



The challenging management of a delayed union midshaft clavicle fracture complicated by an acute pseudoaneurysm of the subclavian artery in a superelderly diabetic patient

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Introduction

Clavicle fractures are among the most common fractures, accounting for 2.6–4% of all adult fractures and for 35–44% of those of the shoulder girdle [1]. Up to 80% occur at the midshaft. Nowadays, the majority of these fractures tend to be treated non-operatively, even when displaced, using an arm supporting sling or a “figure-of-eight” bandage, with good clinical outcomes and an acceptable rate of nonunion. On the contrary, operative treatment is commonly performed in cases of open fractures, skin tenting with the potential for progression to open fracture, “floating shoulder,” and associated acute neurovascular injuries. Despite the proximity of the clavicle to the subclavian vessels, vascular complications in closed clavicle fractures are uncommon, with an incidence of 0.4% [2]. Nevertheless, their prompt diagnosis and proper knowledge is essential because of the high morbidity and mortality rates associated. This report describes the clinical, diagnostic, and therapeutic approaches to address an acute subclavian artery pseudoaneurysm caused by a closed displaced clavicle fracture, complicated by delayed union, in a comorbid octogenarian patient.

Presentation of case

An 88-year-old right handed man was admitted to the Emergency Department (ED) of our institution presenting with a 4 days rapidly growing mass located anteriorly to the right clavicle (Fig. 1a). His medical history was significant for hypertension, insulin dependent diabetes mellitus, and chronic kidney disease. Eight weeks prior, after falling off a bicycle, he had suffered a closed displaced midshaft right clavicle fracture, which was managed non-operatively by a “figure-of-eight” bandage. No chest trauma injuries or ribs fractures were reported, and there was no right arm numbness or weakness. After 6 weeks of conservative treatment, during the final visit, despite the radiographic absence of callus formation and the persistence of displaced fracture fragments, the bandage was definitively removed. Physical examination of the right shoulder showed an acceptable range of motion in relation to the patient’s age, there was no pain and no neurovascular deficit; hence, no further treatment was suggested and no other visit scheduled.

However, at the time of presentation at the ED, physical examination revealed a soft non-pulsatile tumor-like mass located in the right supraclavicular fossa (Fig. 1a) and bone discontinuity along the clavicle midshaft with abnormal mobility of fracture fragments on palpation. The patient was hemodynamically stable: distal pulses were present and no abnormalities were found at the peripheral neurovascular examination of the right upper arm. Hence, the patient underwent first a standard X-ray for the clavicle, which showed delayed union of a midshaft right clavicle fracture (Fig. 1b). Subsequently, a thorax computed tomography (CT) angiogram was carried out. This revealed a 57 × 36 mm pseudoaneurysm of the subclavian artery associated with a partial arterial transection

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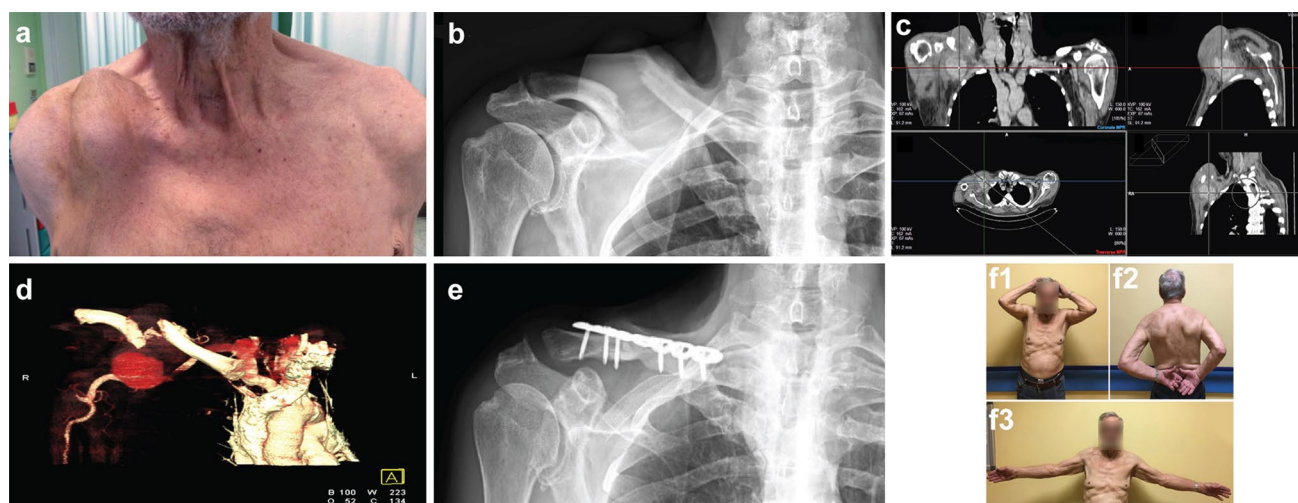


Fig. 1 **a** Clinical image showing the tumor-like non-pulsatile mass located in the right supraclavicular fossa at time of patient's presentation in ED. **b** 20° cephalic tilt radiographic view, showing the delayed union midshaft right clavicle fracture at time of patient's presentation in ED. **c** Coronal, sagittal, axial, and oblique views of thorax CT angiogram of the chest showing the pseudoaneurysm of the subclavian artery. **d** Three-dimensional reconstruction of CT scan images of the subclavian artery pseudoaneurysm. **e** 24-month post-operative radiographic image showing fracture healing. **f** Last follow-up clinical images showing patient's satisfactory right shoulder range of motion in extra-rotation (1), intra-rotation (2), and abduction (3)

located in close proximity to the medial end of the lateral fracture fragment and a large hematoma surrounding both the pseudoaneurysm and the site of nonunion, indicating the presence of active bleeding (Fig. 1c, d). Hence, the vascular surgeon on call was contacted, and the endovascular treatment of the pseudoaneurysm by a Viabahn endoprosthesis (W.L. Gore and Associates, Flagstaff, AZ) was promptly performed under sedation. The post-operative angiography demonstrated the correct position of the vascular endoprosthesis and the complete exclusion of the pseudoaneurysm without endoleak.

Ten days later, the surgical evacuation of the supraclavicular hematoma and the internal fixation of the clavicle fracture with a 3.5 mm LCP precontoured plate and screws (Depuy-Synthes, USA) were performed by an anterior approach under peripheral nerve block anaesthesia. For both procedures any intra-operative or post-operative complications were recorded during the entire recovery. At 6-month follow-up, a duplex ultrasound scan confirmed that the stent had maintained the correct position, without extravasation. The several radiographic follow-up points scheduled at 1, 3, 6, and 24 months after surgery showed satisfactory bone healing at the previous nonunion site, evidenced from the third month, without any signs of plate mobilization (Fig. 1e). Good clinical outcome was observed using the Quick Dash Score (2.27) and the Constant Murley Score (87/100) at 24-month follow-up (Fig. 1f), and there has been no recurrence of the pseudoaneurysm.

Discussion

Due to the close relationship with the subclavian vessels in the thoracic outlet, displaced midshaft clavicle fractures, even if rarely, can cause vascular complications that can lead to severe consequences for patients [2]. These events must be ruled out by performing an accurate physical examination of the upper limb at every follow-up control, focused essentially on possible changes of the anatomical profiles, skin color, temperature, muscle function, sensation, and peripheral pulses [2, 3]. Pseudoaneurysm of the subclavian artery may present as an acute or a chronic event. The first presents with a rapidly growing supraclavicular mass, as in the case described, or with hemodynamic instability and absence of peripheral pulses when massive aneurysmal rupture occurs. The second may present with neurological symptoms due to the compression of the brachial plexus, with distal ischemic arterial symptoms due to embolic episodes, or alternatively, as a visible thoracoscapular venous collateral net caused by the compression of the subclavian vein [2]. Almost 10% of false aneurysms of the subclavian artery lead to a rupture, an event that is potentially life-threatening [2]. In cases of suspected subclavian pseudoaneurysm, some authors recommend arteriography first [2], while others suggest sonography [4]. In our case, a thorax CT angiogram was required, which represents a key diagnostic exam for vascular injury associated with fractures of the shoulder girdle. The pseudoaneurysm of the subclavian artery as a

complication of a closed clavicle fracture can be treated traditionally by open surgery or, less-invasively, by an endovascular approach [5]. When an endovascular treatment has been adopted, the fixation of the clavicle must be then performed, to reduce fracture fragments and prevent repeated insults to the vessels in the thoracic outlet [5]. In our case, a two-step approach strategy was preferred, addressing the vascular complication first, which had put the patient at risk of death. Some days later, the perfect functionality of the Viabahn endoprosthesis was proven by post-operative angiography, and clavicle fracture osteosynthesis was carried out. Surely, a one-step open approach, technically feasible at our level I healthcare trauma centre, would have allowed us to address both problems simultaneously. However, this option was considered extremely demanding for an octogenarian comorbid patient, even if hemodynamically stable. Further, the altered anatomy of the thoracic outlet with hematoma and multiple bone fragments would have exposed him to higher risk of collateral damage of the surrounding neurovascular structures. Finally, an open approach instead of the endovascular one would have required longer operative time, increased blood loss and general anesthesia. The authors strongly believe that, when possible, all of these aspects have to be avoided in an elderly patient.

Only a few cases of pseudoaneurysm of the subclavian artery as an acute complication of a closed clavicle fracture have been published in the literature until now [2]. However, to the best of our knowledge, none has been described for such a superelderly comorbid patient. Further, this case presents some interesting aspects. First, although the severe inferior displacement of the lateral clavicle fragment at the time of trauma caused the primary subclavian artery insults, the patient remained completely asymptomatic for 2 months. During this period, the instability of fracture fragments probably contributed to enlarge the pseudoaneurysm until its rupture. Second, despite the patient's age and his relevant comorbidities, this critical case was managed satisfactory, allowing good long-term radiographic and clinical outcomes without further complications.

Conclusions

This case report points out that a pseudoaneurysm of the subclavian artery could be a rare but serious complication of a closed displaced clavicle fracture, which may present

even several weeks after trauma. A proper knowledge of this potentially life-threatening complication is essential for a prompt diagnosis and, consequently, for an adequate treatment. In comorbid superelderly patients, a two-step approach consisting of endovascular treatment of the pseudoaneurysm first, followed by internal fixation of the clavicle fracture, is recommended.

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Compliance with ethical standards

Conflict of interest This case report received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

Statement of human and animal rights All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed consent The patient received a thorough explanation of this report and gave his oral and written informed consent to be included in this report as well as for publication of these case, anonymous data, and pictures. A copy of the written consent is available for review on request.

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