



Brachial artery injury as a complication of closed elbow dislocation, and disguised as compartment syndrome



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Transection of the brachial artery associated with blunt trauma, such as a closed elbow dislocation, is a rare phenomenon.^{1,2,13} Closed elbow dislocations account for approximately 25% of all elbow injuries, of which 5%–13% result in arterial injury.^{2,4,5}

Acute compartment syndrome (ACS) or brachial artery transection may follow a closed elbow dislocation.^{4,5,16} ACS, which is a surgical emergency, arises clinically from trauma or other circumstances that cause bleeding, edema, or impaired blood flow in the limbs.⁶ ACS is defined as an increase in intracompartmental pressure and can result in severe ischemia of nerve and muscle tissue in the limbs.^{7–9} Timely diagnosis and surgical management of both forms are difficult and crucial. We report a case in which extreme and persistent pain, swelling, and lack of pulse in the radial and ulnar arteries after elbow dislocation were misinterpreted as ACS rather than brachial artery injury.

Case report

A 53-year-old man entered our emergency department after having stumbled, landed on his hyperextended left arm, resulting in dislocation of his left elbow. The elbow dislocation was spontaneously reduced after he stood up from the ground. The patient presented severe pain in his left elbow and forearm, swelling, and limited mobility in the elbow in the emergency department.

During physical examination, the left forearm was swollen, the hand was numb, and the pulse in the radial and ulnar artery was

absent. The active function of the left arm was considerably reduced due to the pain, but there was no pain in the upper arm or shoulder during palpation. The patient was otherwise stable. The primary X-ray of the entire arm showed no obvious signs of fractures or dislocation in the elbow, although a discreet intra-articular fluid accumulation was seen (Fig. 1). Computed tomography (CT) scanning showed an undislocated intra-articular fracture of radial head and medial humerus condyle (Fig. 2, A and B). Unfortunately, the possibility of the use of CT angiography was not considered at the time the patient in our case was brought to the hospital in the middle of the night. The fasciotomy was performed without delay. In Denmark, the clinical symptoms are determining the diagnosis of ACS by standard and the compartment pressure monitoring is not applied.

ACS was the first and most suspected diagnosis based on the extreme and persistent pain, despite administration of strong analgesics; received intravenous morphine (15 mg [5.3E-04 oz]) and fentanyl (200 µg [7.0E-6 oz]) within 1 hour. The limited elbow movement along with numbness in the hand and lack of pulse in radial artery helped confirming the diagnosis of ACS. The patient was transported to the surgery room for decompression—fasciotomy—under general anesthesia, approximately 1½ hours after arrival at the emergency room. The forearm fasciotomy was made by a volar incision through the superficial and deep compartment. The suspicion of ACS was disproved during the fasciotomy, while damage to the proximal flexor muscles and the rupture of the elbow capsule were revealed.

Due to a lack of pulse in the radial artery in the wrist, the artery was dissected out along the forearm, where the rupture of the brachial artery was found in the cubital fossa. Then, a distal non-pulsatile stump and a proximal pulsatile stump were recognized as 2

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Figure 1 No obvious sign of fracture in elbow. A discreet intra-articular fluid accumulation was seen.

ends of the brachial artery in the cubital fossa, and the anastomosis of the 2 ends of the ruptured brachial artery was then performed. The surgical wound was not completely closed because of edema, leaving the anterior site of the proximal forearm open. The elbow was stabilized with Steinmann-pind by transfixing in 90°.

As the radial artery was still pulseless and persistent bleeding seeping from the proximal part of the wound was observed, the suspicion of the leakage of brachial artery was raised. The patient was immediately transferred to a vascular surgery department at a centralized hospital for acute revascularization; using a vein patch from right groin. The partial skin transplantation from the left thigh was performed (Fig. 3, A) 6 days later (Fig. 3, B). Meanwhile, the patient was transported back to and remained hospitalized in the local hospital for observation and postoperative wound care.

The surgical wound was closed by plastic surgeons with partial skin transplantation from the left thigh (Fig. 3, A) 6 days later (Fig. 3, B).

At 2-month follow-up, the range of flexion was 120°, lacking 10°–20° of full flexion, and the range of extension was just 25° in the left elbow.

The pronation was normal; however, there was 5° supination. There was some movement limitation in flexion of the left thumb and middle finger.

The range of motion of the elbow stopped improving after the 4 month follow-up where the flexion defect remained unchanged, but the extension defect was better at 15°. Both pronation and supination were normal.

At 9 month follow-up there was no further progress, and at 2-year follow-up (Fig. 3, C), the full extension of the elbow was still lacking, most likely due to tight distal biceps tendon in the elbow. Pronation and supination as well as movement of the left wrist were normal.

The closed elbow dislocation, associated with a laceration of the proximal flexor muscles, and brachial artery lesion as well as the fasciotomy have had some, probably lifelong, consequences for

the patient in this case report. The patient still suffers from numbness in the radial 3½ digits of the left hand as well as limited flexion, extension, and supination of the left forearm. The transplanted skin is attached to the muscles and the patient has pain superficially in the skin transplanted area, especially when he tries to lift heavy objects. The patient is still waiting for a thorough skin reconstruction.

Discussion

Symptoms of closed elbow dislocation associated with artery injury may be misinterpreted as ACS, since extreme pain is a common main clinical symptom. ACS as well as arterial ruptures can be a consequence of closed elbow dislocation.¹⁶

Although brachial artery injury after closed dislocation of the elbow is rare, it should not be underestimated.²

This rare complication can present itself in different clinical parameters. The presence of distal pulses alone is not always sufficient to exclude arterial injury.⁴ This is because the brachial artery injury disrupts at least one of the collateral arteries around the elbow, and the thrombosis of the collaterals with the spreading hematoma leads to delayed disappearance of the distal pulse in some patients.^{2,4}

Immediate CT angiography prior to surgical repair is the gold standard for evaluating arterial injury associated with closed elbow dislocation to diagnose arterial interruptions.^{1,2,4,10}

Urgent surgical exploration and primary vascular repair is the only acceptable treatment for arterial injury associated with elbow dislocation.^{2,4} However, fasciotomy is indicated if there is increased pressure in the forearm compartment, significant concomitant soft tissue damage, or a prolonged period of time between the injury and the trauma.^{4,10}

Due to the lack of adequate length of the injured vessels, it is often not possible to perform a complete vascular reconstruction immediately after fasciotomy and exploration of the injured arteries.⁷ Complete vascular reconstruction of an anastomosis is proceeded by using an inverted autologous vein graft, preferably from the great saphenous vein of an uninjured lower extremity.^{2,10}

Although ACS associated with an elbow dislocation is a rare condition,¹⁶ the following clinical findings are the gold standard in the diagnosis of ACS.^{11,12} The 5 “P’s” (pain, pallor, pulselessness, paralysis, and paresthesia, as clinical criteria) are the symptom of ACS. However, the pain, which is extreme and persistent pain, the so-called pain out of proportion to injury, is the main symptom of ACS. The extreme pain associated with the mechanism of injury should raise suspicion of ACS,^{3,14} and arterial injuries should not be underestimated. Ultrasonography, magnetic resonance imaging,¹¹ Duplex ultrasound, and especially CT angiography,¹⁵ after reduction of the elbow have been suggested as important complementary investigations to clarify and finally specify the injured arteries when there is doubt about the patency of the vessels.¹⁰

The timing of fasciotomy in patients with ACS is highly discussed in the literature. Jialiang Guo et al⁶ suggest that urgent fasciotomy should be performed before irreversible tissue necrosis occurs, especially in patients who are considered to be at high risk and/or have abnormal clinical findings. Accordingly, the performance of prophylactic fasciotomy is recommended in some literatures and cited as an important factor in limb salvage and preservation of function, especially in patients with vascular trauma.

The need for emergency surgical treatment, such as vascular repair, is especially necessary when dislocation of the elbow has caused interruption of arterial blood flow due to artery laceration.^{2,17}

Unfortunately complications, such as pain, persistent muscle weakness, chronic venous insufficiency, and cosmetic problems can occur after fasciotomy and surgical reconstruction with skin grafting or revascularization.¹⁴

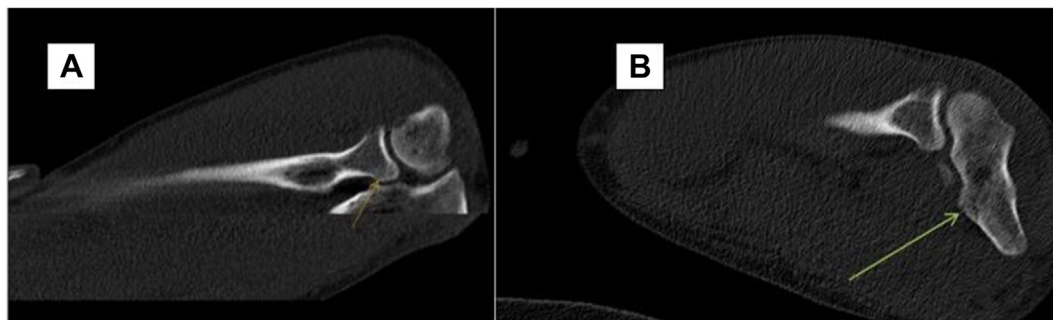


Figure 2 (A) Undislocated intra-articular fracture in radial head. (B) Undislocated fracture in medial humerus condyle.

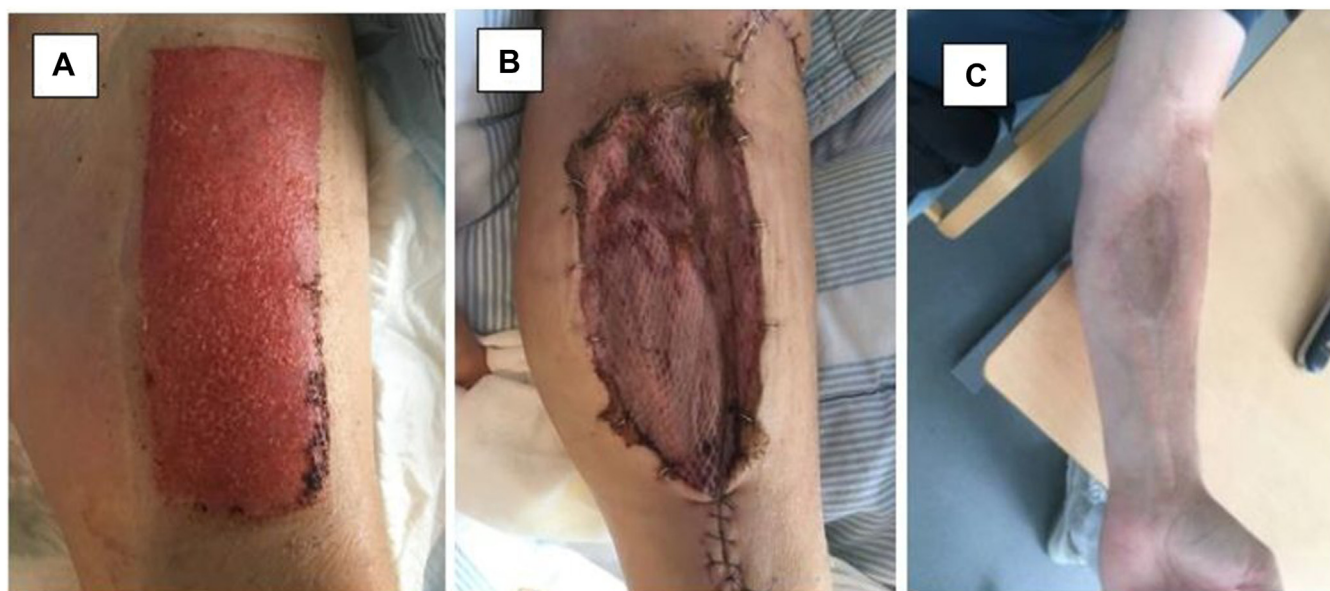


Figure 3 (A) Harvest from the left thigh for partial skin transplantation. (B) Picture of partial skin transplantation. (C) The skin transplantation scar after 2 years.

Conclusion

It is challenging to distinguish ACS from arterial transection, when the patient's dislocated elbow has already spontaneously been repositioned before arriving at the hospital. The patient is extremely in pain, pulseless in the radial artery, and has edema in the elbow and forearm. Besides, there is no particular sign of a fracture in the X-ray, and the CT shows just some very small avulsions in the elbow.

Accurate diagnosis and, therefore, appropriate surgical treatment require a high level of expertise and adequate imaging. Fasciotomy is a treatment option for perceived ACS due to extreme pain following elbow dislocation; however, CT angiography provides a better picture of the damage and better precision in the extent of surgical intervention. The scanning can determine whether the identified vascular lesions should be reconstructed with or without fasciotomy.

“The Five P’s”: pain, pulselessness, paresthesia, paralysis, and pallor.

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References

1. Ayel JE, Bonneville N, Lafosse JM, Pidhorz L, Al Homsy M, Mansat P, et al. Acute elbow dislocation with arterial rupture. Analysis of nine cases. *Orthop Traumatol Surg Res* 2009;95:343-51. <https://doi.org/10.1016/j.otsr.2009.04.013>.
2. Barkay G, Zabatani A, Menachem S, Yaffe B, Arami A acute compartment syndrome of the upper extremity: clinical outcomes following surgical treatment. A retrospective cohort study. *Isr Med Assoc J* 2021;23:516-20.
3. Biswas S, Healy C. Complex posterior elbow dislocation causing complete brachial artery transection. A rare complication of a common orthopedic injury. *Arch Emerg Med Intensive Care* 2018;1:22-6.
4. BC J, Sampath D, N HR, Motukuru V. Complete brachial artery transection following closed posterior elbow dislocation: a rare case report. *Orthop Case Rep* 2015;5:27-9. <https://doi.org/10.13107/jocr.2250-0685.338>.
5. Cepková J, Ungermann L, Ehler E. Acute compartment syndrome. *Acta Medica (Hradec Kralove)* 2020;63:124-7. <https://doi.org/10.14712/18059694.2020.26>.
6. Guo J, Yin Y, Jin L, Zhang R, Hou Z, Zhang Y. Acute compartment syndrome: cause, diagnosis, and new viewpoint. *Medicine (Baltim)* 2019;98:e16260. <https://doi.org/10.1097/MD.00000000000016260>.

7. Lee YK, Lee SH, Kwon TY. Acute compartment syndrome of the forearm associated with transradial coronary intervention. *J Hand Surg Eur* 2020;45:852-6. <https://doi.org/10.1177/1753193419899007>.
8. Marcheix B, Chaufour X, Ayel J, Hollington L, Mansat P, Barret A, et al. Transection of the brachial artery after closed posterior elbow dislocation. *J Vasc Surg* 2005;42:1230-2. <https://doi.org/10.1016/j.jvs.2005.07.046>.
9. McMillan TE, Gardner WT, Schmidt AH, Johnstone AJ. Diagnosing acute compartment syndrome-where have we got to? *Int Orthop* 2019;43:2429-35. <https://doi.org/10.1007/s00264-019-04386-y>.
10. Miranda-Klein J, Howell CM, Davis-Cheshire M. Recognizing and managing upper extremity compartment syndrome. *JAAPA* 2020;33:15-20. <https://doi.org/10.1097/01.JAA.0000660124.51074.e5>.
11. Miyazaki AN, Fregoneze M, Santos PD, do Val Sella G, Checchia CS, Checchia SL. Brachial artery injury due to closed posterior elbow dislocation: case report. *Rev Bras Ortop* 2016;51:239-43. <https://doi.org/10.1016/j.rboe.2016.02.007>.
12. Newton EJ, Love J. Acute complications of extremity trauma. *Emerg Med Clin North Am* 2007;25:751-61. iv. <https://doi.org/10.1016/j.emc.2007.06.003>.
13. Phang ZH, Miskon MFB, Ibrahim SB. Blunt trauma to the antecubital fossa causing brachial artery injury and minor fractures around the elbow joint, an easily missed diagnosis with potential devastating consequences: a case report. *J Med Case Rep* 2018;12:211. <https://doi.org/10.1186/s13256-018-1751-7>.
14. Rasid MF, Ahmad A, Baharuddin KA, Salim AA, Savarirajo JC, Abdullah MS. Acute compartment syndrome of the forearm: a case report of radius fracture with concomitant brachial artery transection. *Med J Malaysia* 2021;76:603-5.
15. Raza H, Mahapatra A. Acute compartment syndrome in orthopedics: causes, diagnosis, and management. 2015;2015 *Adv Orthop* 2015;2015, 543412. <https://doi.org/10.1155/2015/543412>.
16. Saoudi F, Benhazim O, Bassir R, Boufettal M, Albardouni A, Kharmaz M, et al. Rare case of acute compartment syndrome of the forearm following an elbow dislocation. *Int J Adv Res* 2018;6:20-2. <https://doi.org/10.21474/IJAR01/6820>.
17. Tan L, Xia Y, Su Z, Wen Q, Zhang J, Yu T. Brachial muscle injury resulting in acute compartment syndrome of the upper arm: a case report and literature review. *BMC Musculoskelet Disord* 2021;22:545. <https://doi.org/10.1186/s12891-021-04318-1>.