

## Venous Diseases of Lower Limbs: Retrospective Analysis of Duplex Ultrasound Findings

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### Abstract

**Introduction:** Venous pathologies of the lower limb include acute deep venous thrombosis and chronic venous insufficiency. Deep vein thrombosis can cause pulmonary embolism, which is a serious medical emergency. Deep venous thrombosis usually manifests with limb pain and swelling in high risk group whereas chronic venous insufficiencies manifests with limb swelling, telangiectasia, varicosities and skin changes including ulceration which also cause serious morbidity. The aim of this study was to retrospectively analyze the findings of duplex ultrasound in patients with venous disease of lower limbs.

**Methods:** A retrospective hospital-based study in 386 patients was carried out analyzing the records of duplex ultrasound findings at Kathmandu Imaging Center, Maitighar, Kathmandu, Nepal. Clinical information and Duplex ultrasound findings including status of deep veins, superficial veins, sapheno-femoral junction, sapheno-popliteal junctions and perforators were reviewed. Associated findings of deep vein thrombosis and venous incompetence were also noted.

**Results:** The patient population composed of almost equal numbers of males 200(52%) and females 186(48%). Majority 197(51%) of venous Duplex examination was normal. 129(33%) of patient had chronic venous insufficiency. Similarly, 60(15.5%) of patients had deep vein thrombosis and among these deep vein thrombosis patients, 3(5%) had chronic venous insufficiency. Mean age of patients with deep vein thrombosis was  $52.4 \pm 17.5$  years. Males predominantly suffered from deep vein thrombosis with male to female ratio of 1.9:1. However, chronic venous insufficiency was seen in slightly younger patients with mean age of  $40.8 \pm 14.7$  years and males were more frequently affected by chronic venous insufficiency with male to female ratio of 1.3:1.

**Conclusion:** Venous duplex study is an essential tool for evaluation of lower limb venous pathology. From the study, it can be concluded that, the commonest abnormality found in the patient were varicosity, deep vein thrombosis and chronic venous insufficiency.

**Keywords:** CVI, Duplex ultrasound, DVT, Varicose vein, venous disease

### Introduction

Deep venous disease of lower extremity is highly prevalent, economically burdensome, morbid, and debilitating condition.<sup>1</sup> According to the Vascular Disease Foundation, "By the age of 50, nearly 40 percent of women and 20 percent of men have significant leg vein problems."<sup>2</sup> Venous diseases include varicose veins (dilated tortuous veins), deep vein thrombosis (DVT), superficial vein thrombosis or superficial thrombophlebitis and sequelae of old chronic venous insufficiency (CVI).<sup>3</sup>

#### DVT

DVT is a blood clot that forms in the veins of the

leg.<sup>4</sup> Pulmonary embolism (PE) is a life-threatening complication of DVT.<sup>4</sup> Death can occur when the venous thrombi break off and form PE, which pass to and obstruct the arteries of the lungs.<sup>5</sup> Long distance flights may contribute to the risk of DVT. Other risk factors for DVT include coronary artery disease, being overweight or obese, cigarette smoking, pregnancy, taking a high-dose combined oral contraceptive pill, family history of DVT and recent surgery or injury.<sup>4</sup> More people suffer from DVT annually than from heart attack or stroke. DVT affects men and women, all ethnic groups and all social levels. It is seen most often in adults over the age of 40, and more frequently in elderly, but can occur at

any age (DVT and air travel).<sup>6</sup> Approximately 300,000 to 600,000 people are affected by DVT/PE each year in the United States, and 60,000 to 100,000 Americans die of DVT/PE. <sup>7</sup>Some of the recent studies published from other Asian countries have shown that DVT is not a rarity in Asian patients as it was thought earlier. The incidence of DVT in the general population has been estimated to be 80-100/1,00,000 annually in the western societies, 4-75/1,00,000 in South-Asia.<sup>8</sup>

### CVI

CVI is a common cause of leg pain and swelling, and is commonly associated with varicose veins. It occurs when the valves of the veins do not function properly, and the circulation of blood in the leg veins is impaired. Damaged valves in the veins or blockage in the vein may cause CVI. Over time, CVI may result in varicose veins, swelling and discoloration of the legs, itching and the development of ulcers near the ankles.<sup>9</sup> The normal flow of blood from the veins in the leg is upwards towards the heart for which calf muscles and the muscles in the feet need to contract with each step to squeeze the veins and push the blood. To keep this unidirectional blood flow, the veins contain one-way valves. These valves are made of two very thin flaps of tissue, which meet in the middle to stop the backward flow of blood. When the venous valves are abnormal or have been injured, venous incompetence or reflux can occur allowing the blood to reflux back into the legs. Venous reflux may occur in the superficial veins, the deep veins or the perforating veins. If the lumen of the veins is scarred or blocked, it prevents normal venous outflow. Any or all of these problems can cause venous hypertension within the veins which can push fluid and protein out of the vein into the interstitial spaces which causes skin and tissue changes associated with chronic venous insufficiency.<sup>11</sup> Two other major contributors to venous insufficiency are venous reflux and venous obstruction.

Chronic venous insufficiency occurs when these valves become damaged, allowing the blood to leak backward. Valve damage may occur as the result of aging, extended sitting or standing or a combination of aging and reduced mobility. CVI most commonly occurs as the result of a clot in the deep veins of the legs, which is known as deep vein thrombosis (DVT). CVI also results from pelvic tumors and vascular malformations, and sometimes for unknown reasons. Failure of the valves in leg veins to hold blood against gravity leads to sluggish movement of blood, resulting in swollen legs. Chronic venous insufficiency that develops as a result of DVT is also known as post-thrombotic syndrome. As many as 30 percent of people with DVT will develop this problem within 10 years after diagnosis.<sup>10</sup>

The prevalence of venous insufficiency increases with

age. Peak incidence occurs in women aged 40-49 years and in men aged 70-79 years. The frequency of venous insufficiency is believed to be higher in Westernized and industrialized nations than in developing nations, most likely because of differences in lifestyle and activity.<sup>12</sup> It has been estimated that 2-5% of all Americans have some changes associated with CVI. Published results from the prevalence of varicosities range from 7% to 60% in the adult population, with most studies shown clinical varicose reflux in about 40% of the population. Venous stasis ulcers affect approximately 500,000 people. The mean incidence of hospital admission due to CVI is 92 per 100,000 admissions.<sup>12</sup>

More than 80% of varicose veins seen on the leg are caused by venous insufficiency or a leaky valve in the GSV, at its junction with the common femoral vein.<sup>14</sup> Estimates of the prevalence of varicose veins vary widely from 2-56% in men and from 1-60% in women.<sup>13</sup> Spider veins occur much more frequently in women.<sup>9</sup>

The main aim of the study was to retrospectively analyze the findings of duplex ultrasound in patients with venous disease of lower limbs.

### Methods

A retrospective hospital-based study was done among 386 patients with a mean age of (16.8%) and median of 44 (25%) using records of duplex Ultrasound examination (Acuson X 500 superficial linear vascular probe VF 8-12 siemens company) at Kathmandu Imaging Center, Maitighar, Kathmandu, Nepal from January 2010 to December 2012. Verbal consents were taken from each patient and none was forced to participate. The confidentiality in terms of information disclosed and identity of patients was ensured. The venous duplex scanning had been performed by single experienced Radiologist and included evaluation of one or both lower extremities as requested in the referral. Clinical information, duplex findings including status of deep veins, superficial veins, sapheno-femoral junction, sapheno-popliteal junctions and perforators were reviewed. Associated findings of DVT and venous incompetence were also noted. Data was entered in a predesigned performa. (Data analysis was done by using IBM SPSS V20.) Numeric variables were presented as mean and standard deviation and categorical variables were presented as number and percentage.

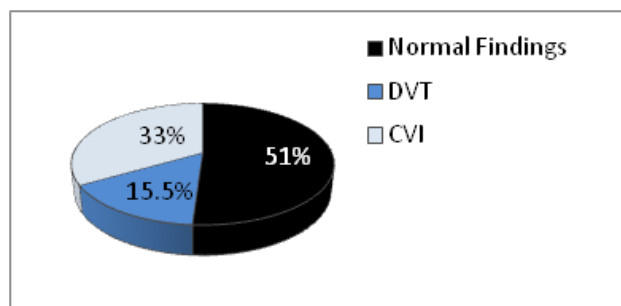
### Results

The patient population of 386 composed of 200 males (52%) and 186 females (48%). Main indication performing the venous duplex examination was suspicious of DVT in 266 (69%) patients, where

patients had limb pain in 199 (52%), pain and swelling in 67(17%).

In rest of the patients, duplex ultrasound was performed for swelling alone or in clinical setting of cellulitis or leg ulcers for venous insufficiency. Right limb was examined in 152(39%), left limb in 130(34%) and both limbs were examined in 104 (27%) patients.

The majority 197(51%) of the Doppler examination was normal. 129 patients (33%) had CVI. Similarly, 60(15.5%) of patients had DVT and among them, 3 patients (5%)also had CVI. (Fig. 1).



**Figure 1. Duplex Ultrasound Findings**

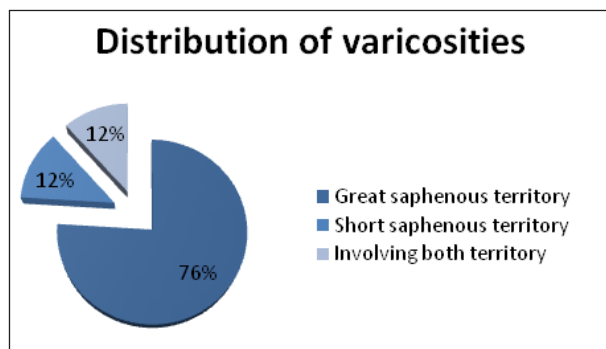
#### DVT

Mean age of patients diagnosed to have DVT was  $52.4 \pm 17.5$  years. Males predominantly suffered from DVT with male to female ratio of 1.9:1. 60 patients (15.5%) had DVT and among them 3 patients (5%) had CVI as well. Acute DVT was seen in 55 (91.6%) of patients. DVT was more frequently seen in left limb 35(58%) as compared to right limb 20(33%). DVT was seen in both lower limbs in 5 patients (8%). Superficial vein thrombosis associated with DVT in 14 patients (22%). DVT can involve in any part of the deep venous system of lower limb. Most common involved vein was popliteal (33; 52.4%) followed by common femoral (31; 49.2%) and superficial femoral vein (30; 47.6%). Calf veins (6; 9.5%) and pelvic veins (3; 4.8%) were relatively less commonly involved.

#### CVI

CVI was seen in younger patients as compared to DVT with mean age  $40.8 \pm 14.7$  years. As DVT males were more frequently affected compared to females with male to female ratio of 1.3:1. Similarly, 129 patients (33%) had CVI. Right leg was affected in 53(41%) patients and left involved in 46(36%) patients. Venous incompetence was seen bilaterally in 30 (23%) patients.

Varicosities were identified in great saphenous vein territory in 98(76%) patients and short saphenous territory in 16(12%) patients and both venous territory in 15(12%) patients (Fig. 2).



**Figure 2. Distribution of Varicosities**

Incompetence of sapheno femoral junction was associated in 98(76%) patients, sapheno popliteal junction in 25(19%) patients and incompetent perforators were noted in 49(38%) patients. Among CVI patients, 3(2.32%) had varicosities and 8 patients (6.2%) had superficial vein thrombosis.

#### Discussion

Ultrasonography has become the primary imaging modality of screening for lower extremity DVT in high-risk patients.<sup>15</sup> DVT is the most common indication for venous ultrasound examination of lower limbs. The most common indication for venous duplex Ultrasound was Clinical suspicion of DVT in patients presenting with pain and swelling. In our study, most patients with clinical suspicion of DVT had negative Duplex scan, and only 20 percent had DVT. Previous USG studies showed clinical findings to be correct in approximate 42 percent of patients<sup>16</sup>, which is higher as compared to our study, probably representing overuse of duplex ultrasonography. Clinical findings have a low diagnostic accuracy with disease entities like thrombophlebitis, Baker's cyst which have overlapping features.<sup>15, 17</sup>

In our study, DVT was seen in older patients with mean age of 52 years. The findings are consistent with the previously established fact that the risk of DVT increases with age with rapid rise in incidence after 45 years<sup>18</sup>. Also the morbidity of DVT increases with age<sup>18</sup>, however our study did not analyze the outcome of the patients. Previous studies also showed the increase in thromboembolic disease with age was mainly due to rise in PE.<sup>19</sup> DVT was seen in males more frequently, almost twice as in females in the present study. Previous studies also showed slight male predominance in the occurrence of DVT.<sup>18, 19, 20</sup> Our study showed higher frequency of left lower limb involvement as compared to right limb. Superficial venous thrombosis was associated with DVT in 22% of patients in our study. The association between deep and superficial venous thrombosis has been noted by various authors with varying frequency ranging from 5-40%, which is also

consistent with the results of our study.<sup>21, 22, 23</sup>

The mean age of patients with varice was 40 years which is similar to epidemiological study done in Edinburg in 2002. They established the increase in incidence of varicosities with age.<sup>24</sup> Males were slightly more affected than females in our study which is against the classical teaching of disease being more common in females.<sup>25, 26, 27</sup> However recent larger epidemiological study showed the condition to be more prevalent in males as with our study.<sup>24, 28</sup> Pregnancy, age, gender, prolonged standing posture, smoking, obesity have all been identified risk factors for chronic venous insufficiency.<sup>25, 26, 27</sup> However the presence or absence of risk factors were not studied in our study. Varicosities along the great saphenous venous territory was the commonest pattern of venous insufficiency which was associated with saphenofemoral incompetence. Incompetent Perforators were also noted in almost half of the patients (38%). The results are similar to the Edinburg Vein study where great saphenous vein insufficiency was the commonest pattern, true perforators, however not analysed.<sup>24</sup> Incompetent perforators have been seen to be associated with venous insufficiency in other studies. Also the presence and number of incompetent perforators were shown to correlate with severity of venous insufficiency. Incompetent perforator's have been shown to be associated with incompetence deep vein also.<sup>29</sup> The presence of deep venous insufficiency were not studied in our study. Similarly the severity of venous insufficiency was also not studied.

## Conclusion

The finding of the study showed the common abnormalities seen in the patients with lower limb venous diseases were varicosity, DVT and CVI respectively. The older patients suffered from DVT and varicosity was seen more in younger patients. Clinically suspected lower limb venous pathology must be subjected to duplex venous study. It is cost effective, commonly available, and easy to perform. It is highly sensitive and specific to evaluate lower limb DVT and chronic venous insufficiency.

**Conflict of interests:** None Declared

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