Misalignment of the clavicle after intramedullary fixation of a midshaft fracture with a titanium elastic nail results in acute neurovascular thoracic outlet syndrome

Jochen Gieger, Frank J. Beeres, Konrad Birrer, Reto Babst – Clinic for Orthopedics & Traumatology, Kantonsspital Luzern

Introduction
Midshaft clavicular fractures represent up to 4% of all fractures in adults. Several complications of nailing of these dislocated fractures are already described in the literature. The most frequently described complications are due to the operation itself, sharp-edged bone fragments, or distinctive production of callus.

Case Report
A 31-year-old patient fell on his left shoulder playing soccer, resulting in a fracture of the midshaft of the clavicle (Figure 1). It was treated with a Titanium Elastic Nail (TEN). Before and directly after surgery, the neurovascular status was normal. Ten days after surgery, the patient noticed a progressive weakness of both the extensor and flexor muscles of the forearm and in the area of the triceps and biceps. In addition, he had paresthesia and livid discoloration of the fingers of the left arm. (Figure 2).

A computed tomography angiography was performed to evaluate blood circulation. Compared with the right arm, there was a shortening of about 5mm and significant narrowing between the first rib and the clavicle without constriction of the subclavian artery (Figure 3 – 11.01 mm on the left side vs. 18.84 mm on the right side). Angiography in the elevated position revealed mild stenosis of the subclavian artery (Figure 4). Compared to specific tests like veno- and arteriography, a modern CT-angiography however, with a late venous sequence, combines the advantages of visualizing the vessels and the bone structures.

A neurologic evaluation did not show any muscular atrophy of the left arm. Manual testing of the muscles of the left side revealed arm abduction 4-5/5, flexion of the elbow 3/5, extension of the elbow 2/5, external rotation 4/5, internal rotation 3/5, extension of the wrist almost 3/5, flexion of the wrist 2/5, spreading of the fingers 1-2/5, manual grip strength 2/5, triceps tendon reflex weak (right side active reflexes), and further muscular reflexes on the left side negative (right side: active reflexes). There was reduced circular sensation from the elbow to the hand.

A color-coded duplex sonography showed regular arteries in the left arm with regular flow of the subclavian, axillary and brachial arteries. There were no relevant signs of hemodynamically obstructions or aneurysms with or without provocation.

A MRI ruled out a lesion of the brachial plexus. It also showed a sufficient consolidation of the fracture, so we decided to remove the TEN earlier than initially anticipated, three months after the initial treatment.

Nine months after trauma, a final clinical and outpatient radiographic follow-up showed a satisfied patient with full range of motion and a consolidated fracture (Figure 5). A final neurological evaluation showed that the paresis of the left arm had fully resolved and that the patient had symmetrical muscle strength, tendon reflexes and complex of the fingers.

Spontaneous activities in the electromyography still documented an axonal lesion of the brachial plexus but without clinical consequences.

Conclusion
Possible transformation or straightening of the natural curvature of the clavicle may cause neurovascular thoracic outlet syndrome. In that case, early removal of the intramedullary nail or conversion to plate osteosynthesis to restore the natural convexity of the clavicle should be evaluated. We recommend the algorithm on the left to deal with a possible neurovascular complication, after intramedullary nailing of a midshaft fracture of the clavicle.

The differential diagnoses to exclude in reference to a specific trauma are iatrogenic lesions of the neurovascular structures during the operative procedure and lesions caused by the fracture fragments themselves.

Non-traumatic differential diagnoses that should be evaluated are carpal tunnel syndrome, ulnar tunnel syndrome, cervical disc herniation, cervical spondylodiscitis, multiple sclerosis, myositis, tendinosis and myocardial infarction.