



Venous Thrombosis in Traumatology and Orthopedics: Diagnostic Difficulties

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Abstract: The review provides information about the relevance of the problem of impaired hemostasis after surgery for fractures of long bones and major orthopedic surgical interventions related to operations with a high risk of developing thromboembolic complications, as well as timely and complete diagnosis of these terrible complications. The value of clinical examination data in these patients is low. Instrumental methods allow diagnosing already formed thrombotic masses. This is not enough to carry out appropriate preventive and therapeutic measures. The pre-thrombotic state can be detected through the use of laboratory methods. Of the laboratory tests currently available, only D-dimer levels can help to objectify a patient's thrombotic risk. However, this test has a high diagnostic sensitivity only in the late post-traumatic phase and, at the same time, has a low specificity, especially in patients with trauma and orthopedic profile. Therefore, the determination of D-dimers may not be sufficient to exclude the diagnosis of venous thrombosis in this group of patients.

Key words: hemostasis, trauma, thrombosis, arthroplasty, D-dimers.

INTRODUCTION

The emergence of new surgical technologies, the improvement of surgical intervention techniques, the high level of modern anesthesiology and resuscitation are steadily reducing surgical mortality and reducing the number of specific postoperative complications. However, violation of the integrity of large bones and major orthopedic surgeries, which entail prolonged immobilization, are the main factor in the increased risk of venous thrombosis [1], so the prevention, diagnosis, and treatment of these dangerous complications remain relevant today.

MATERIALS AND METHODS

Despite prevention, the risk of venous thrombosis in this group of patients remains quite high, reaching an average of 16.1% [2] in hip arthroplasty and 30.1% in knee arthroplasty [3, 4]. In the absence of prophylaxis, venous thrombosis develops in 45–59% of cases [5], and according to some

data, the frequency of asymptomatic deep vein thrombosis in this category of patients reaches 70% [6, 7].

The scatter in data on the frequency of thrombosis in operations on large joints is explained by different diagnostic methods. Such statistics are amazing even without taking into account all possible errors.

RESULTS AND DISCUSSION

The term venous thrombosis (VT) combines two related diseases: deep vein thrombosis (DVT) and pulmonary embolism (PE). Deep vein thrombosis is divided into proximal, or central (ilio-caval and popliteal-femoral segments), and distal, or peripheral (deep veins of the leg), according to localization, according to clinical manifestations - into symptomatic and asymptomatic. It should be noted that it is for the majority of patients with traumatological and orthopedic profile (up to 85%) that the asymptomatic variant of the course of the disease is typical. The reason for this is forced prolonged bed rest, which provides a natural reduction in the load on the venous system, resulting in the absence of the main symptom of acute venous stasis - edema. That is why there is a need for timely diagnosis of this formidable complication and identification of groups of patients with an increased risk of developing deep vein thrombosis.

Already during surgery, a number of factors contribute to the development of deep vein thrombosis. All patients with fractures of the bones of the lower extremities and patients who underwent major orthopedic surgery have a fully formed Virchow triad (blood stasis, increased activity of the coagulation system, and damage to the vascular wall). These factors underlie the mechanism of intravascular thrombus formation.

Studies have shown that during orthopedic operations, the process of thrombus formation begins already during work in the femoral canal and installation of the endoprosthesis [7]. This is due to the massive release of tissue factor and other procoagulants from the bone marrow canal through the drainage veins into the common venous system. Thus, the process of thrombus formation in the femoral vein is initiated.

The operation itself for hip and knee joint replacement is quite traumatic and is performed in close proximity to the vascular bundle. Severe rotation, abduction of the limb, use of retractors, and the surgeon's own manipulations are accompanied by tension, displacement, and "twisting" of the vein during surgery, which leads to rather massive damage to the vascular endothelium and slowing of blood flow, accompanied by release of biologically active substances that activate platelets and leukocytes, inevitably causing activation of coagulation processes. An endothelial defect can also occur indirectly, due to vessel ischemia due to its compression by developing edema, hematoma, and bone fragments.

According to many researchers, the key role in the pathogenesis of venous thrombosis during major surgical interventions, especially in orthopedic surgery, belongs precisely to the violation of the integrity of the endothelium of the vascular wall [2].

Venous stasis predisposes to the development of venous thrombosis due to the local concentration of activated clotting factors, impaired dissolution and clearance, as well as local depletion of clotting inhibitors. Venous stasis is also facilitated by prolonged immobilization and bed rest in the postoperative period.

The hypercoagulable state also makes a significant contribution to the development of venous thromboembolic complications. Under normal conditions, a dynamic balance is established between the processes of coagulation and fibrinolysis. Trauma and surgery lead to a shift in the hemostasis system towards hypercoagulability, which increases the likelihood of thromboembolic complications.

The importance of accurate and timely diagnosis of venous thrombosis cannot be overestimated. A false-negative result threatens the development of pulmonary embolism (PE), overdiagnosis - possible complications of thrombolytic therapy.

The value of clinical examination data for the diagnosis of deep vein thrombosis in patients with injuries of the lower extremities and after arthroplasty operations is low. The main symptoms of deep vein thrombosis, such as limb edema, pain, and local skin temperature increase, are observed after any injury and accompany the normal course of the postoperative period for 1–2 weeks. Therefore, in the considered category of patients, deep vein thrombosis often proceeds asymptotically.

The introduction of instrumental methods into clinical practice has made it possible to increase the effectiveness of diagnosing pulmonary embolism, especially its large branches. However, the diagnostic value of these methods decreases with a decrease in the diameter of the obstructed vein.

Most researchers believe that X-ray contrast phlebography still remains the “gold standard” in the diagnosis of deep vein thrombosis. At the same time, this is an invasive procedure and its implementation requires special equipment.

In peripheral venous thrombosis, ascending distal phlebography has 100% sensitivity and specificity. This is especially important for the detection of postoperative thrombosis in orthopedic patients, since thrombosis of this localization is, according to various data, from 34% to 71%. That is why ascending phlebography continues to be used to diagnose asymptomatic deep vein thrombosis and evaluate the effectiveness of prophylaxis in the postoperative period in orthopedic patients. At the same time, this diagnostic procedure is very traumatic, requires the introduction of a large amount of a contrast agent, and does not allow a reliable assessment of the condition of the ilio caval segment. According to a number of authors, the frequency of complications (thrombosis and anaphylactic reactions) from the administration of a contrast agent with this technique is 7–9%.

Of the laboratory tests currently available, only D-dimer levels can help to objectify a patient's thrombotic risk. D-dimers are one of the end products of the fibrinolysis process - a specific degradation product of cross-linked (insoluble) fibrin. The test detects fibrin degradation products that contain D=D cross-links. An increase in the concentration of D-dimers in plasma indicates, on the one hand, the activation of the fibrin formation process (thrombosis), and, on the other hand, the destruction of stable fibrin (activation of the fibrinolysis system). The degree of increase in the level of D-dimers in blood plasma can be used at the stage of emergency diagnosis of venous thrombosis.

Most researchers believe that the D-dimer test has a high diagnostic sensitivity (high significance of negative results) for the diagnosis of pulmonary embolism and deep vein thrombosis (at least 98%). The results of determining the level of D-dimers are most effective in the group with a low pretest probability of venous thrombosis - in young people without concomitant pathology, without a thrombotic venous anamnesis.

CONCLUSION

Deep vein thrombosis and pulmonary embolism today are one of the serious problems of modern surgery, which significantly worsen the results of surgical treatment. A particularly high risk of developing venous thromboembolism is noted in patients after massive injuries and orthopedic surgeries, so prompt and complete diagnosis of this formidable complication is necessary. Of the laboratory tests currently available, only D-dimer levels can help rule out thrombosis. However, this test has a high diagnostic sensitivity only in the late post-traumatic phase and, at the same time, has a low specificity, especially in patients with trauma and orthopedic profile. Determination of D-dimers may not be sufficient to exclude the diagnosis of deep vein thrombosis in these patients. In connection

with the foregoing, it is necessary to look for new laboratory methods to identify the pre-thrombotic (hypercoagulable) state, and timely and fully begin preventive measures in this category of patients.

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