

Recurrent peripheral embolism following nonunion of the clavicle

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ABSTRACT

Vascular complications in closed clavicular fractures are uncommon, with an incidence of only 0.4%. Subclavian artery injury can present acutely or can have a delayed presentation with arm ischemia. We report the case of an undetected subclavian pseudoaneurysm in a patient with a nonunion fracture clavicle who was referred with persistent ischemia following attempted brachial embolectomy at another center, along with a review of literature to support the hypothesis that in addition to repair of the aneurysm, treatment of the psuedarthrosis by fixation of the clavicle is essential.

Key words: Clavicle nonunion, subclavian pseudoaneurysm, thoracic outlet syndrome, thromboembolism

INTRODUCTION

The nonunion rate after conservative management of clavicular fractures is about 1-4.5%¹ and is more commonly seen with increased fracture displacement and comminution. Both nonunion and malunion of the clavicle have been shown to cause limitation in the range of movement and pain.² While the vascular pathology can be treated with endovascular stenting or open repair, open reduction and realignment of the clavicle is also essential in order to prevent repeated insults to the vessels in the thoracic outlet region and to improve the functional outcome. We present a case, where inadequate treatment of the vascular injury and the clavicle fracture, resulted in recurrent thromboembolic episodes.

CASE REPORT

A 46 year old male presented with severe pain in the left arm for 1 week. Six months earlier, he had sustained a

closed fracture of the left clavicle and upper five ribs. This was managed nonoperatively with an arm sling. Following a duplex scan, a left brachial embolus was diagnosed and an embolectomy was done; but this had to be repeated a few days later, as he presented again, with the same symptoms. As his pain and numbness did not abate after two explorations, the patient was referred to this center.

At the time of presentation to us after the second embolectomy, the left arm was cooler than the right and finger pressure was zero. The left brachial, radial and ulnar pulses were absent. Sensation was decreased below the elbow and motor power was grade 4 (Medical Research Council Grade). On examination of the clavicle, there was a bony discontinuity palpable along the middle one third, with abnormal mobility. There were no pulsatile swellings or palpable bruit at the nonunion site. A chest X-ray revealed an atrophic nonunion of the middle third of the clavicle with significant over riding of the ends [Figure 1a]. A computed tomography angiogram (CTA) showed a pseudoaneurysm of the left subclavian artery, adjacent to the nonunion of the clavicle [Figure 1b].

Patient underwent excision of the pseudoaneurysm and fixation of the clavicular fracture. The vessel was approached via an infraclavicular incision. Proximal and distal control of the subclavian artery was obtained followed by identification of the pseudoaneurysm. The sac was opened and thromboembolectomy was done. The defect was then closed with a primary repair [Figure 2]. This was followed by operative stabilization of the clavicle. The atrophic ends of the nonunion were dissected and the intervening fibrous tissue resected. The distal end of the nonunion was found to be in close proximity to the aneurysm and had

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probably button holed into the subclavian artery causing the primary injury. A 3.5 millimetre precontoured locking plate was applied on the superior surface along with bone graft harvested from the ipsilateral iliac crest. At 12 months following the surgery, he remained asymptomatic, with a good range of movement at the shoulder. The radiographs confirmed clinical union of the clavicle.

DISCUSSION

Fractures of the clavicle account for 2.6-4% of adult fractures and 36% of all shoulder injuries.^{3,4} About 80% of clavicle fractures are at the midshaft.² Associated vascular injuries are about 0.4%, more commonly being associated with a concomitant first rib fracture.⁵⁻⁷ Vascular injury may present with hard or soft signs: Acute vascular injury may present with bleeding, clavicular hematoma with hemodynamic instability, rupture or a pulsatile supraclavicular mass.^{5,7} Chronic cases can present with arterial thoracic outlet syndrome, arm ischemia secondary to thromboembolism and symptoms of venous or nerve compression.^{5,6} A high index of suspicion helps in diagnosing associated vascular injury; more so as a delayed presentation is possible.^{5,6} Complete transection, thrombosis of a true aneurysm or other proximal arterial pathology causing emboli can be ruled out after imaging.

The vascular injury associated with a clavicular fracture can be treated surgically or with endovascular stents. The surgical approach depends on the location of the injury. Sternotomy, supraclavicular, infraclavicular and combined approaches have been described.⁵ The artery can be repaired primarily or with a graft. Embolectomy with transarterial instillation of thrombolytic agents may be needed in selected cases.⁸ Endovascular treatment may be favored for older, unstable patients who present acutely.⁹ Treatment of the arm ischemia by means of a peripheral embolectomy without addressing the proximal lesion as was initially done in this case will not serve any purpose.

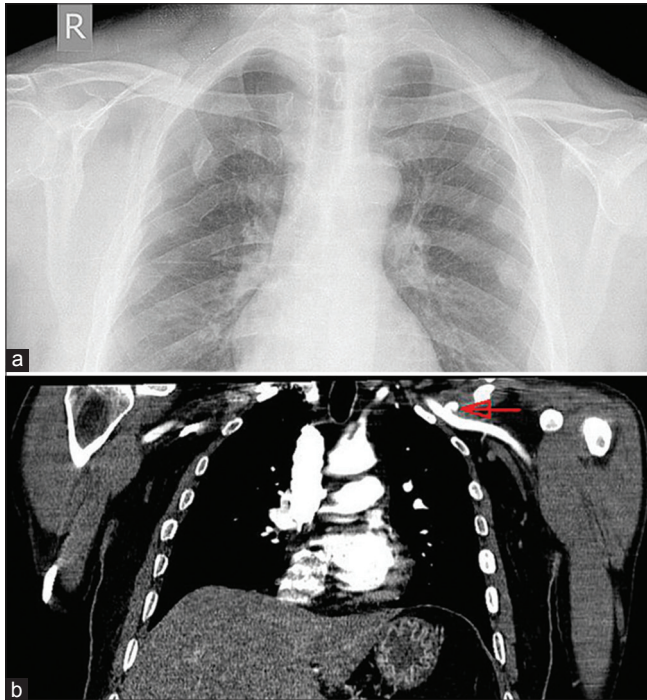


Figure 1: (a) Chest X-ray showing left clavicular nonunion with overriding of fragments. (b) Computerized tomography angiogram coronal section showing aneurysm from left subclavian artery (highlighted by red arrow)

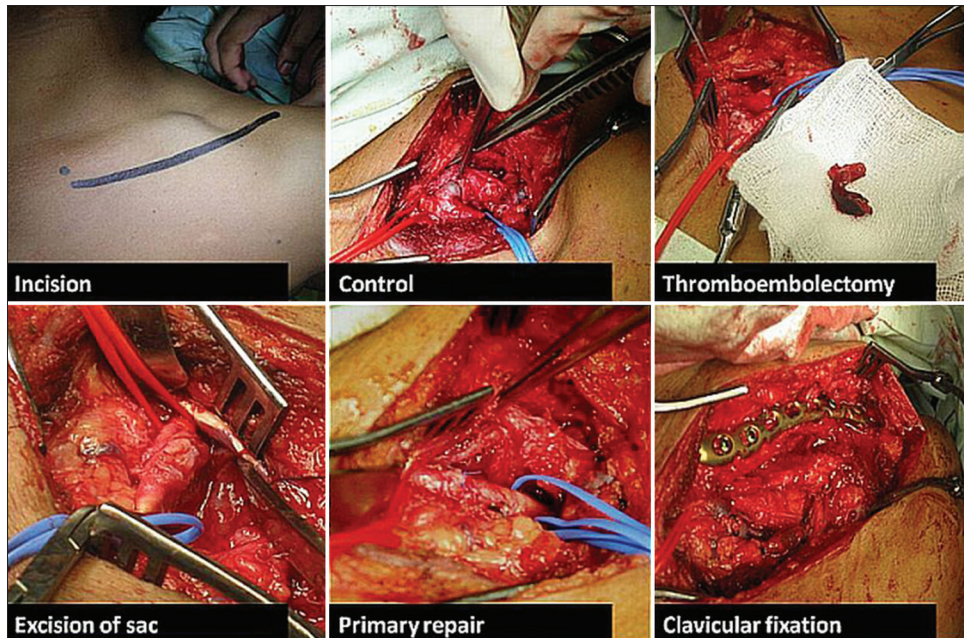


Figure 2: Surgical steps: (Top row, from left to right) showing incision, exposure of aneurysm and thromboembolectomy (bottom row, from left to right) showing excision of sac, primary repair and fixation of nonunion clavicle with locking precontoured titanium plate

Stenting or repair of the arterial pathology, without subsequent fixation of the clavicle pathology could potentially lead to recurrence of symptoms. In this case report, the primary insult to the subclavian artery must have occurred at the time of trauma. The constant movement at the clavicle pseudoarthrosis or hypertrophic callus probably contributed to worsening of the aneurysm and the recurrent thromboembolic events. Therefore, it is essential that when stenting or repair is done, it should be followed up with appropriate treatment of the clavicular fracture.

Nonunion of the clavicle, when associated with subclavian aneurysms has traditionally been treated with resection. This procedure aids in the surgical approach to the vessel and provides relief of the constriction at the thoracic outlet. A first rib excision is also occasionally performed. Garnier *et al.*, in 2003¹⁰ presented three patients who presented with symptoms of thoracic outlet obstruction due to congenital or fracture related pseudoarthrosis of the clavicle. They had reasonably good outcome with resection of a portion of the clavicle along with repair of the injured vessel.

With improvements in fixation and the advent of newer precontoured plates, the union rates and functional outcome of open reduction and internal fixation of clavicle fractures have improved.^{11,12} In cases of clavicle fracture associated with vascular injury, we propose that it is better to treat the clavicle with internal fixation, as functional results would be better. Operative fixation, however if done improperly can potentially present with more iatrogenic vascular complications.^{13,14} With dynamic 3D CT reconstruction films, Burnand *et al.*⁸ illustrated how even after an open reduction and internal fixation of the clavicle, the lack of reconstruction of the normal bow of the clavicle resulted in thoracic outlet obstruction every time the patient abducted the shoulder beyond 90°.

To conclude, when patients present with a clavicle fracture associated with a first rib fracture or chest trauma, there should be a high index of suspicion of an associated vascular injury. If the patient presents late, with symptoms of thoracic outlet obstruction, vascular injury should be ruled out by a computerised tomography angiography (CTA). Open repair or endovascular treatment of the posttraumatic subclavian aneurysms, coupled with either excision or fixation of the pseudoarthrosis is

recommended. Vascular repair without addressing the clavicular pathology is not advisable.

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