

CASE REPORT

Trauma

Delayed thrombosis of all upper limb arteries: A rare complication in the closed posterior elbow dislocation in the emergency department

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Abstract

Vascular injuries are one of the most feared complications of orthopedic emergencies such as fractures and dislocations. The proximity of neurovascular structures to most of the long bones and major joints makes them more vulnerable to injury. A proper and repeated clinical examination is always advised for early diagnosis and prompt management of these complications in the emergency department. We present a case of delayed extensive thrombosis of upper limb arteries, one of the rare complications of closed posterior elbow dislocation managed by surgical thrombectomy.

KEYWORDS

axillary artery, brachial artery, elbow dislocation, occlusion, thrombosis

1 | INTRODUCTION

The elbow is a hinge-type synovial joint consisting of 2 separate articulations: the trochlear notch of the ulna articulates with the trochlea of the humerus, while the head of the radius articulates with the capitulum. Another articulation, the proximal radioulnar joint, is also sometimes considered as a part of the elbow joint. The radial and ulnar collateral ligaments strengthen the joint capsule from the lateral and medial sides, respectively.¹ Although rare, the brachial artery² and the median nerve are always at risk of getting injured in elbow dislocation. We present an interesting case of axillary, brachial, radial, and ulnar artery thrombosis that developed after 2 weeks of posterior elbow dislocation.

2 | CASE PRESENTATION

A 48-year-old male presented to the emergency department (ED) with a complaint of severe left elbow pain after he slipped on a wet floor

and fell on his outstretched left hand. Significant blunt trauma in the same joint as well as the right foot occurred about four weeks ago as well when he did not present to any hospital. On this presentation, his heart rate, blood pressure, respiratory rate, and temperature were 84 beats per minute (bpm), 131/84 mmHg, 17 breaths per minute, and 36.4°C, respectively. Physical examination revealed a visible deformity and swelling of $\approx 2 \times 2$ cm² at the posterior aspect of the left elbow, along with tenderness over the olecranon process and medial valgus instability. Extension at the elbow joint was restricted to almost 20–30°C. Distal neurovascular status was reassuring with normal, palpable, and comparable bilateral radial and ulnar pulses with no radio-radial delay and normal sensations over the respective areas. An x-ray revealed a posteriorly dislocated left elbow joint with adjacent bony fragments (Figure 1A) along with a healing right ankle fracture with callous formation. In view of this radiological evidence, an orthopedic surgeon was consulted for possible open reduction and internal fixation of the complex elbow dislocation. After a detailed discussion and the patient's history of an unattended old elbow trauma, a mutual decision was made to attempt a closed reduction initially. A closed elbow reduction was performed in the ED under sedation with 200 mg of propofol

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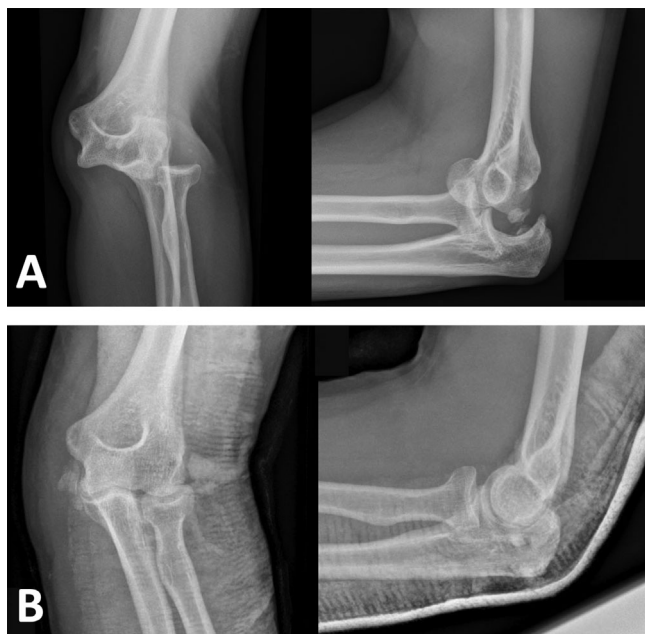


FIGURE 1 (A) Anteroposterior and lateral x-rays of the left elbow showing posterior dislocation of the joint with adjacent bony fragment. (B) Postreduction satisfactory alignment of the bones with joint immobilization in a back slab

with a reassuring postreduction x-ray (Figure 1B). Examination after the reduction also revealed an acceptable range of motion along with normal neurovascular status. After immobilizing the elbow joint with a posterior long arm splint, the patient was discharged with instructions and was referred to the orthopedic outpatient department for follow-up after 2 weeks.

He returned to the ED on the 17th day after discharge with symptoms of gradual onset of pain in his left forearm. A mild pain started 5 days earlier, rated as 2/10 on a numerical rating scale of pain from 0–10, with 0 indicating no pain and 10 indicating the worst pain ever experienced. To relieve his pain, he removed his posterior long arm splint on his own. Despite removal of the splint, the pain intensified to as high as 8/10 on the day of presentation to the ED. His heart rate, blood pressure, respiratory rate, and temperature were 74 bpm, 137/93 mmHg, 18 breaths/minute, and 36.6°C, respectively. Physical examination revealed a cold, tender left forearm with non-palpable radial, ulnar, and brachial arteries compared with the right side. Capillary refill time (CRFT) was delayed (about 5 seconds) in the left arm, which was <2 seconds on the right side. Otherwise, there had been no obvious swelling, discoloration, or motor or sensory impairment in either of the limbs.

There was no audible blood flow in the left brachial, radial, or ulnar arteries during bedside Doppler ultrasonography. A computed tomography (CT) angiography revealed a blockage of almost the entire length of the brachial artery, spanning about 21 cm, with opacification of both the radial and ulnar arteries. CT also redemonstrated a non-displaced fracture of the coronoid process of the left ulna as was evident in the initial x-ray. After that, a conventional angiography replicated the same

findings and revealed a complete occlusion of the left axillary artery with perfusion of the upper limb by the collaterals (Figure 2). A heparin infusion was started at a rate of 16 units/Kg per minute, and the patient was admitted to the vascular surgery department.

During his hospital stay, the patient was investigated extensively for thrombophilia (Table 1). All of the results, except protein S level, came back normal. The protein S level was low (33.2%), which was expected because of the acute thrombosis. On the third day of his stay, he had a left brachial artery exploration and thrombectomy as well as a left subclavian artery angioplasty. Perfusion of the affected limb improved significantly after surgery, with palpable radial and ulnar arteries, normal CRFT, and better pain control. The patient was discharged on the sixth postoperative day on oral anticoagulants (OAC) with a target international normalized ratio of 2–3. We followed this patient for 2 weeks after discharge, and no further complications were encountered. The patient had a follow-up visit with vascular and orthopedic surgery 6 and 14 days postdischarge, respectively, and no postoperative complications were observed. There was no evidence of induced thrombosis. At the time of reporting this case, the patient is being followed up regularly in vascular surgery as well as in the OAC clinic.

2.1 | Ethics statement

The study is conducted ethically in accordance with the World Medical Association Declaration of Helsinki. It was submitted and approved by the Medical Research Centre of Hamad Medical Corporation, Qatar, with approval number MRC-04-21-646.

2.2 | Patient consent statement

Informed written consent was provided by the patient for publication of this article.

3 | DISCUSSION

The elbow is one of the most common large joints dislocated with an incidence of 5.21/100,000/year in the United States, predominantly in men and young adolescents.³ More than 90% of the affected elbows are posteriorly dislocated, with 54% involving a fracture as well.⁴ A multicenter, 5-year, retrospective analysis of vascular injuries revealed that only 0.47% of all simple closed elbow dislocations are associated with brachial artery injury. As a matter of fact, these were 3 of 634 elbow dislocations with only a single case of brachial artery thrombosis.²

There are only a few cases reported of elbow dislocation complicated with brachial artery thrombosis.^{5–8} The proximity of the brachial artery to the elbow joint makes it vulnerable to damage in elbow dislocations, but its incidence is much smaller as compared to popliteal artery injury in knee dislocations, which is as high as 1.6%.⁹ This can be explained by the difference in the anatomy of both arteries. The

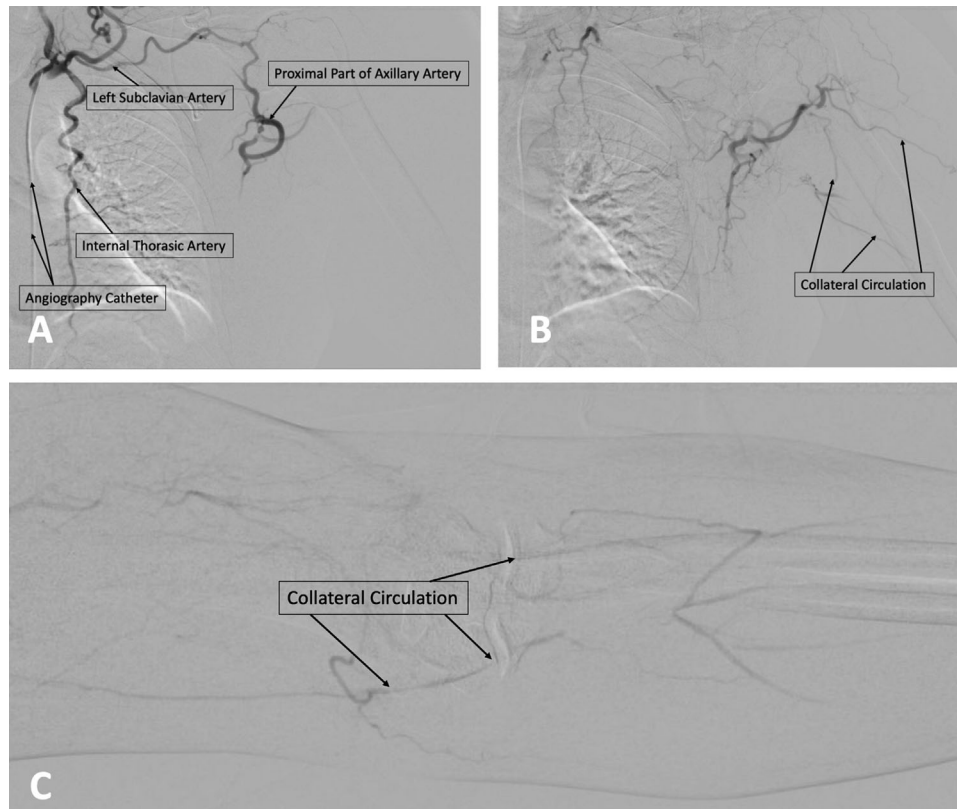


FIGURE 2 (A) Selected angiography image through the left subclavian access showing stenosis in the left subclavian artery with total occlusion of the proximal part of the left axillary artery. Blood supply of the (B) proximal and (C) distal upper limb is maintained with collateral circulation. (A,C) No clearly visible brachial, radial, or ulnar arteries

TABLE 1 Important blood investigations for thrombophilia workup

	Patient's value	Normal range
Protein C (%)	84.4	70–140
Protein S (%)	33.2	72–126
Antithrombin III (%)	81.4	79.4–112
Lupus anticoagulant	Not detected	-
Anticardiolipin antibody IgM (MPL)	5.70	<10 (negative)
		10–40 (weak positive)
		>40 (positive)
Anticardiolipin antibody IgG (GPL)	0.90	<10 (negative)
		10–40 (weak positive)
		>40 (positive)

Abbreviations: GPL, IgG Phospholipid unit; IgG, immunoglobulin G; IgM, immunoglobulin M; MPL, IgM Phospholipid unit.

brachialis and supinator muscles separate the elbow joint from the brachial artery¹ in contrast to the popliteal artery, which is held tightly against the joint capsule by the arch of the soleus muscle.¹⁰

Our patient presented very late despite an extensive thrombosis starting from the proximal axillary artery all the way down to the proximal ulnar and radial arteries. This could be because the radial recurrent artery, superior and inferior ulnar collateral arteries, middle and radial collateral arteries, anterior and posterior ulnar recurrent arteries, and anterior and posterior interosseous arteries form a rich anastomosis around the elbow joint, providing excellent collateral circulation¹ (Figure 3). This makes the forearm able to remain fairly perfused despite devastating brachial artery injuries, described in children as “pink pulseless hands” by Brahmamdam et al,¹¹ and sometimes the patient might be totally asymptomatic.⁶

Endean et al found a strong correlation between open dislocation, absence of a radial pulse before reduction of the dislocation, and coexistent systemic injuries with arterial injury in elbow dislocation in a multicenter, 10-year, retrospective analysis of 62 patients.¹² On the contrary, our patient had palpable distal pulses in his initial presentation, which can be explained by either perfusion by collateral circulation or partial injury to the arterial wall that led to extensive thrombosis as a delayed presentation when there were no radial or ulnar pulses. Partial injury to the arterial wall leads to turbulent blood flow, causing platelets to adhere to the injured area, which ultimately leads to thrombus formation by activating different procoagulants.¹³

The diagnostic test of choice for diagnosing arterial injuries is CT angiography. However, bedside Doppler ultrasonography can also be

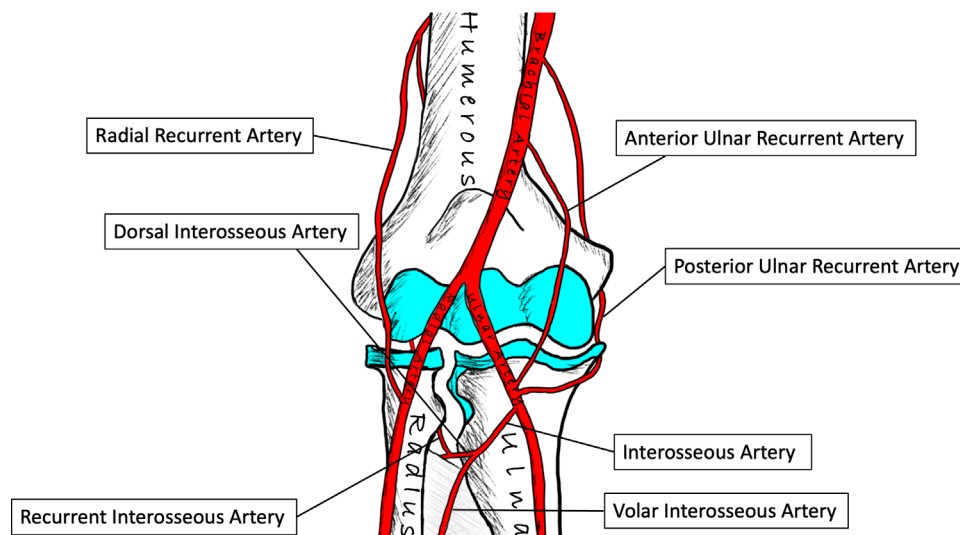


FIGURE 3 Normal vascular anatomy of the elbow joint

done to confirm patency or insufficiency.⁶ Some investigators discourage the later investigation because of its subjective nature. While investigating this case for other possible causes of thrombophilia, we found that the protein S level was low. The causes of low protein S levels might be hereditary or acquired. Acute thromboembolism, liver illness, oral anticoagulants, and post-viral infection are only a few examples of acquired causes.¹⁴ In this case, it was most likely attributed to acute thrombosis.

Treatment options for brachial artery thrombosis are open surgical revascularization, endovascular revascularization with catheter-directed thrombectomy, and anticoagulants with observation. To limit thrombus propagation while the patient awaits surgical or interventional radiology evaluation, initial treatment should include fluid resuscitation, pain management, and injection of unfractionated heparin.¹⁵ We opted for the same plan by starting anticoagulation in the ED followed by surgical thrombectomy after 3 days.

If we compare this case with previously reported cases of brachial artery thrombosis related to post-closed elbow dislocation, this case stands out because of the very late presentation of symptoms. Most patients develop symptoms within 24 hours of the injury.^{5,6} Only a single patient was reported with delayed presentation after 10 days,⁸ whereas our patient developed symptoms after 2 weeks and presented to the ED 17 days after the initial injury.

4 | CONCLUSION

Brachial artery thrombosis is a rare but devastating complication of elbow joint dislocation. As there is multiple convincing evidence that patients might be asymptomatic with brachial artery thrombosis; a proper and repeated physical examination along with bedside Doppler ultrasound is warranted in all cases of joint dislocations in the ED as well as in outpatient follow-up.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

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