CASE REPORT

Subclavian artery injury secondary to clavicular plate fixation: a novel operative approach

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Abstract

We present the case of a 32-year-old male with a delayed symptomatic left subclavian artery pseudoaneurysm secondary to protruding screws from prior perpendicular clavicular plate fixations. The pseudoaneurysm development and our operative approach are unique to the few similar cases available in the literature. The patient presented with a progressive pulsatile mass behind his left clavicle associated with paraesthesia. Angiography demonstrated a subclavian pseudoaneurysm adjacent to a prominent fixation screw. Offending screws were removed and the pseudoaneurysm was repaired using a reversed greater saphenous vein graft. This case illustrates an unusual aetiology for pseudoaneurysm development and highlights a successful operative intervention.

INTRODUCTION

Subclavian artery aneurysms are uncommon, yet the consequences may be life or limb-threatening [1]. True aneurysms, characteristically in later years, are typically degenerative. As opposed to pseudoaneurysms, which tend to be sequelae of vessel trauma. We present the case of a symptomatic pseudoaneurysm developing 9 years following multiple clavicular plate repairs for a non-healed clavicle fracture. A supra- and infraclavicular approach was used to remove offending screws and repair the pseudoaneurysm with an interposition vein graft. Our operative approach is unique to the few similar cases available in the literature.

CASE REPORT

A fit and well 32-year-old male was referred to vascular surgical outpatient clinic with a 1-year history of a progressive pulsatile mass behind his left clavicle, associated with intermittent paraesthesia. He had undergone plate fixation of a comminuted midshaft clavicle fracture 9 years ago. Due to non-union, the patient required a second plate inserted perpendicular to the first, with bone grafts for added strength.

On examination, there was an obvious pulsatile mass posterior to the left clavicle. The perpendicular plates were palpable, with prominent screws. At the time, all upper limb pulses were present with no signs of embolic disease. Neurological examination was also unremarkable. A recent Doppler ultrasound suggested that a plate fixation screw was impinging on the subclavian artery wall, causing increased wall thickness. Computer tomographic angiography (CTA) depicted a left subclavian artery pseudoaneurysm, yet there was significant metalware artefact. Thus, digital subtraction angiography (DSA) was booked (Figures 1 and 2). Yet, prior to undergoing this, he was admitted with sudden worsening of left arm pain and paraesthesia associated with movement despite a viable arm with present distal pulses.

Digital subtraction angiography via the right common femoral artery (CFA) was performed depicting fusiform aneurysmal dilatation of the mid left subclavian artery posterior to the clavicular plates and screws. Further, a focal area of irregularity was noted along the inferior aspect of the artery at the distal
preserved after retraction of scalenus anterior. The subclavian ar-
toid was divided and the phrenic nerve was distinguished and
used for initial exposure. The clavicular head of sternocleomas-
removal of plate
piration of the artery by prominent clavicular screws at the site of the pseudoaneurysm.
The patient subsequently underwent open surgical repair of
pseudoaneurysm, with orthopaedic surgical assistance for
removal of plate fixation screws. A supraclavicular incision was
used for initial exposure. The clavicular head of sternocleidomas-
toid was divided and the phrenic nerve was distinguished and
preserved after retraction of scalenus anterior. The subclavian ar-
tery pseudoaneurysm was identified posterior to the clavicular
plates. There were two perpendicular screws from each plate pro-
truding into the wall of the pseudoaneurysm. The proximal sub-
clavian artery was looped and the clavicular plates exposed. At
this stage, orthopaedic surgical assistance was required for re-
moval of two screws from each plate. There was extensive bony
overgrowth and the fracture was united. The plates were left in
situ. An infraclavicular incision was then utilized to identify and
loop the axillary artery before systemic heparinization. A re-
versed GSV interposition graft was secured end-to-end using 6/0
prolene to repair the pseudoaneurysm. The vein graft was tun-
nelled through the pseudoaneurysm. Further, the subclavian
vein was explored to successfully exclude any damage to it.

Upon review, the patient had complete resolution of symp-
toms and a full complement of peripheral pulses.

**DISCUSSION**

Subclavian pseudoaneurysms are a relatively uncommon phe-
nomenon and typically occur as the result of blunt or penetrating
trauma [2]. Invasive monitoring requirements utilizing central
venous cannulation may inadvertently cause iatrogenic arterial
injury leading to pseudoaneurysm formation [3]. Pseudoaneur-
ysm development in our case presents the unique scenario
whereby an existing true aneurysm caused by the initial injury
enlarged over time to impinge upon the prominent clavicular
screws. Iatrogenic vascular injury from plate fixation of clavicular
fractures is rare, with only four similar cases available in the lit-
erature. Yet it appears all reports employed differing methods of
repair.

Casselman et al. describes a subclavian pseudoaneurysm de-
veloping 8 years post internal fixation of a clavicular non-union
[4]. The pseudoaneurysm was repaired with a prosthetic inter-
position graft, with exposure gained through a transclavicular ap-
proach including first rib resection.

Shackford et al. reported a case where a clavicular plate fix-
ation screw had pierced the subclavian artery causing pseudoa-
neurysm development and brachial artery occlusion [5]. The
patient underwent claviculectomy and interposition vein graft
with autologous saphenous vein.

Similarly, Johnson published a case of left arm ischaemia sec-
ondary to a subclavian pseudoaneurysm where a compression
plate screw was impacting the vessel [6]. Ligation of the sub-
clavian artery coupled with carotid-axillary bypass was used to
restore upper limb blood flow.

Albeit of the axillary rather than subclavian artery, Bain et al.
also report a case of pseudoaneurysm development. This was
also caused by arterial penetration from a plate fixation screw
for a non-united clavicular fracture [7]. The patient underwent
plate removal, then pseudoaneurysm repair via endovascular
sten-t graft with a good result.

Ranging from endovascular repair to open claviculectomy
and first rib excision, all cases utilized somewhat differing surgi-
cal approaches. We initially considered using endovascular bal-
on occlusion to gain proximal and distal control of the
subclavian artery, yet this idea was abandoned due to perceived
obstruction of the operative field.

Due to the intrinsic neurovascular relationship of structures
surrounding the subclavian artery, surgical intervention carries
a high risk of neurological and vascular injuries [8]. As employed
during our case, both supraclavicular and infraclavicular inci-
sions provide adequate exposure to mobilize the proximal and
distal subclavian artery. Due to the age and sporting pursuits of
our patient, we managed to avoid more extensive bony resection
such as claviculectomy, which would have granted greater ex-
posure. If the proximal artery was involved, median sternotomy
or thoracotomy may be required depending on the side [9, 10].

This is indeed quite a rare case that illustrates delayed iatro-
genic arterial trauma. It is worth noting the importance of the
clinical history and findings, both examination and investiga-
tions, in diagnosis. As found in the limited similar cases available
in the literature, operative approach to this condition may vary
and must be tailored to individual patient factors.

**CONFLICT OF INTEREST STATEMENT**

None declared.
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