ORIGINAL ARTICLES

Frequency of Sapheno-Femoral Junction and Sapheno-Popliteal Junction Incompetence on Duplex Ultrasonography in Patients with Varicose Veins

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ABSTRACT

Objective: To determine frequency of sapheno-femoral junction (SFJ) and sapheno-popliteal junction (SPJ) incompetence on duplex ultrasonography in patients with varicose veins.

Study Design: Cross-sectional study.

Place and Duration of Study: Shaikh Khalifa Bin Zayed Al-Nahyan/Combined Military Hospital, Rawalakot, Azad Jammu & Kashmir, from Aug 2019 to Feb 2020.

Methodology: A total of 70 patients were selected using non-probability, consecutive sampling. After ethical approval, informed consent and relevant history taking, duplex ultrasonography (DUS) was done in standing and supine positions in patients with varicose veins, fulfilling inclusion and exclusion criteria. Presence or absence of SFJ and SPJ incompetence was assessed.

Results: Mean age was 41.99 ± 11.08 years with 36 (51.43%) patients between 36-50 years. Mean duration of disease was 6.33 ± 2.29 months while 47 (67.14%) patients had symptoms for more than 6 months at the time of presentation. Occupation wise, 40 (57.14%) patients were field workers while 30 (42.86%) were office and domestic workers. Isolated SFJ, SPJ and combined junction incompetence were found in 27 (38.57%), 20 (28.57%) and 23 (32.86%) patients respectively. Both SFJ and SPJ incompetence were more in obese patients (78.6% and 71.4% respectively) as compared to non-obese patients.

Conclusion: Frequency of SFJ incompetence was more than SPJ incompetence on DUS. Obesity, male gender and prolonged motionless standing predispose to the development of varicose veins. Preventive measures and early diagnosis can decrease disease burden.

Keywords: Duplex ultrasonography (DUS), Incompetence, Sapheno-femoral junction (SFJ), Sapheno-popliteal junction (SPJ), Varicose vein.

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INTRODUCTION

The venous system of lower limbs consists of superficial (great saphenous vein-GSV and small saphenous vein-SSV), deep and perforating veins. Superficial veins have one way valves which prevent reflux from deep to superficial system.[1] Sapheno-femoral junction (SFJ), sapheno-popliteal junction (SPJ) and perforators, are the common sites of reflux.[2] Ambulatory venous hypertension results in varicose veins.[3] Abnormally dilated, firm, thickened and tortuous superficial veins appearing on the skin due to pooling of blood owing to insufficient valves are referred as varicose veins.[4] Most of the patients with varicose veins and valve insufficiency present with subjective symptoms of pain, burning, aching, tenderness, cramping, muscle exhaustion, restless leg and soreness.[5] Intrinsic valvular insufficiency causes primary varicose veins while deep vein thrombosis (DVT), pregnancy, pelvic tumors or trauma etc. are the causes of secondary varicosities.[6] The risk factors include age, gender, hereditary, obesity, physical inactivity, contraceptive pills and long standing durations.[7]

Duplex ultrasonography (DUS) is the primary non-invasive diagnostic imaging technique for identifying venous pathologies like reflux and valvular insufficiency etc.[8] It has 95% specificity and 100% sensitivity in diagnosing varicose veins and venous reflux.[9] Superficial venous insufficiency (SVI) increases venous blood volume and pressure, carried across incompetent valves in reverse direction which is detected by DUS.[10]

Varicose veins represents a globally prevailing disease which is more prevalent in individuals whose daily life involves prolonged motionless standing. Therefore, in our population, field workers like law enforcement agencies, police forces, manual labor workers, field engineers and security guards are at increased risk due to their nature of duties involving prolonged standing. This study was directed to evaluate

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occurrence of incompetence at SFJ and SPJ on duplex ultrasonography. Early diagnosis of varicose veins and valve incompetence ensures prevention and early management, which can decrease disease burden and reduce morbidity in society.

METHODOLOGY

A cross-sectional study was carried out at Shaikh Khalifa Bin Zayed Al-Nahyan/Combined Military Hospital, Rawalakot, Azad Jammu & Kashmir, from August 2019 to February 2020. A sample of 70 patients was estimated using WHO sample size calculator with confidence interval (CI) =95%, anticipated population proportion=23.4%[2] and absolute precision=10%. Study population was recruited using non-probability, consecutive sampling. Ethical approval was obtained from Institutional Review Board (Ref # SKBZ/CMH/ERC/19/07/R010).

Inclusion Criteria: Patients between 20-65 years of age, with the clinical diagnosis of unilateral lower limb varicose veins and disease duration of more than 2 months were included in the study.

Exclusion Criteria: Patients with the secondary causes of varicosities like history of trauma, previous surgery, recurrent varicose veins, bilateral lower limb involvement, concurrent pregnancy, pelvic tumors, DVT and other comorbid conditions like diabetes mellitus and hypertension were excluded from the study.

The patients predominantly consisted of field workers, who were subjected to tough manual physical duties. Admitted patients were referred by clinicians to the radiology department for the assessment of venous system of the lower limb. Patients were recruited after informed written consent. A pre-designed proforma was used to record pertinent history, which included the patients' general information, demographics, medical and surgical history. Data was collected by performing DUS of the affected lower limb.

All the Duplex scans were performed by a consultant radiologist using ALOKA Pro-Sound SSD- 5500 Japan ultrasound machine with 7.5 MHz linear array transducer. Duplex scan of the patients was performed in standing and supine positions and with various maneuvers modifying flow dynamics like Valsalva maneuvers and distal thigh or calf manual compression, to improve the diagnostic abilities of DUS2. The leg under examination was turned outwards for tracing the course of GSV along thigh and calf. SSV was examined on postero-lateral aspect of calf. The course of GSV and SSV was tracked, assessed and findings for presence or absence of isolated or combined junction incompetence were recorded. SFJ incompetence, SPJ incompetence and combined junctions' incompetence were documented by the radiologist using pulse wave and colour Doppler with a retrograde flow/reflux time of >0.5 seconds considered as the cut of value.[11]

Collected data were entered into the Statistical Package for Social Sciences (SPSS) version 23. The data was summarized using descriptive and inferential statistics. Mean and standard deviation were calculated for the duration of disease, age and body mass index while percentage and frequency were computed for gender, occupation, parity and junction incompetence. Chi-square test was applied to see the statistical difference. The *p*-value of ≤0.05 was considered statistically significant.

RESULTS

The age range of the patients was from 20-65 years, with the mean age of 41.99 ± 11.08 years. In our study, 48 (68.57%) were males while rest were females. Mean disease period was 6.33 ± 2.29 months. Predominantly the patients had BMI in healthy category 29 (41.4%) followed by overweight category 27 (38.6%), while only a small percentage of patients were in obese category (Table-I).

Table-I: Baseline characteristics of the patients.

Parameters	n (%)
Age (Mean ± SD)	41.99 ± 11.08 years
Gender	
Male	48 (68.57%)
Female	22 (31.43%)
Duration of Disease (Months) 6.33 ± 2.29	
<6 months	23 (32.86%)
>6 months	47 (67.14%)
Weight/ BMI Index(kg/m²)	**27.9 ± 2.14**
Normal Weight (BMI-Index= 18.5-24.9)	29 (41.4%)
Overweight (BMI-Index= 25-29.9)	27 (38.6%)
Obese (BMI-Index >30)	14 (20%)
Parity (Females) n=22	
Nulliparous	5 (22.7%)
Uniparous	8 (36.4%)
Multiparous	9 (40.9%)
Occupation	
Field workers	40 (57.14%)
Office workers	19 (27.14 %)
Domestic Workers (House-hold work)	11 (15.71%)
Hours of Motionless Standing (average no of hours/day)	
1-2 hours	10 (14.6%)
2-3 hours	8 (11.3%)
3-4 hours	4 (5.6%)
>4 hours	48 (68.5%)

Majority of the females presenting were married and had one or multiple children, only 5 (22.7%) had no children. According to occupation, 40 (57.14 %) of the patients were field workers while the rest were office or domestic workers. The details of participant characteristics were listed in Table-I.

In our study, all the patients had unilateral varicose veins on DUS and were assessed for presence or absence of junction incompetence, among them 27 (38.57%) had isolated femoral junction incompetence, 20 (28.57%) had isolated popliteal junction incompetence and 23 (32.86%) had combined junction incompetence. The details of frequency of reflux at these sites were outlined in Figure-1.

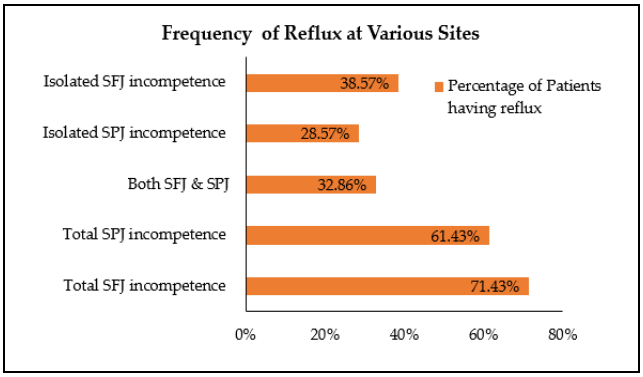

Figure-1: Frequency of sapheno femoral and sapheno popliteal junction incompetence in patients with primary varicose veins.

Chi square test showed SFJ incompetence was significantly more in males, field workers and in 36-50 years age category while SPJ incompetence was significantly predominant in males, office workers and 36-50 years age category. The detailed results were shown in Table-II. The association of BMI and junction incompetence showed that SFJ and SPJ incompetence were more in patients with increased BMI while those with healthy BMI had significantly less occurrence of incompetence (Figure-2).

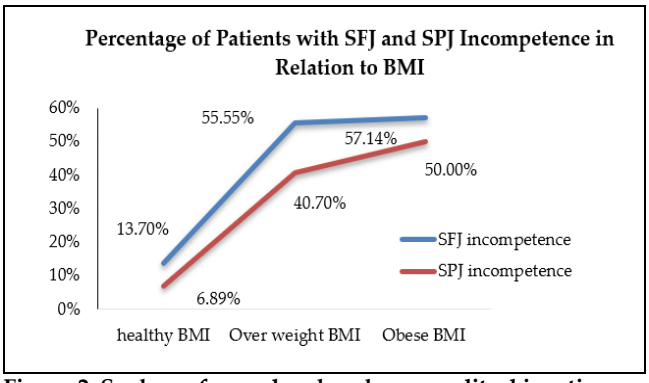

Figure-2: Sapheno-femoral and sapheno-popliteal junction incompetence in relation to body mass index.

DISSCUSSION

Chronic venous diseases are one of the most common medical conditions involving lower limbs. Various diagnostic methods ranging from clinical assessment, handheld Doppler, DUS to invasive venography technique are used to assess lower limb varicosities. In past, venography was gold standard for detecting varicosities but it became obsolete as it poses life-threatening risk to patients for diagnosing non-life-threatening disease due to invasive procedure, use of contrast medium and inability to elicit reflux.[3] Clinical evaluation of varicosities is primarily related to surgeon's examination proficiency. With adjunct use of hand held Doppler, diagnostic accuracy is enhanced but still there is a chance of false positive error, there by compromising reliability of diagnosis.[12] DUS is a compact

Table-II: Association of sapheno-femoral and sapheno- popliteal junction incompetence with age, gender and occupation.

Parameters	Isolated Sapheno-Femoral Junction Incompetence		*p*-value	Isolated Sapheno-popliteal Junction Incompetence		*p*-value
	Yes	No		Yes	No	
Age (in years)						
20-35	06 (42.9%)	08 (57.1%)	0.004	03 (21.4%)	11 (78.6%)	0.03
36-50	13 (36.1%)	23 (63.9%)		10 (27.8%)	26 (72.2%)	
51-65	08 (40%)	12 (60%)		07 (35%)	13 (65%)	
Gender						
Male	20 (41.67%)	28 (58.33%)	0.05	11 (22.9%)	37 (77.1%)	0.01
Female	07 (31.82%)	15 (68.18%)		09 (40.9%)	13 (59.1%)	
Occupation						
Field workers	15(37.50%)	25 (62.50%)	0.02	08 (20%)	32 (80%)	0.006
Office workers	08 (42.1%)	11 (57.9%)		09 (47.4%)	10 (52.6%)	
Domestic workers	04 (36.36%)	07 (63.6%)		03 (27.2%)	08 (72.7%)	
BMI Index (kg/m²)						
Normal weight (Index=18.5-24.9)	4 (5.71%)	25 (35.7%)	0.002	2 (2.9%)	27 (38.6%)	0.02
Overweight (Index=25-29.9)	15 (21.4%)	12 (17.1%)		11 (15.7%)	16 (22.9%)	
Obese (Index >30)	8 (11.4%)	6 (8.6%)		7 (10.0%)	7 (10%)	

and transportable device, employs a non-invasive technique and is repeatable, and is rather cost effective tech-nique with safety and patient acceptance for the procedure is high.[13]

Vashist *et al*, and Prasad reported that duplex ultrasonography maps venous tracks and elicit valvular functioning with high diagnostic precision of 94%, 100% and 98% in their studies.[11,14] There is a close congruence between the results reported by Khaira *et al* for the venography in reporting SPJ incompetence (20%).[12] Hence, due to provision of accurate results with patient's safety, DUS has eventually become the leading diagnostic tool for superficial venous insufficiency (SVI) assessment.[15]

Patients in our study were aged between 20-65 years with predominance in middle-aged group i.e. 36-50 years group. Various studies world-wide have reported mean age of cohort as 69 ± 3.2 years, 44.5 ± 5.9 years and 52 ± 2.8 years.[16] A much lower age range in our study as compared to international statistics might be attributed to the presenting study, which predominantly consists of field workers, whose job demands protracted duty schedules and strenuous physical activities as compared to office workers having sedentary lifestyle. This explains an early onset of varicosities and its symptoms in the field workers as compared to general population.[17] It is implicit from the results of this study that environmental factors play a vital role in development of varicosities in addition to genetic causes.[18,19]

Our study had a definite male predominance (68.57%) with ratio of 2.2:1 between males and females. Two studies conducted in England reports that 40% and 28% males and 60 % and 72% females present with varicose veins respectively.[20] Prasad, in his research on the Indian population and Konoeda's work on European population stated that 78% and 71% females present with varicosities as opposed to only 22% and 28% males.[14,16] According to western studies, females present early due to cosmetic concerns and are more prone to developing varicosities due to child bearing which subjects them to increased pelvic pressure and weight bearing over pelvis and lower limbs.[3] Conversely, our study had male majority because of cultural influences and work habits involving prolonged motionless standing for males. Field workers form a predominant group of patients and they have prolonged duties involving heavy weight bearing and motionless standing which increases their risk of developing varicose veins.[21] Congruent with the results of an Indian study, female presentation is scarce because of low socioeconomic conditions.[13] Furthermore, females usually present when symptoms begin to develop or complicate, thereby concealing the enormous hidden disease burden and reflecting only a small percentage in majority of the studies.

Most of the patients in our study had varicose veins for >6 months at the time of clinical presentation. This closely correlates with the results reported in an Indian study.[11] Typically, patients present when symptoms of varicose veins begin to bother them.

SFJ, SPJ and combined junction incompetence frequency in our study were as 38.5%, 28.5% and 32.68% respectively. Holistically across the world, SPJ incompetence ranges between 20-40% while SFJ incompetence is more prevalent and has around 60-86.79% occurrence. A study conducted in Punjab, Pakistan reflected junction incompetence of 86.79% at SFJ and 30.19% at SPJ sites.[22] Similarly 35.9% and 23.4% junction incompetence was reported at SFJ and SPJ sites in another study conducted in Pakistan.[2] Khaira *et al*, and Drake in their respective studies reported incompetence at SFJ to be 72%, 71% and 80% respectively in their studies.[17,23] Studies conducted in UK, India and Spain and reported 77%, 47% and 65.30% incompetence at SFJ site respectively.[14,24,25] The statistics reported in the studies worldwide reflect more prevalence of SFJ incompetence in contrast to SPJ incompetence.

This study reports a direct relation between BMI and junction incompetence. Both SPJ and SFJ incompetence were more in obese patients 78.6% and 71.4% respectively, as compared to overweight and normal BMI patients in which the incidence was much lower. Youngs *et al*, in their study reported that advancing age, family history, obesity, smoking and pregnancy increase the risk for development of varicose veins. [3] The results reported in this study showed close similarities with multiple countrywide and worldwide studies, which implicitly authenticate the use of DUS for varicose veins assessment and substantiate its multifactorial etiology. The disease spectrum around the globe is somewhat similar. Multiple environmental variants like obesity, extended duration of standing, parity, life style reformations and weight bearing in addition to genetics, financial capability for seeking treatment affect the disease development and time of patient presentation.[3]

This study concludes that frequency of incompetence at SFJ is more common as compared to SPJ site. Obesity increases the risk of development of both SFJ

and SPJ incompetence. Prolonged standing is one of the contributory factors of development of varicose veins and field workers are at a greater risk of developing varicosities and junction incompetence. DUS can be used for early and precise detection of varicosities to reduce morbidity and complications and ensure better health care.

LIMITATIONS OF STUDY

Being a single centre study with small sample size in a controlled setting, the results of this were not generalizable. A similar study can be replicated at a large scale for validation of our finding. Comparison of unilateral and bilateral varicosities along with frequency of perforator incompetence can also be explored. Duplex scan can be used for quantification of disease severity. Thus, our study provided a platform for in-depth exploration of varicose veins at population level.

CONCLUSION

Frequency of sapheno-femoral junction incompetence was more than sapheno-popliteal junction incompetence on Duplex ultrasonography. Obesity, male gender and prolonged motionless standing predispose to the development of varicose veins. Preventive measures and early diagnosis can decrease disease burden.

Conflict of Interest: None.

Authors' Contribution

MHR: Conception & design, Literature review, Data collection, abstract and paper drafting, AURS: Conception & design, critical review, IMQ: Paper drafting, critical review, SS: Literature review, data entry, proof reading, MS: Data analysis, paper drafting.

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