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Nonsaphenous Superficial Vein Thrombosis Associated with Varicose Veins

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Out of 250 examined lower limbs with superficial vein thrombosis associated with varicose veins the thrombotic process was not spread into the trunks of great and small saphenous veins in 94 cases (37.6%, 95% CI 31.6-43.9%). In such cases, that is in case of nonsaphenous superficial vein thrombosis, the pulmonary embolism and independent of the thrombotic process in superficial veins deep venous thrombosis were not observed, but thrombosis of perforating veins was found out in 9.6% of patients (95% CI 4.5-17.4%), and the spread of thrombotic process through perforating veins into deep veins was found out in 2.1 % (95% CI 0.3-7.5%). Among all the patients with superficial vein thrombosis associated with varicose veins the spread of thrombotic process into perforating veins and through perforating into deep veins happened more often out of nonsaphenous superficial veins, than out of saphenous superficial veins (p=0.040 and 0.021).

Keyword: Superficial Vein Thrombosis, Varicose Veins, Deep Venous Thrombosis, Nonsaphenous Superficial Veins.

1. Introduction

In patients with a diagnosis of superficial vein thrombosis (SVT), 6-44% of cases are associated with deep venous thrombosis (DVT), 20-33% with asymptomatic pulmonary embolism (PE) and 2-13% with symptomatic PE [1]. The most common form of SVT is a superficial vein thrombosis associated with varicose veins (V-SVT) [2]. In cases of V-SVT the strongest association with venous thromboembolism (VTE), that is both with DVT and PE, has localization of the thrombotic process in the saphenous superficial veins, this is both in great and small saphenous veins (GSV and SSV) [3]. In particular, in a retrospective study of 114 patients with V-SVT the incidence of a concomitant DVT was 15.6% when SVT affected the GSV or SSV, but only 5.2% when the nonsaphenous superficial veins were involved [4]. But taking into account the high frequency of V-SVT in the population, 5.2% is not quite a small number of patients. Therefore, nonsaphenous V-SVT does not exclude the probability of VTE. However, nonsaphenous V-SVT is traditionally considered a benign disease, which does not require both: not only immediate surgical treatment, but even the patient's hospitalization. In this regard, it is important to study the frequency of VTE aiming at nonsaphenous V-SVT, distinguishing those persons who have a high chance of DVT and PE developing.

The aim of the work was the optimization of nonsaphenous V-SVT of lower limbs treatment by examining the risk of DVT and PE development in these patients.

2. Materials and methods

It was examined 236 patients with V-SVT in 250 limbs against a background of primary venous

disease. The middle age of patients was 57.2 years (from 23 to 83 years). There were 169 (71.6%) of women and 67 (28.4%) of men. On 8 limbs (3.2%) until the rise of V-SVT the degree of chronic venous disorders according to the criterion "C" of CEAP classification was characterized as C2, 112 limbs (44.8%) - as C3, 123 (49.2%) - as C4, 2 (0.8%) - as C5 and on 5 (2%) - as C6. On 22 lower limbs (8.8%) V-SVT emerged against the background of primary venous disease recurrence.

Before treatment all the patients underwent ultrasound scan triplex of venous system of lower limbs (apparatus "GE Logiq 500 PRO", USA) with a detailed mapping of dissemination of thrombotic process parcels. Patients with absence of thrombus in trunks of the saphenous superficial veins (GSV and SSV) were separated in the group, at the example of which the frequency and the peculiarities of occurrence of VTE were studied. To confirm the diagnosis of PE in the presence of its clinical symptoms the computer tomography angiopulmonography was performed (apparatus "Thoshiba Aquilion PRIME", Japan).

According to modern international interdisciplinary nomenclature of lower limbs veins we referred the GSV and SSV to the saphenous superficial veins, and to nonsaphenous we referred all other superficial veins, that is tributaries of the GSV, tributaries of the SSV and superficial veins, which drain into the deep venous system through the perforating veins, passing GSV and SSV [5].

While carrying out statistical analysis of research results the determination of the exact confidence intervals (CI) for relative values, measured as a percentage, as well as the relative frequency of one event in different groups, according to precise Fisher criteria, were conducted using the software «R» (Revolution Analytics, USA). To compare the relative frequency of different events in one group it was used software «Microsoft Excel» (Microsoft, USA) and «Libre office» (Document Foundation, Germany). Herewith we used specific analog of z-criterion to compare the probabilities of different events in one group. The critical level of significance (p) during the testing statistical hypotheses in this study we chose equal to 0.05.

3. Results and discussion

Out of 250 surveyed by us lower limbs with the V-SVT the thrombotic process was not spread into the trunks of great and small saphenous veins in 94 cases (37.6%, 95% CI 31.6-43.9%). The proximal thrombus limit was visible in tributaries of the GSV in 84 limbs (33.6% of the total number of limbs; 95 % CI 27.8-39.8%), in the tributaries of the SSV in 5 limbs (2.0%; 95 % CI 0.7-4.6%), in the tributaries both the GSV and the SSV in 2 limbs (0.8%; 95% CI 0.1-0.29%) and in nonsaphenous superficial veins, into which pathological venous reflux was not spread from GSV or SSV, it was visible in 3 limbs (1.2%; 95% CI 0.2-3.5%). As can be seen, the tributaries of the GSV were thrombosed more often than the tributaries of the SSV ($p<0.001$). It should be noted that 94 limbs with nonsaphenous V-SVT belonged to 90 patients because 4 persons had this variant of V-SVT in both limbs.

While giving a detailed characteristics of the localization of thrombus, its proximal limit was visible in tributaries of the GSV at the thigh in 50 limbs (53.2% of limbs with thrombosis of nonsaphenous superficial veins; 95% CI 42.6-63.6%), in tributaries of the GSV at the leg in 36 limbs (38.3%; 95% CI 28.5-48.9%), in tributaries of the SSV at the upper half of the leg in 4 limbs (4.3%; 95% CI 1.2-10.5%), in tributaries of the SSV at the lower half of the leg in 3 limbs (3.2%; 95% CI 0.7-9.0%) and in nonsaphenous superficial veins, into which pathological venous reflux was not spread from GSV or SSV, was also visible in 3 limbs.

Among the 236 patients studied by us the clinically distinct PE was detected and confirmed by computer tomography angiopulmonografy in 9 persons. In none of them thrombus localized in nonsaphenous superficial veins were the source of PE. Therefore, the PE frequency among 90 persons with nonsaphenous V-SVT comprised 0.0% with 95% CI 0.0-4.0%. Thus, in cases of nonsaphenous V-SVT the probability of PE is low and statistically significantly less than in

cases of V-SVT with thrombosis of the GSV and/or SSV (p=0.029).

At any lower limb with thrombus localisation in nonsaphenous superficial veins the independent of the thrombotic process of superficial veins DVT was discovered as well (0.0%; 95% CI 0.0-3.8%), while among the 156 limbs with GSV and/or SSV thrombosis it was found in 19 limbs (12.2%; 95% CI 7.5-18.4%), which was statistically significantly more frequent (p<0.001).

The only way of thrombotic process spread in the deep venous system, which was discovered in patients with nonsaphenous V-SVT is the way through the perforating veins. In general thrombosed perforating veins were detected in 9 of the 94 limbs with nonsaphenous V-SVT (9.6%; 95% CI 4.5-17.4%), and in cases of V-SVT with thrombosis of trunks of GSV and/or SSV they were detected in 26 of 156 limbs (16.7%; 95% CI 11.2-23.5%), moreover, in 3 of them they it was detected 2 perforating veins in each of them. Statistically significant differences between these frequencies were not found (p=0.135), although there was a tendency towards more frequent thrombosis of perforating veins in case of saphenous V-SVT.

Among the 9 perforating veins, which were thrombosed in patients with nonsaphenous V-SVT there were 2 medial gastrocnemius, 2 posterior tibial (1 upper and 1 middle), 2 paratibial (1 Boyd and 1 Sherman), one anterior leg, one sciatic and one lateral knee perforating veins.

In 2 of 94 limbs (2.1%; 95% CI 0.3-7.5%) with thrombus localisation in nonsaphenous superficial veins through the perforating veins the thrombotic process was extended into the deep venous system. On one of them a thrombus was spread into the popliteal vein through lateral knee perforating vein, and on the second it was spread through the middle posterior tibial perforating vein into the posterior tibial vein. At the same time, from 156 limbs with thrombosed GSV or SSV the thrombotic process extended into the deep venous system in 13 limbs (8.3%; 95% CI 4.5-13.8), on one of which it extended through 2 perforating veins simultaneously. As well as for the frequencies of perforating veins thrombosis, statistically significant differences between the frequencies thrombus spread through perforating veins into the deep veins between above mentioned groups of patients were not found, although in cases of the GSV and/or SSV thrombosis a tendency to a higher value of this index was observed (p=0.055). One way or another, but it was clearly confirmed that the isolated thrombosis of nonsaphenous superficial veins can also be the cause of DVT.

It should be noted that the thrombotic process may extend into the perforating veins from nonsaphenous superficial veins not only in case of their isolated thrombosis, but in cases of simultaneous nonsaphenous and saphenous superficial veins thrombosis. Taking it into account, for a full assessment of the nonsaphenous superficial veins role in cases of V-SVT, in our view, it is important also to compare the frequency of thrombosis distribution into the perforating veins from nonsaphenous and saphenous superficial veins among all studied patients.

Among the 35 existing subgroups of perforating veins our patients had thrombosed veins out of 12 subgroups. Into the medial gastrocnemius, all 3 subgroups posterior tibial, sciatic, lateral knee and anterior leg perforating veins the thrombotic process proceeded solely from nonsaphenous superficial veins. In perforating veins of the femoral canal and in paratibial Sherman perforating veins the thrombosis distributed solely from the GSV. In paratibial Boyd perforating veins, intergemellar perforating veins and popliteal fossa perforators the thrombotic process could move from both saphenous and nonsaphenous superficial veins.

Overall, it was found out 38 thrombosed perforating veins. 25 of these veins (65.8%; 95% CI 48.6-80.4%) were joined with thrombosed nonsaphenous superficial veins, and the 13 remaining (34.2%; 95% CI 19.6-51.4%) were joined with thrombosed trunks of the GSV or SSV (p=0.040). Thus, among the total number of patients with V-SVT most of thrombosed perforating veins are joined with nonsaphenous superficial veins. Therefore, during the diagnostic

process of GSV or SSV thrombosis it should be also paid attention to the thrombosed nonsaphenous superficial veins to detect thrombosed perforating veins.

However, it should be noted that only 9 out of 25 (36.0%; 95% CI 18.0-57.5%) thrombosed perforating veins, connected to nonsaphenous superficial veins, were placed in the limbs with the isolated thrombosis of the latter. The remaining 16 of such perforating veins (64.0%; 95% CI 42.5-82.0%) were discovered in limbs with a combination of nonsaphenous and saphenous superficial veins thrombosis (p=0.145).

Among 16 perforating veins, through which the thrombotic process moved to trunks of the deep veins, only 4 (25.0%; 95% CI 7.3-52.4%) were connected with thrombosed trunks of GSV or SSV. They were the following perforating veins: one popliteal fossa perforators, which offshooted from the proximal area of SSV, 2 intergemellar perforating veins and one Dodd perforating vein of the femoral canal. The remaining 12 perforating veins (75.0%; 95% CI 47.6-92.7%) connected the deep veins with thrombosed nonsaphenous superficial veins. These included: medial gastrocnemius perforating veins - 5 cases, posterior tibial perforating veins - 4 cases (including middle - 3 and lower - 1), popliteal fossa perforator which is not joined with SSV – 1 case, lateral knee perforating vein - 1 case and intergemellar perforating vein – also 1 case. The passing of thrombotic process into the deep venous system through the perforating veins, connected with nonsaphenous superficial veins was statistically significantly more frequent than through the perforating veins, connected with GSV or SSV (p = 0.021).

However, only 2 out of 12 perforating veins (16.7%; 95% CI 2.1-48.4%), through which thrombotic process passed from nonsaphenous superficial veins into the deep veins, were thrombosed without simultaneous thrombosis of the GSV and/or SSV trunks vs. 10 cases (83.3%; 95% CI 51.6-97.9%) with their thrombosis (p=0.002). This suggests that in most cases when the thrombotic process passes into the deep veins through the perforating vein, connected to the nonsaphenous superficial vein, the trunks of GSV and/or SSV are thrombosed.

We remember that totally 13 thrombosed perforating veins, connected with trunks of GSV or SSV, were found out. Only through 4 of them (30.8%; 95% CI 9.1-61.4%) the thrombotic process passed into the deep vein trunks. For nonsaphenous superficial veins, this figure was 12 out of 25, or 48.0% (95% CI 27.8-68.7%). There was no statistically significant differences between these parameters (p= 0.490). At the same time, in cases of only nonsaphenous superficial vein thrombosis, among 9 thrombosed perforating veins, connected with these veins, the thrombotic process passed into the deep venous system in only 2 cases (22.2%; 95% CI 2.8-60.0%), and in cases of both nonsaphenous and saphenous superficial vein thrombosis this process passed into the deep venous system in 10 out of 16 cases (62.5%; 95% CI 35.4-84.8%). The difference between these parameters was not statistically significant (p=0.097), although there was a tendency to more frequent passing of thrombotic process into the deep venous system through the perforating veins, connected with nonsaphenous superficial veins, in the case of a combination of nonsaphenous superficial veins thrombosis with GSV or SSV thrombosis.

In general, if we take into account the saphenofemoral and saphenopopliteal junctions, the saphenous superficial veins were responsible for 23 out of 35 points through which the thrombotic process extended into the deep veins in our patients (65.7%; 95% CI 47.8-80.9%), and nonsaphenous superficial veins were responsible for 12 (34.3%; 95% CI 19.1-52.2%).The difference between these data was on the edge of statistical significance (p=0.05).

And there is one more thing. The frequency of thrombotic process affection by only nonsaphenous superficial veins in case of thrombotic process distribution into the deep veins or perforating was 9 out of 64 (14.1%; 95% CI 6.6-25.0%), and in the absence of such distribution was 85 out of 186 (45.7%; 95% CI 38.4-53.1%) (p<0.001). This suggests that in cases of V-SVT, complicated by thrombosis of perforating or deep veins, the thrombosis of

exclusively nonsaphenous superficial veins is found statistically significantly less than in cases of uncomplicated V-SVT.

The results of our study confirmed the view that saphenous V-SVT is more associated with the spread of thrombotic process into the deep veins, than the thrombosis of nonsaphenous V-SVT [3]. However, it's caused by extremely high frequency of thrombus distribution into the deep veins through the saphenofemoral and saphenopopliteal junctions. Instead, the spread of thrombotic process into perforating veins and through perforating into deep veins more often happened out of nonsaphenous superficial veins. However, in most cases the thrombotic process passing out of nonsaphenous superficial veins into the deep or perforating veins occurred when the thrombosis of nonsaphenous superficial veins was combined with GSV or SSV thrombosis.

Isolated thrombosis of nonsaphenous superficial veins was accompanied by DVT in 2.1% of patients with 95% CI 0.3-7.5%, which was also consistent with the above mentioned literature data [4]. PE and independent of the thrombotic process in superficial veins DVT were observed in none of these patients.

Finally, it was found out that the nonsaphenous superficial veins of the GSV system are thrombosed significantly more often than the same veins of SSV system ($p<0.001$).

Taking into account the results, received in the work, we believe that in cases of isolated nonsaphenous V-SVT the patients with the transition of thrombotic process into the perforating veins must be immediately hospitalized. Other patients with thrombosis of nonsaphenous superficial veins can be operated in a planned manner. However, in the presence of thrombotic process in the superficial veins, connected with incompetent medial gastrocnemius, posterior tibial, paratibial, anterior leg, sciatic and lateral knee perforating veins, if surgery is not scheduled on the day of these patient's application for medical care, it is required daily ultrasonographic examination to exclude the progression of thrombosis into these perforating veins.

4. Conclusions

1. In cases of V-SVT the spread of thrombotic process into perforating veins and through perforating into deep veins happened more often out of nonsaphenous veins, than out of saphenous superficial veins ($p=0.040$ and 0.021).
2. Isolated nonsaphenous V-SVT is accompanied by perforating vein thrombosis in 9.6% of patients (95% CI 4.5-17.4%) and DVT in 2.1% (95% CI 0.3-7.5%).
3. PE and independent of the thrombotic process in superficial veins DVT were not observed in examined patients with isolated nonsaphenous V-SVT.
4. To identify indications for urgent surgery in case of surgery treatment of patients with V-SVT they should have carefully examined not only the perforating veins, which are connected to thrombosed GSV or SSV, but also and especially those which are connected to thrombosed nonsaphenous superficial veins.

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