining its prevalence and pattern of reflux.

Varicosity and its skin complications are important cause of morbidity. Varicose veins can occur due to many causes which lead to incompetence in valve or pumping mechanism in lower limbs. Most of the causes are idiopathic, however in some, there may be history of deep vein thrombosis(DVT). Post thrombotic varicose vein is traditionally thought as cause of severe ulceration and lipodermosclerosis². Varicose veins are reported more in females and in left limbs^{1,3} and they are more prevalent in pregnancy, older patients, obesity and few occupational groups⁴.SFJ incompetence is the main cause of varicosity, though there are multiple possible sites of reflux including saphenopopliteal junction(SPJ), deep femoral and popliteal vein reflux, and perforators incompetence⁵. Color doppler and spectral study is gold standard for evaluation of varicose veins⁶. Doppler analysis is very important to locate the site of venous reflux, severity of reflux and venous anatomy which is important to plan surgical and even nonsurgical treatments like ablation³. On spectral analysis, longer duration of reflux and more number of perforators may be associated with more severe outcome^{3,7}. We aim to find out epidemiology of varicose

veins, pattern of varicosities, associated reflux sites, relation of size of saphenous vein and reflux severity and any factors significantly associated with complications in these patients.

MATERIALS AND METHODS

All consecutive patients sent for venous doppler study in radiology department with clinical impression of varicose vein in lower limb from 1 July 2013 to 30 June 2014 were taken as study sample. Patients with superficial thrombophlebitis, deep vein thrombosis, peripheral arterial disease and pregnancy were excluded. Sixty one patient were followed, of them 5 were excluded because of associated peripheral vascular disease. Altogether, 56 patients(96 affected legs) were studied. Patient particulars were recorded in preformed performa and doppler was conducted by senior radiologist. Duplex ultrasound was done in Toshiba Aplio 400 machine with linear transducer,9 MHz frequency. B-mode, color doppler and spectral analysis was conducted in all patients. Study was done in standing position with weight transmitted in contralateral side while examining. Both limbs were evaluated when clinically indicated. Common femoral vein(CFV), proximal GSV, SFJ, superficial femoral vein(SFV), popliteal vein (PV), SPJ, proximal small saphenous vein (SSV), perforators were studied.

The superficial and deep veins were examined for patency, competence and size. The diameters of SFV and GSV were measured just distal to level of SFJ in the groin. Similar measurements of the popliteal vein and SSV were done in the popliteal fossa. Deep venous reflux was looked in the femoral vein in the groin, popliteal vein in popliteal fossa. Incompetence was also looked for at the junctional sites i.e. sapheno-femoral junction (SFJ), sapheno-popliteal junctions (SPJ) and perforator veins. Incompetence at these sites

were assessed during Valsalva maneuver and using color doppler and spectral Doppler analysis. Reflux was established if the duration of reverse flow exceeded 500 milliseconds in the superficial veins or 1,000 milliseconds in the deep veins, as recently recommended by Labropoulos et al⁸. Time duration of reflux were also recorded. Perforators were looked for in well defined areas above knee and below knee in all sides. Perforators were specifically looked for in areas where varicosity is prominent and flow pattern/reflux, and diameter of perforators were also noted. The number and distribution of the incompetent perforators were also recorded.

Data was entered in Statistical Package for Social Sciences(SPSS) version 16. Statistical significance was checked using chi square test.

RESULTS

Of the 56 patients, 40 patients had bilateral leg involvement. Altogether 96 legs were evaluated. Males comprised 30(53.6%) cases and 26(46.4%) cases were females. Mean age of presentation was 8.8(S.D=9.8) years. Significant number of patients were farmers and housewives. Commonest occupation of patients was farmer which was of 16 patients(28.6%) in our study group(graph 1). Mean age of presentation after onset of problem was 8years(S.D.4.9).

Skin related changes/Complications were noted in 58(60.4%) of limbs, pigmentation being the commonest which was noted in 52 limbs. Six limbs had lipodermosclerosis and ulceration only. Lipodermosclerosis was noted in 31 limbs. All patients with lipodermosclerosis showed ankle edema. Only 3 patients had history of DVT. Isolated left leg was involved in 9 cases and isolated right leg was involved in 7 cases. Mean proximal GSV diameter in 96 legs

was 8.58mm(S.D.=1.4). Mean proximal superficial femoral vein diameter and small saphenous vein diameter were 10.4mm (S.D.=1.92) and 4.5mm (S.D.=0.95)mm respectively(Table 1).

Reflux was noted most commonly in SFJ. SFJ incompetence was noted in 79 limbs. Isolated SFJ incompetence was found in 48 cases(50%) and combined deep venous reflux(DVR) and SFJ reflux was noted in 24 limbs. Isolated SFV incompetence was detected only in 4 limbs. Deep venous reflux was noted in 30 limbs, however isolated deep venous reflux when seen(4 limbs) was associated with perforator incompetence(Table 2). Overall, superficial reflux seen in 91.6%(88 limbs), deep reflux in 31.2%(30 limbs) and Perforators reflux were detected in 63.5% (61 limbs). Mean duration of reflux in GSV, SFV and SSV were 1.52 secs, 1.7 secs and 1.98 secs respectively(Table 1). All these limbs with perforator showed perforators in calf. Mid calf was commonest site(43 legs,46% of cases) which was commonly associated with perforators in other areas(19 legs, 19.8% of cases) and thigh was least common which was seen in only (5 limbs,5.2% cases)(Graph 2).

Almost all perforators were noted in posteromediaside, except 5 perforators noted in lateral side near ankle. Upper calf and thigh showed no lateral perforators. Isolated perforator insufficiency was noted only in 4 limbs. Multiple perforators were noted mostly, mean number was 1.96(S.D.=1.13).

Skin changes were more seen when both lower limbs were involved with chi square value of 5.06 (P Value=0.024). Gender didn't show any correlation with complications. Patient with history of illness for more than 9 years showed more complications(P=0.000) (Table 3). GSV diameter more than 9 mm was associated with more complications(P value=0.029). With increasing duration of reflux(>2 second), GSV size also increased significantly(P=0.000).

Pattern of reflux in superficial or deep veins also showed statistical correlation with complications (P=0.002), deep venous reflux showing more complications (Table 3). Also, perforator incompetent patients had more skin related complications (P=0.003). When 2 or more perforators were involved, the association with skin changes was not statistically significant, however it was significantly associated when 3 or more perforators were involved (Table 3). GSV size more than 7 mm was associated with SFJ incompetence (P=0.001) and more or equal to 10 mm was significantly associated with complications (P=0.003). SSV size more or equal to 5mm is also strongly associated with SSV reflux (P=0.000) (Table 4).



Figure 1: Prevalence of different occupation in CVI patients

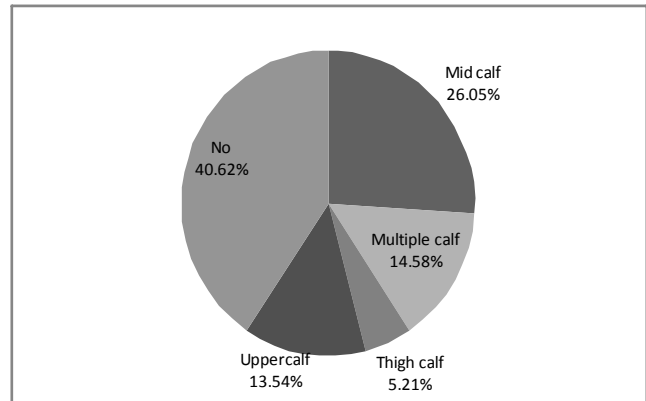


Figure 2: Prevalence of perforators and location in CVI patients

Table 1: Mean values of important doppler parameters

Parameters	Mean	S.D.
GSV diameter	8.58 mm	1.4
Duration of reflux		
superficial vein	1.53 sec	0.6
SFV diameter	10.4 mm	1.92
Duration of reflux		
in deep vein	1.7 sec	0.67
SSV diameter	4.5 mm	0.95
Duration of reflux		
in perforators	1.98 sec	0.6
Number of perforators	1.96	1.13

Table 2: Pattern/site of reflux in CVI patients

Incompetance site	Number	Percentage
Superficial system	88	91.7
Deep system	30	31.2
Perforator	61	63.5
Isolated GSV	48	50.0
GSV	79	82.2
SPJ	22	22.9
Isolated SPJ	7	7.2
Isolated SFV	4	4.1
Isolated perforator	4	4.2

Table 3: Statistical significance of epidemiological factors and doppler parameters on skin changes

Parameters	Chi square value	P value
History of CVD>9 year	15.4	0.000
Female gender	3.5	0.058
Both limb involved	5.0	0.024
Reflux in deep system	9.58	0.002
GSV>9mm	8.9	0.003
Duration of reflux>2 sec in GSV	18.2	0.000
Perforator incompetence	9.6	0.002
Perforator 2 or more	2.13	0.14

Table 4: Relationship of size of veins and reflux

Parameters	Chi square value	P value
GSV(>7mm)	10.5	0.001
SFV(>9mm)	33.9	0.000
SSV(>4mm)	17.9	0.000

DISCUSSION

Many professions as described elsewhere are risk factors for varicosity like farmers, security persons, so is obesity but we lack data regarding such epidemiological association in our part. Varicose vein was commonly found in farmers in our study probably because Nepal is an agricultural country and farmers work for prolonged hours in standing position(orthostasis). The no of males were more in our sample which is contradictory as varicosity is found more in females^{1,9}, related to effects of hormones in females^{9,10}. This may be explained by male seeking more health care as compared to females in our part.

Orthostatic position leads to constant venous pooling and damage to valves which leads to reflux in superficial

and deep veins. Venous hypertension in superficial veins transmitted through perforators during calf contraction in absence of competent valves can also lead to skin related changes. On the other hand, Post thrombotic syndrome generally leads to damage of valves in deep venous system and perforators and less in superficial venous system. But later on, superficial system also fails from the complex pathophysiology and CVD results. In our study, most cases were due to primary venous insufficiency.

Deep venous reflux was noted in 30 limbs(31.2% of cases), however most of these cases showed associated superficial reflux and perforator insufficiency. These are consistent with previous findings^{11,12}. All cases of post thrombotic reflux showed deep venous reflux. Most cases in previous studies also showed deep venous reflux in post thrombotic cases¹¹. Saphenofemoral junction incompetence was most common pattern(50%) which was also commonly associated with SPJ, SFV and perforator incompetence. Site of incompetence in our study was comparable to previous studies^{3,7,12,13}. Perforator insufficiency(63.5% of cases) was mostly associated with incompetence in superficial and deep venous system, however isolated perforator insufficiency was seen in only 4.1% cases. Perforators incompetence can be the cause of varicose veins but themselves occur because of other reflux related to orthostasis, so overall isolated perforator incompetence is low, which was also found in our study. Perforators were mostly located in mid(46% of cases) and upper calf(28% of cases). Perforators were mostly found in posteromedial aspect which is well established and described elsewhere³, but lower calf perforators were very less in our patients in contrast to some other studies³. Perforators incompetence leading to more severe skin changes has been documented elsewhere^{3,7} and we found the same. Generally multiple perforators(3 or more) were noted in those with complications; however, 2 or more

perforators were not associated with skin changes which was reported in some studies⁷.

Diameter reflux relationship in superficial veins have been extensively studied^{14,15}. GSV diameter more than 7mm near SFJ is associated with reflux in most limbs¹³ which was also found in our study. We also found that SSV diameter more than 4 mm is associated with reflux, which supplements those studies. Bilateral leg involvement was associated with skin changes as compared to single leg involvement. This may be related to late presentation in patients with varicosity, presence of systemic disease/problems like obesity, family history of venous disease, chronic airway disease and higher age in those patients. Age as independent risk factor for severe disease has also been described¹⁶. We assessed different doppler parameters which may be associated with increased skin changes. Larger GSV, delayed presentation to hospital, presence of deep venous reflux, presence of perforators were associated with more skin changes. These were previously reported^{13,7,8}. We also found more skin related changes if there is increased duration of reflux which was not statistically significant in study by Irodi A etal³.

CONCLUSION

Bilateral venous involvement in common than unilateral venous involvement in varicose vein disease. Farmers are most common group to be affected. Superficial vein incompetence is common pattern as compared to deep vein incompetence. SFJ incompetence is commonest pattern among junctional incompetence, though perforators incompetence is associated in most cases. Larger caliber of vein, prolonged duration of reflux, reflux in deep venous system and perforator insufficiency are significantly associated with skin changes.

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