CASE REPORT

Rock climbing-related subclavian vein thrombosis

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SUMMARY

Paget-Schroetter syndrome, also known as upper extremity deep venous thrombosis (UEDVT), is a rare condition, characterised by a (sub-) total occlusion of the axillary-subclavian venous system due to thrombosis. UEDVT is the most common vascular condition among athletes so far; although the general incidence is low, this problem will become more frequent as a result of increased participation in climbing sports. The purpose of this report is to illustrate two cases in rock climbers where UEDVT developed during rock climbing or bouldering. Fortunately, both patients were diagnosed relatively early after the symptoms began, despite the ambiguity of UEDVT symptoms. This relatively unfamiliar condition may become more highly recognised as a potentially serious differential diagnosis of unspecific pain of the shoulder. Rock climbers are disposed to develop UEDVT due to frequent stress on the upper extremities during training or competition.

BACKGROUND

Paget-Schroetter syndrome, also known as upper extremity deep venous thrombosis (UEDVT) or thrombose par effort, is a rare condition, characterised by total or subtotal occlusion of the axillary-subclavian venous system due to thrombosis. Although the general incidence is still low (approximately 2/100 000 persons per year), this problem will gain importance as a result of increased participation in climbing and bouldering sports.

The purpose of this report is to illustrate two cases in rock climbers, where a primary upper extremity atraumatic subclavian vein thrombosis developed during training.

Sports with constant high stress on the upper extremities are known to be connected with UEDVT, or Paget-Schroetter syndrome.^{1–5} Several cases of mostly young athletes are described in which this vascular affection appeared with unspecific pain and tendinitis-like symptoms of the shoulder, combined with a swelling and change of colour in the affected arm during intense training periods.^{1–3}

CASE PRESENTATION

In 2008, we investigated a 41-year-old man with a thrombosis of his left subclavian axillary and basilic vein, presumably developed during or after climbing a roof in a climbing gym (figure 1). Three years earlier, the athlete suffered from the same symptoms after an extensive training session. On both occasions, the patient suffered from unspecific pain in the shoulder, a feeling of pressure in the upper arm, a swelling of the whole arm and change of

skin colour combined with point-shaped redness. The correct diagnosis of this patient's first UEDVT (2005) was finally made after an ascending phlebography in a vascular centre. In the second occurrence, the patient recognised a pressure-like pain in the right upper arm (2008). Diagnosis could be made instantly as the patient defined the symptoms as identical to those felt 3 years earlier, during the first episode. Regular medication or substance abuse was denied. In 2005 (right arm), the patient was treated with oral phenprocoumon therapy (international normalised ratio (INR) 2.5–3.0) after a bridging period with heparin (subcutaneously) and a compression sleeve. Six weeks after the initial diagnosis, a phlebography of the right arm and a digital subtraction angiography (DSA) of the right shoulder region were performed; no fresh thrombosis was seen, but the right subclavian vein showed a post-thrombotic occlusion with a prominent collateral circulation. Six months later, the patient was re-evaluated in a centre for hemostaseology. A mild hypercoagulability of unknown origin was diagnosed; hereditary or acquired risk factors for hypercoagulability were excluded. A prophylaxis with low-molecular heparin was prescribed for risk situations. In 2008, the patient was sent to a university hospital after diagnosis, immediately after the symptoms began on the left arm during a roof-climbing session. A duplex sonography of the left arm showed a complete thrombosis of the subclavian axillary and basilic vein; all other deep veins in the shoulder/cervical region were free of thrombosis. Thoracic outlet syndrome and antiphospholipid syndrome were excluded via MRI and blood screening, respectively. The same therapy that had been formerly performed on the right arm was repeated and climbing was discouraged.

Our second patient, a 34-year-old healthy athletic woman, noticed tightness in her left arm (non dominant) from wrist to shoulder after a climbing session. She described feeling as if a blood pressure cuff had been left on (discomfort but no pain), which decreased at rest. The feeling instantly heightened with exercise, in particular mountain biking, where she had to stop and shake out her arm to regain complete sensation. However, it was most noticeable when rock climbing. The patient felt an instant loss of muscle strength (climbers' jargon: 'getting pumped') when she started climbing, even on warm up. Along with loss of strength and tightness in the arm, the athlete noticed different colouration of her arm (pink/reddish). Furthermore, significant swelling of approximately 3 cm difference between left and right was recognised. Small bruise-like lesions (burst capillaries) appeared on

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Figure 1 Schematic figure showing the venous system of the shoulder/arm region with passage to superior vena cava. *1: superior vena cava, *2: brachiocephalic veins, *3: jugular veins, *4: subclavian veins, *5: cephalic veins, *6: axillary veins, *7: passage to brachial and basilic veins. # Numbers showing number of sonographic vein classification (modified according to Scholz⁶).

her upper arm. Initially, a medical consultation was postponed as the athlete thought she possibly had not allowed sufficient recovery between sessions or had pushed her body too hard during training. As the symptoms remained, although the patient had done nothing outside of her capabilities, she went to a healthcare centre. One week after the symptoms began, a deep venous thrombosis was diagnosed on first medical exploration as a result of the patient's detailed description of the affliction. No family history of thrombosis was known by the patient. Regular medication was specified as a daily intake of 125 µg levothyroxine for Hashimoto's disease, daily use of an asthma preventer (fluticasone/salmeterol) and irregular intake of ventolin.

INVESTIGATIONS AND TREATMENT

Examination of the first patient in our department 3 months after the second UEDVT showed a satisfying reduction of the symptoms at rest; in a duplex sonography of both arms, we could clearly see good recanalisation of the right shoulder/arm veins and the left axillary and basilic veins, whereas the subclavian vein still presented a thickening of the vessel wall. Provocative tests such as the Eden test, Adson test and Abduction-External-Rotation test (AER) showed no evidence for thoracic outlet syndrome. A further phlebography of the left arm showed an ongoing occlusion of the subclavian vein; the planned phlebography in a functional position was cancelled and further 3-month anticoagulant therapy advised (figures 2 and 3).

During the second patient's initial medical consultation, blood tests (inconspicuous results) were carried out along with an ultrasound, where the occluding blood clot was seen. Initial therapy started with a single daily shot of low-molecular heparin (Clexane)—weight-based method. The oral anticoagulant dabigatran (Pradaxa) was prescribed, overlapping with the heparin. Approximately 8 weeks after the initial diagnosis was made, a further ultrasound showed partial recanalisation of the subclavian vein with some residual, non-occlusive clots still present. Symptoms suggested a post-thrombotic limb. A consulted vascular surgeon finally made the proper diagnosis of Paget-Schroetter syndrome. Oral anticoagulant therapy with dabigatran (Pradaxa) was continued.

DIFFERENTIAL DIAGNOSIS

Shoulder pathologies.

OUTCOME AND FOLLOW-UP

Several months after the previous consultation of our first patient, a good recanalisation of the left shoulder/arm veins was seen in ultrasound examination, without any proof of a post-thrombotic syndrome. Surprisingly, a follow-up investigation of the opposite (right) side showed a distinct post-thrombotic syndrome in absence of any symptoms. Pronounced subcutaneous venous collaterals had developed (figure 4). Oral anticoagulation was continued for almost 1 year after the patient was free of

Figure 2 Digital subtraction angiography of the left shoulder/arm venous system. (A) Near-total occlusion of basilic-axillary-subclavian venous complex. (B) Clearly identifiable collaterals around occluded basilic-axillary-subclavian veins. (C) The cephalic vein is well vascularised (patient 1, January 2008).

Figure 3 Phlebography of the left shoulder-arm venous system. The near-total occlusion of basilic-axillary-subclavian venous complex can be seen whereas remaining venous drainage is provided by cephalic vein and collaterals (patient 1, January 2008).

symptoms. At this point, no discomfort remained, and light occasional climbing could be resumed.

Following consultation of the female climber, a stress ultrasound (abduction and elevation) performed on both the left and right arm, showed narrowing of the left S2/S3 segment of the subclavian vein with chronic thrombotic residue ([figure 1](#)).⁶ The vessel occluded in this area with the arm raised.⁴ Owing to this patient's unimproved symptoms, she finally received surgical

therapy with first rib resection. The athlete recently finished rehabilitation; symptoms are decreasing and she is regaining her climbing abilities.

DISCUSSION

Shoulder or upper arm disorders are seen regularly in sport climbers and are mostly related to capsule, ligament or tendon affections.⁷ In contrast, deep vein thrombosis in the shoulder/

Figure 4 Subcutaneous venous collaterals. Right side: 10 years after upper extremity deep venous thrombosis (UEDVT), left side: 5 years after UEDVT (patient 1, May 2015).

arm is rarely seen; its diagnosis can be difficult due to indeterminate cause and indistinct pathophysiology.¹ Corresponding with the increasing number of (mainly indoor) rock climbers, the frequency of all traumas and degenerative disorders is likely to increase.⁷ Some cases of Paget-Schroetter syndrome will be among these, which is why this case report has been presented.⁵

The pathogenesis and treatment of UEDVT are discussed controversially throughout the literature.^{2–8,11} The mechanism that leads to the occlusion is presumed to be associated with the repetitive pinch of the subclavian vein between the clavicle and first rib during upper extremity activities such as rock climbing, weight lifting, etc. This compression leads to an intimal injury that, appearing as a chronic repetitive injury, triggers fibrosis and extrinsic constriction of the vessel wall. The formed circumferential perivenous scar tissue leads to progressive stenosis. Collaterals might compensate this course quite well, but higher blood flow during workout or even a small thrombus formation can lead to insufficient blood flow or a total occlusion of the remaining lumen. As collaterals are too slight to maintain free blood flow, the patient will become symptomatic.^{2–9} Symptoms are unspecific and vary in intensity, from totally asymptomatic to strongly restricting, along with being position-dependent in the majority of cases.¹ Patients describe a feeling of ‘tightness’ or ‘heaviness’ in the arm, more of a discomfort than a pain. A dull ache and even pain in the neck/shoulder or axilla may also occur. Furthermore, swelling weakness or fatigue, discoloration with ecchymosis and heightened symptoms under effort are indicative of UEDVT.^{1–11} The differential diagnosis is complex, as these symptoms might be misinterpreted as thoracic outlet syndrome.¹

Neither of our patients showed any predisposing factors, underlying diseases or trauma to the affected extremity, which might have been a reason for the thrombosis at first appearance.

It is highly recommended for physicians to be familiar with the signs and symptoms of Paget-Schroetter syndrome, to ensure a quick and correct diagnosis, and to instantly afford the athlete proper therapy, as serious complications such as pulmonary embolism (PE) are present in up to one-third of patients with UEDVT.^{2–4,9}

UEDVT should always be considered as a differential diagnosis for shoulder pathologies as well as for the thoracic outlet syndrome in patients with tightness, discomfort and weakness

of the arm combined with a swelling, discoloration and possibly even bruising or visible capillaries. In most cases, these symptoms worsen with exercise, particularly associated with climbing. History of previous UEDVT strongly indicates the correct diagnosis, even on the opposite side.³

Learning points

- ▶ Prevalence of Paget-Schroetter syndrome will increase based on individuals’ changing sport preferences.
- ▶ Early correct diagnosis can prevent serious complications such as pulmonary embolism.

Competing interests None declared.

Patient consent Obtained.

Provenance and peer review Not commissioned; externally peer reviewed.

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