

# EVALUATION OF TREATMENT EFFICACY OF UPPER EXTREMITY EFFORT DEEP VENOUS THROMBOSIS IN ATHLETES

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## Abstract

**Purpose:** The purpose of the study was to evaluate the treatment results of upper extremity effort Deep Venous Thrombosis (DVT) and coexistent Thoracic Outlet Syndrome (TOS) in athletes.

**Materials and Methods:** The study included 13 physically active patients from 19 to 38 years of age with upper extremity deep venous thrombosis. The diagnosis of DVT was based on clinical examination and radiological imaging evaluation with phlebography. Fibrinolytic treatment was based on administration of streptokinase through a catheter placed in the vein in contact with the thrombus. Streptokinase infusion was continued for 2 to 3 days and subsequently replaced with intravenous administration of heparin and oral anticoagulants. After 6 to 8 weeks following fibrinolytic treatment, all patients with signs of subclavian vein compression underwent a decompressing operative procedure such as resection of the first rib or accessory cervical rib.

**Results:** Successful recanalization of thrombosed veins was achieved in 10 patients at 48 to 72 hours after streptokinase infusion. In remaining 3 patients, only partial patency was restored. 11 patients underwent first thoracic rib resection, and the remaining 2 patients had their accessory cervical rib resected. All operated patients returned to their normal physical state, and to this date no signs of blood retention in the periphery have been observed.

**Conclusions:** These findings confirm that TOS-related DVT of upper extremities should be treated with immediate thrombolysis combined with delayed surgical decompression, especially in cases of confirmed compression of the subclavian vein.

*Key words: effort thrombosis, phlebography, thrombolytic therapy, Paget-Schroetter syndrome*

## Introduction

Idiopathic deep vein thrombosis of the upper extremity has a high rate among young physically active people (72%), and therefore it is often called effort thrombosis, or Paget-Schroetter syndrome (1). According to Scott, it is the most common vascular pathology among professional athletes (2). The Paget-Schroetter syndrome

originally considered idiopathic, is now more frequently linked to the Thoracic Outlet Syndrome (3, 4, 5). This suggests, that the original cause are anatomic abnormalities leading to vein compression from the exterior and peripheral blood retention leading to the development of thrombosis. The upper extremity deep veins entering the thoracic outlet, can undergo compres-

sion by: Langer's axillary arch, ligament of pectoralis minor, or bony substance from the costoclavicular space (6). Additional and direct cause of the appearance of the Paget-Schroetter syndrome is a physical overexertion of the upper extremity region and the shoulder girdle.

Along with the change of opinion on the pathogenesis of the disease, the treatment method of thrombosis also underwent gradual modification (7, 8). Unsatisfactory early and late results obtained after the administration of anticoagulants combined with upper limb elevation lead to the search of more effective therapeutic methods of treatment. Currently radical, fundamental operative treatment is more often recommended preceding the restoration of venous flow with the use of fibrinolytic therapy (1, 9).

The aim of this report is the retrospective evaluation of treatment results of venous thrombosis with fibrinolytic method and subsequent decompressing procedure in physically active patients.

### Materials and Methods

Between the years 1989 and 2002, 32 patients were treated in the Department of General and Vascular Surgery in Poznan due to upper-extremity deep venous thrombosis. Among them, 15 patients (4 women, 11 men) were determined to have primary upper-extremity deep venous thrombosis resulting from pathology in the thoracic outlet region. 13 of those patients between 19 and 38 years old were physically active. All patients with primary thrombosis and indication of compression, after successful fibrinolysis, underwent causal surgical treatment. The remaining 17 patients, in whom imaging evaluation (Doppler-Ultrasound, phlebography, x-ray of thoracic outlet) did not reveal exterior compression of subclavian or axillary vein, were eliminated from the study. 6 of them compla-

ined about temporary numbing of the limb, intensifying with its elevation and outer rotation. 3 of the patients additionally experienced headaches with numbing of partial face. No one reported trauma or previous treatment procedure in the upper extremity and the shoulder girdle region.

The bases of thrombosis identification were clinical symptoms: extremity edema, pain with noticeable, rope-shaped engorgement in the axillary fossa, bluish color of the skin, dilatation of superficial veins of the upper extremity and anterior surface of the thorax. Final diagnosis was confirmed by phlebography. Phlebography of the upper extremity was completed in horizontal position of the patient, where at first the arm was in anatomical position and secondly was abducted 90 degrees with external rotation, in order to detect the presence of subclavian vein compression. The basilic vein was pricked and a catheter placed up to the level of the beginning of the brachial vein. Saline-diluted uroline and urograffine 30% were used as the contrast medium. All patients were diagnosed with different levels of radiologic symptoms of venous thrombosis appearing as extensive deficits in vein flow, irregular contour of the evaluated vessels and developed collateral vessel network.

Doppler examination revealed decreased blood pressure in the radial artery during activity tests of the upper extremity, typical for the thoracic outlet syndrome (Alson's evidence, Roos procedure). In order to differentiate between the types of pathology responsible for the compression of the veins, x-rays were performed.

Confirmed by phlebography venous thrombosis was an indication for administration of streptokinase and supplementary anticoagulant treatment in order to protect the endothelium of the vessels. Catheter in the basilic vein was used for local fibrinolytic treatment, through which phle-

bography was conducted, and was subsequently placed in contact with the thrombus. Streptokinase was administered in a 100,000 IU/h dose for 2-3 days. In order to dissolve the thrombus, the catheter was successively moved upwards until full venous patency was restored. The effectiveness of treatment was evaluated according to clinical symptoms (subsiding edema, skin color changes and pain), decrease in the level of fibrinogen and lengthened thrombin time. Additionally, daily phlebography allowed for monitoring of progress of thrombus lysis and position of the catheter. Continuous intravenous heparin infusion in a 100 IU/h dose was started as the streptokinase administration was ending. The heparin dosage was determined according to the activated partial thromboplastin time (APTT). Heparin was administered for 4-5 days, with subsequent oral anticoagulants, which were maintained for 6 months from the onset of treatment.

After successful fibrinolytic treatment, all patients were operated. The procedure was carried out after 6-8 weeks after cessation of acute symptoms. The procedure was based on transaxillary resection of the first rib with attachment of scalenus muscle tendon or resection of additional cervical rib from supraclavian access. Observations of patients continued for 1 to 6 years.

## Results

The duration of clinical symptoms of thrombosis, from the onset to the fibrinolytic treatment, varied from 2 to 10 days. Thrombotic changes caused complete obstruction of deep veins in the upper extremity (Figure 1). Developed collateral circulation through superficial system was observed in all patients. Thrombosis was determined in the upper right extremity in 8 patients and in the upper left extremity in 5 patients. In one patient, radiologic evaluation revealed the presence of additional

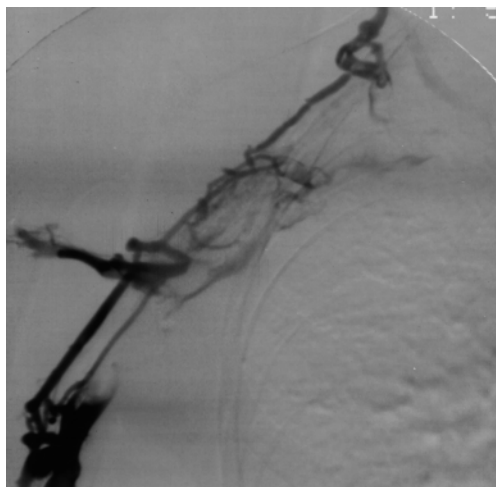


Fig. 1. DSA phlebography of the right upper extremity. Patient 19 years old with clinical symptoms of Paget-Schroetter Syndrome. Complete obstruction of the brachial, axillary and subclavian veins. First examination.

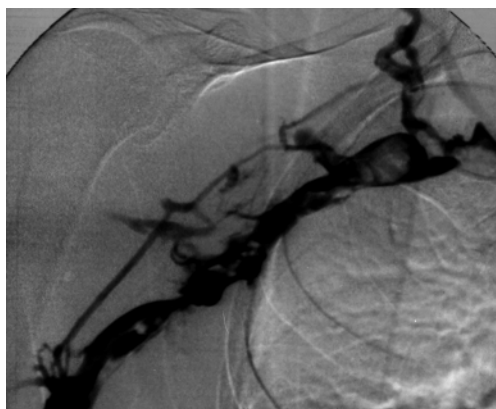


Fig. 2. Third day of fibrinolysis. Evolution of thrombotic changes. Partial deep venous recanalization. Subsiding collateral circulation.

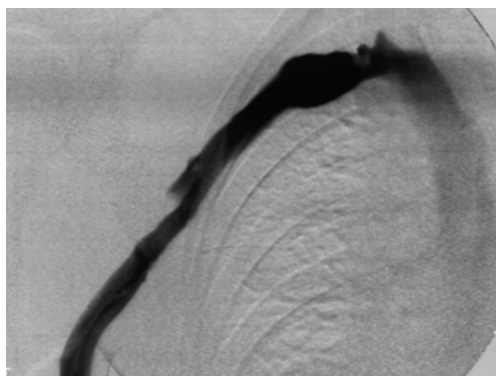


Fig. 3. Fifth day of treatment. Complete venous recanalization: brachial, axillary and subclavian. No radiologic evidence of post-thrombotic syndrome.

cervical rib bilaterally, and in another patient additional cervical rib was found unilaterally, on the side of the thrombus. Radiologic evaluation revealed excessively developed transverse process of VII cervical vertebrae in 8 patients.

Restoration of complete patency in the deep veins of upper extremity was achieved in 10 patients after 48-72 hour administration of streptokinase (Figure 2 and 3). In 3 other patients, only partial recanalization was achieved. Clinical manifestations included decreased edema of the extremity, subsided skin discoloration and a feeling of relief reported by the patients. Despite the lack of ailments, during late observations (more than 1 year) in patients with incomplete lysis of the thrombus, symptoms of increased venous pressure were maintained. Phlebography identified incomplete deep venous patency of upper extremity with developed collateral flow. In the remaining patients, clinical or radiological evaluation did not show a deviation from the norm.

Operative decompression was completed in all 13 patients. 11 patients underwent resection of the first rib, while two other patients underwent a procedure to remove the additional cervical rib. No perioperative complications, or early postoperative complication were reported. Patients are continuing to undergo clinical and ultrasonographic monitoring. They remain without pain. The patients returned to their original work and physical activity.

## Discussion

Paget-Schroetter Syndrome is described as thrombosis leading to obstruction of the axillary and subclavian veins, resulting from intense physical activity of the upper extremity and the shoulder girdle. There are many types of deep venous thrombosis, which result in obstructed venous outflow with increased blood pressure. One

of the types of thrombotic changes in upper extremities is primary thrombosis, which is seen among 25% of cases (10). It often concerns young people and more and more it is identified as concealed type caused compression syndrome of vasculo-neurogenic structures in the thoracic outlet (5).

Mansuez et al (11) presented a patient group with primary thrombosis, in which 78% of treated patients were under 40 years of age. They were mostly men with highly developed musculature and leading intense physical activity (athletes). Thrombotic changes pertained mainly to the right extremity, the dominant one. It was explained by two facts: domination of the right extremity in the evaluated population and anatomically disadvantageous conditions of junction, which is formed by the subclavian vein and the brachiocephalic vein. Junction of those veins is found right after the costo-clavicular ligament, which in certain conditions creates additional possibility of injury. According to the authors, it is favorable to the development of venous blood retention and thrombotic complications (11). It is also consistent with our observations. The age of the patients treated in the present study was between 19 and 38. Thrombosis most often concerned the right upper extremity and mostly men. Development of thrombosis in our patients was linked not only to intense physical workout, but also to anatomical abnormalities. It is interesting, that in 8 analyzed patients complete questionnaire revealed previously occurring symptoms of chronic compression of the vasculo-neurogenic structures in the form of temporary numbing of extremities and pain of the shoulder with radiation to the face. It indicates the relationship of Thoracic Outlet Syndrome with the pathology of Paget-Schroetter Syndrome. This was confirmed by further diagnosis with the use of imaging methods. Noteworthy is that in patients without pre-

vious compression symptoms, anatomical anomalies were also found in the thoracic outlet region. This evidence negates views presented by some experimenters who suggest that anatomical abnormalities are related to arterio-neurogenic complications in TOS, and do not lead to the compression of the subclavian vein (10). Others consider upper extremity deep venous thrombosis in 1.5-5% of cases may accompany TOS (11, 12, 13). Similarly like them, we believe that the lack of symptoms of venous compression, even with the application of widely accepted clinical trials, does not exclude the possibility of hindered venous circulation. Highly probable are also the observations of Campbell et al reporting that 8% of TOS cases develop solely venous complications and often in both upper extremities.

The widely used conventional treatment of upper extremity primary thrombosis, based on its elevation and administration of anticoagulants, leads in 40-70% of cases to the development of nonspecific symptoms of chronic venous insufficiency, submissive to temporary intensification in the form of edema, pain and the feeling of "extremity exhaustion" (14, 15). It is difficult to objectify the consequences of preexisted and improperly treated upper extremity venous thrombosis, because pain depends highly on the type of work performed and the level of patient's awareness (16). Their negative impact on the quality of life, especially in originally physically active patients, remains an indisputable fact. Under the assumption that effort thrombosis is related mainly to young individuals, fully active professionally, and that additionally it is in many cases associated with the exterior venous compression in the thoracic outlet, the aim of the patient treatment should be not only restoration of patency, but also prevention of recurrences. Therefore, implemented by the

authors, in first order of fibrinolytic treatment, surgical decompression followed.

The analysis of the effectiveness of the implemented treatment is also interesting. Short evaluation demonstrated high effectiveness of streptokinase treatment. Complete lysis of the thrombus achieved in 10 patients, in combination with the rest, who achieved partial recanalization, correlates with the duration of the disease. In the first group the fibrinolytic treatment was implemented no later than 5 days after the manifestation of acute symptoms, whereas in others that time was longer and lasted on average 9 days. That indicates directly the necessity of early diagnosis of the Paget-Schroetter Syndrome, with the aim of increasing the effectiveness of fibrinolysis. In contrast, substantial physical improvement (subsided edema and feeling of heaviness of the extremity) despite incomplete recanalization seems to justify the acceptance of fibrinolytic therapy strategy even after a period of 7 days, suggested by some authors (17). In late observations, no recurrences were observed. It could be associated with, based on the understanding of TOS in the disease pathogenesis, with effective establishment of the prevention concept based on surgical decompression of the compressed vein (18). Implemented by us procedure found its confirmation in many reports, in which positive results of fibrinolytic treatment with subsequent operation were seen in 85%, in comparison to the conventional treatment of 36% (19, 20). According to Sanders and Hang (21) fibrinolytic treatment should be supplemented with operative treatment in more than 60% of cases of upper extremity deep venous thrombosis. It should rely on the resection of the first rib, angioplasty or direct venous reconstruction. In Becker's opinion, the above implemented method of treatment should be reserved mainly for young individuals, patients active professionally, with

early, confirmed by phlebography thrombosis, and with potential for operative correction (17).

## Conclusions

1. Upper extremity primary deep vein thrombosis may be the complication of concealed Thoracic Outlet Syndrome in athletes.
2. Treatment of upper extremity primary deep vein thrombosis, should be the immediate restoration of original vessel flow by method of fibrinolysis, with subsequent decompressing operation, based on the resection of the first rib or the accessory cervical rib.

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