

# Successful treatment of an adolescent patient with acute subclavian vein occlusion using the Cleaner thrombectomy device

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## Abstract

Paget-Schroetter Syndrome is a rare condition characterized by the thrombosis of the axillary and/or subclavian vein due to repetitive activity of the upper extremity. This effect results in exertion-induced deep venous thrombosis (DVT) of the upper extremity. In the literature, it has been reported more frequently among the adult population. We aimed to introduce a 15-year-old female patient who suffered an acute DVT of the left upper extremity, and her successful treatment using the Cleaner thrombectomy device.

**Keywords:** Upper extremity, Deep venous thrombosis, Juvenile, Cleaner device

## Introduction

Paget-Schroetter syndrome (PSS), or venous thoracic outlet syndrome, occurs due to the compression of the subclavian vein as it passes through the thoracic outlet. The compression may occur with hypertrophy of the pectoralis minor, scalenius, or subclavius muscles. Moreover, a cervical rib may be another cause of PSS. This condition typically affects the dominant arm of healthy and athletic young adults with a typical history of repeated overhead exertion. Management of PSS in adults includes anticoagulation, systemic or mechanic thrombolysis, angioplasty, and surgery for decompression of the vascular structure [1].

Symptomatic deep venous thrombosis (DVT) is rare in children, with an incidence of approximately 0.7 per 100,000 children [2]. Treatment mostly includes systemic thrombolysis; however, due to the increased practice of pharmaco-mechanic thrombolysis, experiences and favorable results encourage medical practitioners to use this in children and adolescents.

We introduce a 15-year-old female patient who suffered an acute DVT of the left upper extremity. Treatment was successful using the Cleaner thrombectomy device in its early follow-up results.

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## Informed Consent

The authors stated that the written consent was obtained from the legal guardians of the patient presented with images in the study.

## Conflict of Interest

No conflict of interest was declared by the authors.

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## Case presentation

A 15-year-old female patient was admitted to the emergency service with pain in the left upper extremity, swelling, rash, and an increase in temperature that occurred six hours after repetitive abduction exercises in school. On physical examination, her left upper extremity was significantly swollen, with a 5 cm larger diameter and warmer, compared to the right extremity. The patient's pulse was palpable. On Doppler ultrasound, the left subclavian vein was nearly totally occluded due to acute thrombosis, and compression of the vein was diagnosed. Computed tomography angiography showed a subtotal occlusion (Figure 1). A cervical rib was visualized on X-ray. Platelet count, hematocrit, international normalized ratio (INR), partial thromboplastin, and prothrombin time were normal. Plasma D-dimer level was  $> 2500$  ng/mL (normal,  $< 500$  ng/mL). The patient did not possess a medical history involving thrombophilia, cancer, previous DVT of the same extremity or central venous catheterization except for the cervical rib. Doppler USG examination was performed and acute DVT caused by subtotal occluding thrombosis of the subclavian vein was detected. Informed consent was taken from relatives of the patient.

Figure 1: Pre-interventional contrast tomography view of the left subclavian vein occlusion



At the time of diagnosis, 1 mg/kg enoxaparine was administered as the first step of medical treatment. Local anesthesia was administered and a 6 Fr sheath for entry access was inserted through the cephalic vein with USG guidance. An initial venogram was performed and the diagnosis confirmed. A 6 Fr 65 cm Cleaner thrombectomy device (Argon Medical Devices, Inc.; Plano, Texas, USA) was inserted through the introducer sheath. Recombinant tissue plasminogen activator (tPA) (alteplase, Genentech, South San Francisco, California, USA) was administered intermittently (10 mg recombinant tPA diluted with 50 mL saline) through the catheter lumen. The clot material was macerated by advancing and withdrawing the device into the vessel over a period of ten minutes. By aspirating adversely through the catheter lumen, clot material and the lytic medical agent were removed. Via arterial catheter, alteplase (0.5 mg/saline over 24 hours) was infused to remove the residual clot material and avoid probable thrombosis due to possible catheter damage. When the procedure was terminated, the catheter was removed. Within the first 24 hours no bleeding occurred. Enoxaparin (0.125 mg/kg/dose) was administered twice daily to complete the anticoagulation process. The patient was discharged on the third postoperative day with warfarin. INR control was

performed monthly and warfarin was administered for three months. Following treatment, symptoms, including swelling, rash, pain and edema, recovered gradually.

## Discussion

DVT of the upper extremity is rare compared to the lower extremity, with an incidence rate of 4–11% [3]. The most determined etiological factors are: central venous catheter insertion, pacemaker leads, cancer, thrombophilia caused by a major surgical procedure, trauma, pregnancy, oral contraceptive medical treatment, and hyperstimulation syndrome of the ovary [3-4]. PSS may be detected at a ratio of 20% of all etiologies. Spontaneous DVT of the upper limb is extremely rare in childhood and occurs in the dominant arm, typically following repetitive abduction activity, at a ratio of 68% [3]. The condition mostly occurs due to PSS.

To evaluate for spontaneous DVT in childhood and adolescents, it has been suggested to examine for abnormalities in antithrombin III level, protein C and S activity, factor VIII level, anti-phospholipid antibodies and homocysteine level [5]. It is important to determine if thrombophilia is present to avoid the recurrence of DVT [6]. The aim of medical management is to prevent vascular insufficiency and limb edema (i.e., post-thrombotic syndrome) [5].

Catheter-directed thrombolysis (CDT), seldom used in children and adolescents, is extremely rare, particularly for DVT of the upper limb [6]. There are a few studies and case reports regarding CDT usage, but it is mostly used for pulmonary embolism. Goldenberg's study [7] reported that 3 of 16 pediatric patients suffering from upper limb DVT received CDT. The underlying reason for upper limb DVT in these three patients was PSS. In the literature, there exists a case report of a 16-year-old male patient diagnosed with bilateral upper extremity DVT caused by PSS, but treated medically. No consensus regarding PSS and upper limb DVT in pediatric and adolescent populations exists. Treatment may be medical (associated with anticoagulant and thrombolytic agents) or interventional. In some instances CDT is strongly recommended, and surgical decompression can be advised in the case of anatomical defect [2].

We did not find any thrombophilic factors, such as anomalous antithrombin III level, protein C and S activity, factor VIII level, anti-phospholipid antibodies and homocysteine level in our case post-interventionally. We would have investigated the patient by CT angiography for TOS etiology post-interventionally, but, unfortunately, the patient's parents would not allow us due to recurrent radiation exposition.

The symptoms of the patient were detected in the non-dominant left arm. This was unexpected and contradictory to the literature. We preferred CDT therapy for our patient, in this case, the upper limb DVT, and bleeding, which is a complication, did not occur. Although we did not locate involvement of a cervical rib, we detected slight compression of the venous vasculature on Doppler USG, signifying PSS. We did not advocate a massive decompression surgery, as recommended in the literature. Early during follow-up, the patient's symptoms regressed and did not recur. We continued to follow the patient for probable recurrence.

The American College of Chest Physician (ACCP) guidelines [5] advise at least three months of anticoagulant medicine. If more than one risk factor exists, anticoagulant treatment should be extended for a lifetime. This patient was treated with warfarin for three months.

### Conclusion

PSS is a rare reason of essential deep vein thrombosis of the upper extremity, and it is more frequent in the young population. The main cause is repetitive and forcible arm activity and vascular compression by anatomical structures. The diagnosis can be considered if it does not present any trauma to the subclavian vein or if interventional procedure does not exist in medical history [8]. Doppler Ultrasound should be the first choice in diagnosis prior to computed tomography. We believe that this is one of the rare cases documenting non-dominant upper extremity DVT caused by repetitive abduction activity, with a background of PSS in childhood. This adolescent patient was successfully treated via CDT.

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