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"THE PENDING OEDEMA SYMPTOM OF THE THIGH" AT THROMBOSIS OF THE DEEP FEMORAL VEIN

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Abstract

The presence of oedema on a segment of the limb is a typical clinical sign of thrombosis (thrombophlebitis) of the main veins of the limb. The oedema of the limb is typically located lower than the level of venous occlusion, starting from the foot and then progresses in cranial direction. The deep femoral vein is rarely affected by thrombosis. However, when the deep femoral vein is the singular vein affected by thrombosis, its clinical presentation is "the pending oedema symptom of the thigh". The symptom is characterized with presence of oedema at the posterior-medial muscle group of the thigh and subcutaneous tissue from the knee to the upper 1/3 of the thigh. This oedema is in contrast with absence of oedema of the foot, shank and anterior-lateral muscle group of the thigh. The purpose of this paper is to analyze the contribution of the peculiarities in the topographic anatomy of the venous blood vessels which accompany the deep femoral artery for occurrence of the thrombosis in this venous segment, as well as for disappearance of the oedema during the convalescence.

The functional state of the deep femoral vein is of great importance to the venous haemodynamics of the limb. The results of the anatomical analysis of the literature data showed that the three main veins which accompany the branches of the deep femoral artery have some anatomical peculiarities which are very important for the haemodynamics in these venous segments.

The diagnosis of venous occlusion of the deep femoral vein is possible with Doppler ultrasound. Using the phlebography of the limb, the contrast material drains through unaffected deep veins. For this reason, the diagnosis of the disease cannot be made using classical phlebography. This means that only retrograde phlebography can confirm clinical diagnosis.

Key words: deep femoral vein, thrombosis, pending oedema, retrograde phlebography

Introduction. The deep venous thrombosis (thrombophlebitis) (DVT) of the lower limb is well-known as prevalent disease, and most of the pulmonary emboli originate from the femoral and/or popliteal veins [1,2]. Because of this the DVT needs very intensive and systematic prevention and treatment. According to Ouriel et al. [2], in 34.7% of the cases the etiology of the DVT is postoperative state, in 9.5% – malignancy, in 7.9% – trauma, and in 38.9% of the cases the etiology is unknown. The different segments of the lower extremity venous system are affected to a different degree from the DVT [3]. The results from the large study of Ouriel et al. [2] showed that the frequency of the DVT increased in the distal direction – 6.3% in common iliac vein (CIV), 7.8% in external iliac vein (EIV), 9.2% in common femoral vein (CFV), and 42.0% in popliteal vein (PV). In contrast, the deep femoral vein (DFV) [4] (alternative term profunda femoris vein [5]) is affected in 0.9% of cases only [2]. The anatomical extent of DVT is probably in correlation with the etiology of the disease [2].

According to Virchow's triad, there are endothelial, haemodynamic and haemostatic factors predisposing to thrombus formation [6]. Roudaut et al. [7] define the basic characteristics of these three factors in prosthetic heart valves. We consider that Roudaut et al. definitions in general, are valid for the arterial and venous system of the human body, too [6]. However, the intimate mechanisms of the interaction between these three groups of factors have specificity in the arterial and venous system. According to Weksler [8], while in the arteries the endothelial injury plays a major initiating role at the first interacting stage of haemostasis, in the veins in which the stasis of blood circulation occurs more often, platelets have a lesser initiating role in the coagulation process. These circumstances showed the important role of the haemodynamic factors, including the haemodynamic disturbances related to the regional anatomical peculiarities of the venous system, for the development of the DVT.

The presence of oedema on a segment of the limb is a typical clinical sign of thrombosis of the main veins of the lower limb. The oedema of the lower limb is typically located lower than the level of venous occlusion, starting from the foot and then progresses in cranial (proximal) direction. However, when the DFV is the singular vein affected by thrombosis its clinical presentation is "the pending oedema symptom of the thigh" [9].

The purpose of this paper is to analyze the contribution of the peculiarities in the topographic anatomy of the venous blood vessels, which accompany the DFA, for occurring of the thrombosis in this venous segment, as well as for disappearance of the oedema during the convalescence.

Clinical implications. As it was mentioned above, the venous thrombosis occurs most often in the CIV, EIV, FV and PV, in which the hydrostatic pressure is higher, in comparison with the DFV, which in contrast is rarely affected by thrombosis [2]. When the DFV is the singular vein affected by thrombosis, its clinical presentation is "the pending oedema symptom of the thigh". The symptoms are characterized with presence of oedema at the posterior-medial muscle group of the thigh and subcutaneous tissue from the knee to the upper 1/3 of the thigh. This oedema is in contrast with absence of oedema of the foot, shank and anterior-lateral muscle group of the thigh. In addition, according to some authors, the degree of the development of oedema is higher in the cases when the thrombus is very well adhered to the venous wall.

The diagnosis of venous occlusion of the DFV is possible with Doppler ultrasound. During the phlebography of the lower limb, the injected contrast material drains through unaffected deep veins. For this reason, the diagnosis of the DVT cannot be made using classical phlebography. This means that only retrograde phlebography can confirm clinical diagnosis [10,11].

Clinical anatomy of the venous blood vessels accompanying the DFA. ***General considerations.*** FV is a continuation of the PV, which accompanies the femoral artery (FA) through the abductor channel and into the femoral triangle, where it lies within the femoral sheath.

DFA is a main branch of the FA, originating within femoral triangle in 35.41% from the postero-lateral aspect and in 31.25% from the posterior aspect of the FA [12]. The distance of origin of DFA from the midpoint of the inguinal ligament on the right side was mostly between 41 and 52 mm, whereas on the left side it was between 46 and 54 mm [12].

DFV empties into the FV about 8 cm distal to the inguinal ligament.

The DFA gives the next clinically important arterial branches:

- lateral circumflex femoral artery (LCFA);
- medial circumflex femoral artery (MCFA);
- terminate in three [13], according to other authors in four [14] perforating arteries (PAs) (Table 1).

The FV receives separately or in common three venous branches which accompany the branches of the DFA [14]:

- the largest lateral circumflex femoral veins (LCFV);
- the narrowest medial circumflex femoral vein (MCFV);
- the DFV [13,15].

Table 1

The distribution of the deep femoral artery and vein

Branches/tributaries of the deep femoral artery/accompanying veins		Distribution of branches/tributaries	Branches supply; Tributaries drain	Anastomoses of: arterial branches; venous tributaries
Primary	Secondary			
Medial circumflex femoral artery Medial circumflex femoral vein	Superficial branch/tributaries	Medial muscle group of the thigh	Medial muscle group of the thigh	
Pass in medial direction	Profound branch/tributaries	Passes between pectineus m. and iliopsoas to reach posterior femoral and gluteal regions	Branch for hip joint	Inferior gluteal artery and vein; Obturator artery and vein
	Ascending ramus			
	Descending ramus			
Lateral circumflex femoral artery; Lateral circumflex femoral vein; Passes in lateral direction in the	Ascending ramus	Tensor fasciae late muscle; Gluteus medius muscle	Tensor fasciae late muscle; Gluteus medius muscle	Superior gluteal artery; Superior gluteal vein
connective tissue space below the sartorius muscle and rectus femoris muscle where the arterio-venous	Descending ramus	Quadriceps femoris muscle; The skin on the thigh	Quadriceps femoris muscle; The skin on the antero-lateral aspect of the thigh	
bundle gives two deviations	Transversal ramus			
Three or four perforating arteries; Three or four pairs of perforating veins	Muscle branches	Perforate the muscles of the adductor group and reach the posterior region of the thigh	Both medial and posterior muscle groups; The skin on the medial and posterior aspects of the thigh	Small saphenous vein; Femoropopliteal vein (Variation)
	Aa. nutriciae femoris	Femur	Femur	

According to CHARLES et al. [16], the modes of termination might be placed in one of four classes:

- Class I: both LCFV and MCFV terminate directly in the FV (86.14%);
- Class II: the LCFV terminates in the DFV, while the MCFV ends directly in the FV (5.18%);
- Class III: the MCFV terminates in the DFV, while the LCFV ends directly in the FV (6.28%);
- Class IV: both MCFV and LCFV terminate in the DFV vein (1.85%) [16].

The LCFA and LCFV form the arteriovenous bundle. According to DIXIT, MEHTA and KOTHARI [12] the origin of the LCFA on the right side was from the DFA in 75%, from the DFA common stem in 16.67% and from the FA in 8.33% of the cases. On the left side, it originated from the DFA in 91.67% and from the DFA common stem in 8.33% of the cases. The distance of origin of the LCFA from the origin of the DFA was between 23 and 34 mm [12]. More details for the distribution of the LCFA branches and anastomoses and LCFV tributaries and anastomoses are shown on Table 1. In general, the LCFV serves for the outflow of the venous blood from the muscles of the antero-lateral group of the thigh and from the skin on the antero-lateral aspect of the thigh.

The MCFA and MCFV form the arteriovenous bundle. The medial circumflex artery is a branch of the PFA in 59% or of the FA in 36% according to LIPSHUTZ [17], 53% and 40% according to CLARK and COLBORN [18] and on average in 62.5% of cases from the profunda and in 20.63% of cases from the femoral according to DIXIT, MEHTA and KOTHARI [12]. According to the latest paper, on the right side the MCFA arose from the DFA in 50%, from the FA in 29.12% and from the DF common stem in 20.88% of the cases [12]. On the left side, it originated from DFA in 75%, from the FA in 12.5% and from the DF common stem in 12.5% of the cases. The distance of the origin of the MCFA from the origin of the DFA was between 21 and 30 mm on the right, while on the left it was between 11 and 30 mm. Thus it was observed that the MCFA had a more variable origin from the FA than the LCFA, which mostly arose from the DFA [12]. More details for the distribution of the arterial branches and anastomoses of the MCFA and of the tributaries and anastomoses of the MCFV are shown on Table 1. In general, the MCFV drains the venous blood from the muscles of the medial and posterior groups of the thigh and from the skin on the medial and posterior aspect of the thigh [13, 15].

The DFV originated from the confluents of the perforating veins (alternative term – the deep femoral communicating veins) accompanying PAs, which drain the venous blood from the medial and posterior thigh [5, 13, 15], and through the

Nutritient femoral artery supply with arterial blood the longest bone in the human body – the femoral bone [13].

In addition, the deep femoral vein receives the venous blood from the small saphenous vein [15, 19]. In some cases, the variable femoropoliteal vein is present. The latter vein is an anastomotic vein between the short saphenous vein and both the deep vein of the thigh and the veins in gluteal region [13, 15]. More details for the distribution of the arterial branches and anastomoses of the PAs and of the venous tributaries and anastomoses of the DFV are shown on Table 1.

Discussion. The functional state of the PFV is of great importance to the venous haemodynamics of the limb [11]. The results of the anatomical analysis of the most important literature data show that the three main veins which accompany the branches of the DFA have some anatomical peculiarities, which are very important for the haemodynamics in these venous segments.

1) The diameter of the lumen of the LCFV is superior in comparison with the diameter of the MCFV, which supports the venous drainage from this vein.

2) The narrowest diameter of the lumen of the MCFV in comparison with the LCFV, which makes difficult the venous drainage of this vein.

3) The LCFA reaches the connective tissue space below the sartorius muscle and rectus femoris muscle, where the venous drainage is supported from the very intensive contraction of the quadriceps femoris muscle during locomotion.

4) The venous tributaries of the MCFV serve for the outflow of the venous blood from the medial and posterior muscle groups, whose contractions are not so intensive in comparison with the muscle contraction in the antero-lateral group.

5) The deep femoral vein receives the venous blood from the small saphenous vein. Because of this, the venous return from this vein is more voluminous than the arterial blood flow from the perforating arteries. This circumstance in some conditions is possible to make the venous drainage difficult.

6) The degree of venous stasis in the system of the veins accompanying the DFA depends on some additional factors:

   a) A valve in the proximal PFV is normally present in about 84% of patients [20]. However, it may be incompetent, which will contribute to the venous reflux and stasis in more patients.

b) In addition, the residual changes from acute deep thrombosis may be seen in up to 50% of sonograms until 6 months and may persist indefinitely. These conditions result in reverse flow in the veins, which is revealed on sonography by using Valsalva's manóeuvre [1].

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