Persistent subclavian artery stenosis following surgical repair of non-union of a fractured clavicle


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Abstract

Arterial thoracic outlet syndrome (TOS) is a rare vascular abnormality. Its common cause is a cervical rib but it is seldom detected secondary to trauma of the clavicle, particularly in association with surgical repair of a fractured clavicle. An athletic 45-year-old man developed a recurrent ischaemic upper limb after repair to a non-union fractured clavicle. He underwent multiple separate procedures including embolectomy, angioplasty, thrombolysis and subclavian stent insertion. Definitive diagnosis was made using 3D reconstructed computer tomography. He had a subclavian artery stenosis with arm abduction as a result of loss of curvature of the clavicle after orthopaedic reconstructive surgery. The best surgical approach for this problem remains controversial.

Keywords

Thoracic outlet syndrome; 3D CT reconstruction; subclavian artery stenosis.

Introduction

Arterial thoracic outlet syndrome (TOS) accounts for 1% of all TOS[1]. Iatrogenic arterial TOS following surgical repair of a fractured clavicle has seldom been described in the literature and its cause is normally protrusion of a screw or migration of Kirschner wires[2]. Our patient, however, had arterial TOS as a result of loss of curvature of the clavicle after surgery for non-union. Diagnostic computer tomography (CT) was decisive in demonstrating this uncommon vascular abnormality.

Case report

A 45-year-old right-handed man with a passion for extreme sports was referred to the orthopaedic surgeons following non-union of a left segmental clavicular fracture from a mountain biking accident 4 years previously. He underwent removal of excessive fibrous tissue and interfragmentary screw and compression plate fixation to reduce the floating medial segment and

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to stabilize the fracture (Fig. 1). Postoperatively he experienced transient numbness in the median nerve distribution but a radiograph showed satisfactory reduction and fixation.

Three months later, the patient was readmitted with left hand claudication and associated ischaemic colour changes. Arterial duplex revealed a significant stenosis and thrombosis in the subclavian artery in the region of the clavicular fracture. The brachial artery was occluded from its origin in continuity to the radial artery, which was occluded throughout its length. The ulnar artery reconstituted in its proximal third. This suggested post-traumatic damage leading to embolic occlusion of both the brachial and radial arteries. The patient underwent emergency brachial, ulnar and radial embolectomies. Two days later an antegrade subclavian artery stent was placed across the narrowing without complication. One month later the patient re-presented with an occluded subclavian stent. He required 4 days of thrombolysis with tissue plasminogen activator and brachial artery angioplasty to unblock his stent and distal vessels. He was also commenced on warfarin in view of recurrent thrombosis.

An ultrasound scan revealed evidence of subclavian artery and vein compression as it passed between the clavicle and the first rib, which was shown to be most marked when he abducted the left arm to 90 degrees. A reconstructed, 128-slice contrast CT scan of his thoracic outlet (Fig. 2) clearly demonstrated patency of the stent with the arm down by his side and when he raised his arm, the abnormal clavicle, with the loss of anterior and posterior curvature, impinged on the stent, occluding it against the first rib.

The patient has been counselled by both vascular and orthopaedic surgeons but has currently declined all further surgical intervention and has returned to work on long-term anticoagulation. He is currently still doing regular windsurfing and mountain biking but he is refraining from all sports that require him to abduct his left arm greater than 90 degrees.

Discussion

There are a number of reports in the literature of TOS secondary to clavicular pathology following trauma[3], tumours[4] or congenital pseudoarthrosis. There is, however, very little on iatrogenic TOS following clavicular surgery[5]. This case also demonstrates the diagnostic use of newer 3D imaging techniques for vascular pathology.

Surgical treatment for TOS is considered a last resort but in the case of arterial TOS it is nearly always necessary. It usually involves a scalenectomy and removal of the first rib. In this case a transaxillary approach would not be suitable as the patient cannot abduct his arm because of occlusion to the subclavian artery with the stent in situ. Transthoracic or supraclavicular approaches to remove the first rib would be hazardous for what amounts to be a relatively benign condition, as there is likely to be a significant amount of fibrous tissue from the initial trauma.

Fig. 1. (a) Non-union of fractured clavicle; (b) clavicle following screw and compression plate fixation.
and the previous surgery. So far the patient has declined this option. Subclavian artery bypass surgery would not correct the venous compression.

A straight plate was used on this patient to fix his clavicle. Pre-contoured clavicle plates are now available commercially, however this patient had a floating mid-segment of clavicle and essentially non-union in the midpart of the clavicle. A pre-countoured plate might have made the surgery technically easier but it is unlikely that it would have made any difference to the position of the fractured fragments as the midpoint of the clavicle is straight. Revision of the clavicle, which would involve dividing the bone in its mid-third and pre-bending the plate in order for the clavicle to be curved anteriorly to create more space under its surface for the artery and vein to pass, may fail to resolve the TOS and further destabilise the clavicle. At present the patient has declined this option.

**Teaching point**

This case illustrates that 3D CT reconstruction can be a useful diagnostic tool for vascular pathology. It is important to address the cause of an arterial stenosis/occlusion before endovascular stenting because otherwise the stent will occlude. It highlights what a challenge planning surgery to remove the first rib is in someone who has previously had clavicular surgery because of the amount of scar tissue present. Patient choice is a vital part of all
Currently this patient feels his present quality of life outweighs the risks of any further surgery.

References


