Transverse Flatfoot is a Potential Risk Factor for Development of Varicose Veins in the Lower Extremities of Middle-Aged Women

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Abstract

Objectives: To evaluate the effect of transverse flatfoot on the severity of varicose veins in the lower extremities (VVLE) of middle-aged women.

Materials and Methods: This was a cross sectional study which included 50 women between 39-54 years old who were scheduled for their routine care outpatient visit for their varicose vein lower extremity (VVLE) disease at the Mirovtseva hospital, which is affiliated with Saratov State Medical University (SSMU). Both orthopedic and vascular surgeons examined all patients. Patients were excluded, if they were diagnosed prior with any of the following conditions: veins affected by thrombosis, post-thrombophlebitic disease, isolated severe varicose transformation of the main trunk of the great saphenous vein at hip level, ectasia and ultrasound signs of valvular insufficiency of the iliac and deep femoral veins, as well as women with clinical manifestations of chronic venous disease of the C4 to C6 categories by CEAP classification. All patients underwent triplex scanning (TS) ultrasound test of the lower extremities. All images were acquired on the Philips HD 11 XE scanner and expert class linear (2-5 MHz) transducer was utilized for all ultrasound tests.

Results: The VVLE was found in majority of patients: out of 50 patients initially screened for this study, 48 patients have had clinics symptoms of varicose vein disease in their limbs with co-existent flatfoot condition and were included into final analysis, which had resulted in 88 lower limbs qualified after vascular surgeon clinical examinations and TS test of the lower limbs (96% participation rate). Varicose transformation of reticular or saphenous veins, corresponding to C1 category by CEAP classification, was found only in 3 out of 48 examined subjects (6%) with 6 of the lower limbs affected by venous disease. The C2 category of venous disease by CEAP classification was detected in 36 patients with 68 lower limbs out of 48 assessed subjects (75%). Clinical manifestations of C3 category of venous disease were detected in 9 women with 14 lower extremities affected (18.75%). There was no more severe degree of venous disease observed in this study. TS ultrasound of superficial and deep veins of the lower limbs revealed varicose transformation in the great saphenous vein in 43 women. In majority of cases expanded and/or incompetent perforating veins were detected (86% noted in 60 of the lower limbs). Small saphenous veins were less often affected: as observed in 8 patients only out of 48 (16%) with 10 lower limbs examined. Also noteworthy was ectasia of shin vein in 33 women (66%) with 46 of the lower limbs examined. The most common cause of deep vein extension was attributed to ectasia of medial sural veins (observed in 26 patients out of 48 (52%) with 32 of the lower limbs examined. Ectasia of soleus veins was detected in 24 patients out of 48 (48%) with 30 of the lower limbs examined.

Conclusion: Transverse flatfoot is a potential risk factor in VVLE in middle-aged women. Despite an active lifestyle flatfoot was found to be associated with VVLE in 96% of cases. The main cause of VVLE was attributed to the reflux in the great saphenous vein, and in some occasions the expansion of perforators was observed. In addition, ectasia of deep shin veins was detected in 66% of analyzed subjects, which considerably affects patients’ quality of life. Based on the finding of this study women diagnosed with flatfoot and at risk for development of varicose vein disease should be screened once a year prophylactically to prevent further exacerbation of venous disease.

Keywords: Flatfoot; Varicose veins; Lower extremities; Risk factors for venous diseases
Introduction

The varicose veins disease is very common in modern society. Incidence rate of varicose veins vary widely from 2% to 56% in men and 1% to 60% in women worldwide [1]. According to the National Women’s Health Information Center as many as 60% of all American adults have some form of varicose veins. However, women are more affected by this disease, on average by 50% as compared to men [1]. At our institution, which is located in Eastern Europe, we treat similar population of patients with chronic venous diseases. In recent studies it was noted that half of all examined patients with venous problems were office workers and people who stand on their feet for prolonged periods of time due to their occupation [1,2]. Moreover, 81.2% of patients with varicose disease are females as observed in a recently conducted study called SPECTRUM [2]. In this study only 25.8% of patients were reported to have flatfoot as co-existent disease [2]. Criqui M.H. et al. [3] noted that office employees have a combination of risk factors for varicose diseases such as family history venous disease, hypodynamia, flatfoot condition, obesity, etc [4]. We examined our population of female patients with varicose vein disease and attempted to find correlations between flatfoot condition and venous system diseases.

Materials and Methods

Study design and procedures

This was a cross sectional study which included 50 women between 39-54 years old (average age was 43.5 years) who were scheduled for their routine care outpatient visit for their varicose vein lower extremity (VVLE) disease at the Mirotvortseva hospital, which is affiliated with Saratov State Medical University (SSMU). There was no randomization applied (Figure 1). In accordance with Declaration of Helsinki, Institutional Review Board (IRB) approval and informed consents from each individual patient were obtained prior to any study procedures been performed. Both orthopedic and vascular surgeons examined all patients. The examination included: physical exam, ultrasound test and orthopedic assessment. The physical exam consisted of the following assessments: pitting or non-pitting edema, skin conditions (i.e. redness, macerations, discolorations, etc.), appearance of veins, tissue loss and/or ulceraions. All women were diagnosed with transverse flatfoot and symptoms of venous insufficiency of the lower limbs.

Patients were excluded, if they were diagnosed prior with any of the following conditions: veins affected by thrombosis, post-thrombophlebitic disease, isolated severe varicose transformation of the main trunk of the great saphenous vein at hip level, ectasia and ultrasound evidence of valvular insufficiency of the iliac and deep femoral veins, as well as women with clinical manifestations of chronic venous disease of the C4 to C6 categories by CEAP classification (C4 - included skin pigmentation or eczema, C5 - characterized by healed venous ulcer and C6 – subject has an open venous ulcer). The CEAP classification was utilized to further assess study population for severity of the venous disease: C0 – no visible or palpable signs of venous disease, C1 – telangiectasia or reticular veins, C2 – varicose veins, C3 – edema, C4a – pigmentation or eczema, C4b – lipodermatosclerosis, atrochie blanche, C5 – healed venous ulcers, C6 – active venous ulcer) [5]. Forty eight subjects (N=48) qualified for this study and had VVLE confirmed by physical exam and TS test, with diagnosed co-existent flatfoot condition.

In order to assess varicose transformations and measure vein diameters all patients underwent triplex scanning (TS) test of the lower extremities by a standard of care ultrasound-based method. Physical exam, triplex scanning (TS) ultrasound test of the lower extremities (LE) and assessment of varicose veins was perform to assess eligibility criteria. The CEAP classification was utilized to further assess study population: C0 – no visible or palpable signs of venous disease, C1 – telangiectasia or reticular veins, C2 – varicose veins, C3 –edema, C4a – pigmentation or eczema, C4b – lipodermatosclerosis, atrochie blanche, C5 – healed venous ulcers, C6 – active venous ulcer) [5]. Forty eight subjects (N=48) qualified for this study and had VVLE confirmed by physical exam and TS test, with diagnosed co-existent flatfoot condition.

Incompetent veins were categorized and varicose transformation was staged by summary of contributing factors as detected by ultrasound: reflux, condition of the valve, time to valve closure, length and diameter of examined veins, etc. Ectasia of muscle veins was assessed and categorized as “Normal” versus “Abnormal”. Diameter of sural and soleus veins was measured on images obtained by ultrasonic technique as a distance between vessel walls in the biggest portion of the vein as it appeared on the image. The average diameter (mean value) of measurements obtained was calculated.

It is important to note that almost all study subjects had an active lifestyle (i.e. exercising at least 2-3 times a week, walking, and running weekly, etc.). Patients with hypodynamia and/or obesity were not included in this study.

In order to assess varicose transformations and measure vein diameters all patients underwent triplex scanning (TS) test of the lower extremities by a standard of care ultrasound-based method in the Department of Ultrasonic and Functional Diagnostics at the Mirovortseva hospital, which is affiliated with Saratov State Medical University (SSMU). All images were acquired on the Philips HD 11 XE scanner and expert class linear (2-5 MHz) transducer was utilized for all ultrasound tests.

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Figure 1: Study design and procedures: Cross sectional study of 50 women (average age = 43.5 years old) who were scheduled for routine clinical care for their varicose vein of lower extremity (VVLE). Both vascular and orthopedic surgeons examined all patients, which participated in this study. Physical exam, triplex scanning (TS) ultrasound test of the lower extremities (LE) and assessment of varicose veins was perform to assess eligibility criteria. The CEAP classification was utilized to further assess study population: C0 – no visible or palpable signs of venous disease, C1 – telangiectasia or reticular veins, C2 – varicose veins, C3 – edema, C4a – pigmentation or eczema, C4b – lipodermatosclerosis, atrochie blanche, C5 – healed venous ulcers, C6 – active venous ulcer) [5]. Forty eight subjects (N=48) qualified for this study and had VVLE confirmed by physical exam and TS test, with diagnosed co-existent flatfoot condition.

Figure 2: Prevalence of varicose disease stage by CEAP classification (clinical, etiology, anatomy, and pathophysiology), C1 category included group of subjects with small varicose vein issues such as telangiectasies or reticular veins, C2 category consisted of subjects with large varicose veins, C3 group included small and large vein problems with edema.

Statistical data analysis

The data obtained from 48 subjects with 88 lower limbs affected were analyzed using SAS program, version V 9.1 (SAS Institute Inc., Cary, NC, USA). The non-parametric analysis was performed to evaluate correlation between varicose transformation of veins and anatomic location. The CEAP category assigned based on clinical diagnosis was utilized to further examine study population in order to assess prevalence of varicose disease.

We performed stratified data analysis and controlled for multiple variables (i.e. age, race, family history of venous disease) as potential confounders by using multiple linear regression models or stratified Mantel-Haenszel chi-squared analysis as appropriate.

Also, Student’s t-test was performed to examine correlation between diameter of the affected veins and the type of the vein by anatomic location.

Results

The data for this study included 50 patients initially screened for the study, 48 patients have had clinical symptoms of varicose vein disease in their limbs with coexisting flatfoot condition and were included into final analysis (N= 48), which had resulted in 88 lower limbs qualified after vascular surgeon’s clinical examination and TS test of the lower limbs (96% participation rate) (Figure 1).

CEAP classification of venous disease was utilized to further characterize study population [5]. Varicose transformation of only reticular or saphenous veins, corresponding to C1 category by CEAP classification (C1 included telangiectasia or reticular veins), was found only in 3 out of 48 examined subjects (6%) with 6 of the lower limbs affected by venous disease (Figure 2). The C2 category of venous disease by CEAP classification (C2 - included varicose veins) was detected in 36 patients with 68 lower limbs out of 48 assessed subjects (75%) (Figure 2). Clinical manifestations of C3 category of venous disease, which included edema of lower extremity, were observed in 9 women with 14 lower extremities affected (18.75 %). There was no more severe degree of venous disease observed in this study (Figure 2).

Figure 3: Varicose transformations of veins by anatomic location:

Varicose transformations in the great saphenous veins were assessed by triplex scanning (TS) ultrasound test and observed in 43 out of 48 of examined women (86%). There was a small amount of varicose transformations in the small saphenous vein observed in this study (16%). Ectasia of shin veins was detected in 66% of subjects. Ectasia of soleus veins and medial sural veins was observed in 48% and 52% examined subjects, respectively.

Figure 4: Diameter of sural and soleus veins:

Statistical analysis demonstrated statistically significant difference in the diameter of sural and soleus veins in patients affected by varicose vein disease (p=0.00483). The average mean value of the sural and soleus veins diameter was 6.83 ± 0.70 mm and 7.45 ± 0.78 mm, respectively.

TS ultrasound test of superficial and deep veins of the lower limbs revealed reflux and varicose transformation in the great saphenous vein in 43 out of 48 examined subjects. In majority of cases expanded and/or incompetent perforating veins were detected (86%; noted in 60 of the lower limbs) (Figure 3). Small saphenous veins were less often affected; as observed in 8 patients only out of 48 (16%) with 10 lower limbs examined (Figure 3).

Also noteworthy was ectasia of shin vein which was found in 33 women (66%) with 46 of the lower limbs examined (Figure 3). The most common cause of deep vein extension was attributed to ectasia of medial sural veins (observed in 26 patients out of 48 (52%) with 32 of the lower limbs examined (Figure 3). Ectasia of soleus veins was detected in 24 patients out of 48 (48%) with 30 of the lower limbs examined (Figure 3).

Student’s t-test demonstrated statistically significant difference in the diameter of sural and soleus veins in patients affected by varicose vein disease (p= 0.00483). The average mean value of the sural and soleus veins diameter was 6.83 ± 0.70 mm and 7.45 ± 0.78 mm, respectively (Figure 4).

Discussion

Both vascular and orthopedic surgeon examined all 50 patients, which participated in this study. Almost all patients were office workers diagnosed with flatfoot and had clinical symptoms of varicose vein disease (N=48).

In terms of prevalence of venous disease, the C2 category of venous insufficiency by CEAP classification, which included varicose veins on physical examination, was observed in 75% of assessed subjects (Figure 2). Typically this group of patients has visible issues and/or cosmetic defects on their legs attributed to the symptoms of chronic vein disease which has developed over prolonged period of time without seeking medical attention. Unfortunately, it is a very common situation in Eastern Europe where majority of patients ignore C1 earlier stage of venous disease. The current study population was reflective of these social trends and consisted only of 6% of patients with C1 category by CEAP classification (Figure1,2).

That, in part, contributes to the higher prevalence of patients with more advanced stage of the disease been enrolled into this study with more severe outcomes observed (Figure 2).
In addition, forty three women had transformations in the great saphenous vein as confirmed by TS ultrasound test (Figure 3). Moreover, most of them had incompetent perforating veins. These observations can serve as indication for endovascular interventions and/or surgical treatment.

Based on the results of this study, we suggest that women who are office workers as well as individuals with other occupations, which require standing on their feet for prolonged periods of time, should be examined by vascular surgeon once a year for preventive screening of venous disease. Specifically, patients seen by orthopedic and/or podiatry physicians and diagnosed with flatfoot should be referred to vascular surgeon for further evaluation. Based on the findings of this study 72% of examined subjects, who have been diagnosed with flatfoot, had this condition associated with C2 category of venous disease, which is associated with varicose veins. Therefore, flatfoot seems to be an emerging risk factor for development of varicose vein disease in the lower extremities.

The limitations of this study are cross sectional design and a small sample size. Inherently, due to study design causality cannot be established directly between contributing factors and the outcome. Therefore, association between flatfoot and development of varicose veins of the lower extremities (VVLE) needs to be evaluated further in larger prospective cohort studies.

**Conclusion**

Transverse flatfoot is an additional risk factor in VVLE in middle-aged women. Despite an active lifestyle flatfoot condition may have led to VVLE in 96% of all examined subjects. This possible association of flatfoot with development of varicose vein disease, among other contributing factors, needs to be further evaluated in prospective studies to establish causality.

Although, the main cause attributing to development of varicose veins was the reflux in the great saphenous vein, there were some cases observed when patients had no reflux but developed symptoms of venous disease due to damaged valve in the calf perforators. In addition, ectasia of deep shin veins was observed in 66% of assessed subjects, which considerably affects patients’ quality of life.

Based on the finding of this study we recommend that women diagnosed with flatfoot and at risk for development of varicose vein disease should be assessed once a year prophylactically by a vascular surgeon to prevent further exacerbation of venous disease.

**References**