Case report

Subclavian artery occlusion after a clavicle fracture

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SUMMARY

A 44-year-old man with a 9-day-old left displaced midshaft clavicle fracture was initially treated conservatively. The patient experienced an increase of pain with tickling and cold sensation in the left upper extremity. CT angiography showed left subclavian artery occlusion over 3 cm at the level of the fracture. At surgical repair, a subclavian-brachial bypass was constructed and fracture fixation was done with an eight-hole locking compression plate. Follow-up at 6 months showed full range of motion of the left shoulder, an open bypass and fracture consolidation.

BACKGROUND

Subclavian artery injuries are an uncommon complication of blunt chest trauma. The subclavian artery is protected by the clavicle and the first rib and soft tissue (the deep subclavius muscle, cervical fascia and clavi-coraco-axillary fascia) and the costo-coracoid ligament.¹ Because of this mechanical protection, blunt or penetrating subclavian artery injuries are less than 5% of all vascular injuries.² Thoracic outlet syndrome (TOS) is also associated with subclavian artery pathology and osseous abnormalities can cause TOS.³ We would like to present a case of a post-traumatic arterial TOS, a subacute occlusion by mechanic compression after a clavicle fracture.

CASE PRESENTATION

A 44-year-old, healthy, man presented at the emergency department of our teaching hospital 9 days after a skiing accident abroad. He was diagnosed with a displaced midshaft clavicle fracture, Arbeitsgemeinschaft für Osteosynthesefragen (AO) type 15.2B. Initial treatment was conservative management with a sling.

After returning to the Netherlands, the patient experienced an increase of pain in his left shoulder with a continuous tickling of his left hand and cold sensation in the complete left upper extremity.

Physical examination did not reveal motor or sensory function loss of the left upper extremity. The radial artery had a diminished pulse and there was no pulse at the ulnar artery palpable. Capillary refill was three seconds. Compared with the right hand, the left hand was not significantly colder. Doppler examination revealed biphasic radial and ulnar pulses. The clavicular area was painful and swollen with a haematoma and deformity consistent with the fracture.

INVESTIGATIONS

Radiographic examination confirmed a displaced midshaft fragmentary wedge left clavicle fracture AO-type 15.2B (figure 1). CT Angiography showed an occlusion of the left subclavian artery over a length of 3 cm at the level of the fracture. Distal to the occlusion the subclavian artery filled via various circumflex collaterals (figure 2).

TREATMENT

Surgical repair was planned on both the fracture and vascular injury. The planned treatment was reconstruction of the subclavian artery with a venous interposition (great saphenous vein) and open reduction and internal fixation of the clavicle fracture by a locking compression plate (LCP).

During surgery there was compression of the left subclavian artery due to several clavicle fracture fragments and callus formation at the fracture zone, and was presumed to be the mechanical cause of occlusion of the left subclavian artery. The extensive callus formation impaired the planned venous interposition, because of the close relationship to the brachial plexus. Therefore, it was decided to perform the planned bail out procedure, an extra-anatomical venous subclavian-brachial bypass. The greater saphenous vein was used as graft for the bypass. Subsequently, reduction and internal fixation of the clavicle was performed using an 8-hole LCP (figure 3).

OUTCOME AND FOLLOW-UP

Postoperatively there were normal motor and sensory functions of the left upper extremity. The preoperative sensory symptoms were no longer present; clopidogrel was started directly after surgery to be used for 12 months postsurgery. After 2 weeks the patient showed improving shoulder function with minimal impairment and he returned to work 8 weeks after surgery.

Duplex ultrasound at 2 and 6 months postsurgery showed a patent bypass without stenosis and a triphasic flow pattern to a patent radial and ulnar artery. At 6 months motion function had recovered completely.

DISCUSSION

There is limited evidence about subclavian artery injury repair. Most of the injuries at the subclavian artery are penetrating injuries.² Blunt trauma causing injury to the subclavian artery is rare and is the cause of only 2%–3% of all subclavian artery injuries.⁴

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Figure 1 X-ray of the displaced midshaft fragmentary wedge left clavicle fracture AO-type 15.2B.

TOS refers to a constellation of signs and symptoms attributable to compression of the neurovascular bundle in the thoracic outlet region of the upper extremity. Less than 1% occurs of the arterial subtype of the TOS.⁵ Mostly cervical ribs are the cause of an arterial TOS; less common is a clavicle fracture.³ In our search, subacute occlusion of the subclavian artery due to compression of callus formation after a clavicle fracture has not been described in current literature.

Symptoms of fracture related TOS are mostly very subtle but can be a decreased or absent radial and/or ulnar artery pulse, sensory alterations with clinical signs of a clavicle fracture like haematoma and deformation around the clavicle.

Treatment of an arterial TOS was described by Hussain *et al* as a surgical strategy guided by three main principles: decompression, arterial reconstruction and distal revascularisation.⁵

Reconstruction after arterial occlusion in the (sub)acute phase, does not provide space for only decompression due to callus formation from the clavicle fracture.

However, the open surgical repair of an arterial TOS and traumatic arterial injury is still the gold standard. Some studies describe an open procedure for decompression with an endovascular stent in the subclavian artery.^{6,7} The advantage of an

Figure 2 CT Angiography with an occlusion of the left subclavian artery over a length of 3 cm at the level of the fracture, indicated with a red arrow. Distal to the occlusion the subclavian artery filled via various collaterals.

Figure 3 Postoperative X-ray with reduction and internal fixation of the clavicle was done with an eight-hole locking compression plate.

endovascular approach is that it is minimally invasive. This needs to be weighed against a larger risk to restenosis or occlusion in fracture related arterial TOS because of the bony structures, which could lead to external compression or stent breakage.⁸ Furthermore, fixation of the fracture is done by an open approach.

In this case an open surgical approach was chosen because of several reasons. First, this was a young patient, and active long-term results of endovascular repair are lacking and stent related complications are expected to be high in this group of patients.⁸ Second, there was a displaced clavicle fracture, which required open reduction and internal fixation. Thirdly, fracture fragments would have caused external compression on the endovascular stent.

The amount of callus formation is something to consider when open repair is planned. It is essential to have good exposure of the proximal and distal landing zones to perform an interposition. If this is not possible a bypass is a good and effective alternative.

In conclusion, a subacute occlusion of the subclavian artery after a clavicle fracture was repaired with an extra-anatomical venous bypass and LCP, with good vascular and functional outcome in a young patient.

Learning points

- ▶ Subclavian artery injuries after blunt trauma is an uncommon injury.
- ▶ Subclavian artery injury should be excluded after clavicle fractures.
- ▶ The distal arterial pulse should be checked after clavicle fracture and registered during follow-up.
- ▶ Open repair of a subclavian artery injury in presence of a clavicle fracture can be challenging because of extensive callus formation and a close relation of plexus and subclavian artery.

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REFERENCES

- 1 Assenza M, Centonze L, Valesini L, *et al*. Traumatic subclavian arterial rupture: a case report and review of literature. *World J Emerg Surg* 2012;7:18.
- 2 Aksoy M, Tunca F, Yanar H, *et al*. Traumatic injuries to the subclavian and axillary arteries: a 13-year review. *Surg Today* 2005;35:561–5.

- 3 Vemuri C, McLaughlin LN, Abuirgeba AA, *et al.* Clinical presentation and management of arterial thoracic outlet syndrome. *J Vasc Surg* 2017;65:1429–39.
- 4 Katras T, Baltazar U, Rush DS, *et al.* Subclavian arterial injury associated with blunt trauma. *Vasc Surg* 2001;35:43–50.
- 5 Hussain MA, Aljabri B, Al-Omran M. Vascular thoracic outlet syndrome. *Semin Thorac Cardiovasc Surg* 2016;28:151–7.
- 6 Malliet C, Fourneau I, Daenens K, *et al.* Endovascular stent-graft and first rib resection for thoracic outlet syndrome complicated by an aneurysm of the subclavian artery. *Acta Chir Belg* 2005;105:194–7.
- 7 Ikeda N, Nakamura M, Hara H, *et al.* Combined endovascular and open surgical approach for the management of subclavian artery occlusion due to thoracic outlet syndrome. *J Card Surg* 2011;26:309–12.
- 8 Phipp LH, Scott DJ, Kessel D, *et al.* Subclavian stents and stent-grafts: cause for concern? *J Endovasc Surg* 1999;6:223–6.

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