



Closed Posterolateral Elbow Dislocation without Fracture Leading to Complete Brachial Artery Rupture

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Abstract

Traumatic vascular injury of the brachial artery by closed posterolateral complete elbow dislocation, without fracture is an unusual injury. Based on clinical and radiological evidence, emergency treatment is necessary.

We present a case of complete brachial artery rupture, with a clot resulting from a closed posterolateral elbow dislocation, without fracture. We report the early assessment and operative treatment.

A brachial artery injury due to a closed elbow dislocation, without fracture is uncommon. The diagnosis poses a dilemma and the operation is a challenge. It is addressed by Orthopaedic and Vascular team.

Keywords

brachial vascular injury, closed elbow dislocation, without fracture elbow

INTRODUCTION

Although open elbow dislocation with associated vascular injury is well described in the literature, closed elbow dislocation with concomitant vascular trauma is an unusual severe condition, especially if it is underdiagnosed or left untreated. These unusual cases of combined blunt elbow injury with arterial involvement necessitate high clinical

suspicion and prompt management for a successful outcome. We present a case of a 77-year-old female patient suffering an atraumatic rupture of the brachial artery due to an uncomplicated misdiagnosed closed posterolateral elbow dislocation after a blunt injury.

CASE REPORT

A 77-year-old female patient was referred to our emergency department with a left hyperextended elbow, rotation of the forearm and severe pain of her non-dominant extremity after a fall from a height. The patient was presented twenty-four hours after the first assessment at a nearby district hospital where it was initially misdiagnosed as a wrist injury (Figs 1A, 1B, 1C). On physical examination, her elbow was markedly swollen showing signs of ecchymosis and blister formation due to tensity of the elbow region arm and a rapidly expanding hematoma extending into the forearm. The affected arm was also noted pale, cold with markedly reduced capillary refill and absent peripheral arterial pulses. Doppler signals were absent at the wrist level with impaired sensation and reduced movement of the hand (Fig. 2). The patient was unable to actively flex or extend the elbow, representing indirect signs of dislocation. Vascular consultation reconfirmed the arterial disruption of the vascular supply of the distal forearm and hand. Anteroposterior and lateral

view radiographs indicated posterolateral dislocation of the elbow and despite the immediate successful closed reduction; radial and ulnar pulses remained reduced (Fig. 1).

Under general anesthesia, the patient was positioned in the supine position. The arm rested on the side table with the shoulder in abduction and external rotation, and the elbow in extension. On intraoperative examination after performing a lazy 'S' incision through an anterolateral approach to the elbow, a pulsating tubular structure with occluded lumen was noted, raising the suspicion of a complete brachial artery rupture (Fig. 3). After hematoma removal, a complete disruption of the brachial artery was revealed with lacerated distal and proximal vessel ends and incomplete homeostasis by internal stagnation thrombus (Fig. 4A). Arterial reconstruction followed by performing excision of the injured arterial segment and bridging the arterial defect using a reversed brachio-brachial venous bypass (ipsilateral distal cephalic vein) (Fig. 4B). Intraoperatively, biphasic Doppler signals in both radial and ulnar arteries along with palpable pulses confirmed the patency of the graft and the physiologic blood



Figure 1. A. Radiographic image of shoulder, humerus and misdiagnosed dislocation of elbow; B. Radiographic image of immobilization of a wrist injury with cast and misdiagnosed dislocation of elbow; C. An image of closed reduction of elbow and cast immobilization.



Figure 2. Operation room. We show ecchymosis on median surface of the elbow and forearm. Ulnar arterial pulse was absent.



Figure 3. Complete rupture of the brachial artery and the presence of a brachial clot.

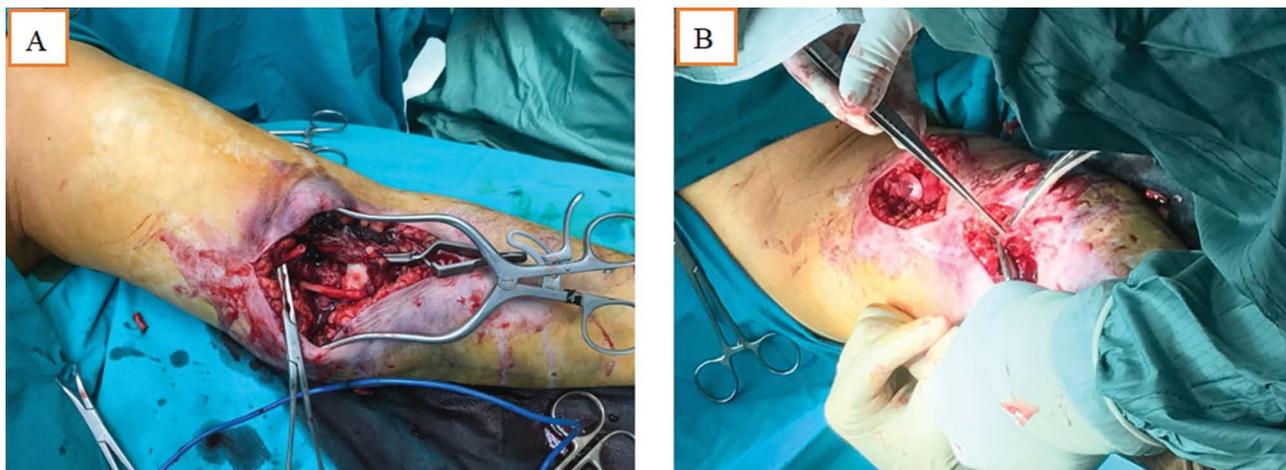


Figure 4. A. Preparation of the brachial artery; B. End-to-end anastomosis with a reversed cephalic vein graft.

restoration to the hand. A 90° humeroulnar external fixation was placed to ensure maximum stability (**Fig. 5**). At the end of the procedure, fasciotomies of forearm compartments were performed prophylactically due to the high risk of developing compartment syndrome.



Figure 5. Postoperative imaging showing humeroulnar external fixation and final closure, without a cast.

Outcome and follow-up

Postoperatively, sensation and motor function of the hand were fully restored and on the third post-operative day the patient was discharged. Immediately after external fixation removal, a functional elbow brace was placed and a range of elbow motion (ROM) exercises were initiated. The range of elbow movement (Mayo Elbow Performance Score) after 3 weeks was good and after 1 year it was excellent (**Fig. 6**). Finally, 2 years postoperatively, the ROM was restored and there are not any coronal or sagittal instability.

DISCUSSION

According to the literature, the incidence of elbow dislocation is approximately 2.7–6.1 cases per 100.000 people and this represents 10% to 25% of all injuries to the elbow.¹ The dominant extremity is dislocated in approximately 40% of cases with a male preponderance.² It occurs as a high-energy injury in young adults and as a low energy injury in older patients.³ Although the elbow is the third most commonly dislocated joint in the human body, there are only short series of sporadic case studies and therefore the frequency of these complex injuries is difficult to establish.⁴

Vascular injuries associated with elbow dislocation usually occur along with open dislocation, anterior dislocation, penetrating injuries and dislocations associated with fractures.⁵ Vascular injury is usually evident from physical examination findings that include absence of distal pulses, paleness of the hand, cold extremity and diminished sensation or movement. Palpable pulses are present in 10% of patients with vascular injuries, especially in cases that the arterial damage is presenting as a (sub) total rupture of the vessel with restricted peripheral circulation, thus necessitating a repeated vascular examination during the next immediate period after the event.⁶ Ayel et al. recently highlighted the point that this injury is accompanied by arterial lesions in 0.3%–1.7% of all cases.² This can be explained



Figure 6. Follow-up at 1 year. **A.** Range of motion full flexion, **B.** extension, and **C.** pronation.

by the close anatomical proximity of the brachial artery to the joint.

According to the literature, the brachial artery is usually injured in its distal segment, a few centimetres above the bifurcation of the radial and ulnar arteries² as it was the case in our patient (**Fig. 2**). The anatomical explanation is that in cases of posterior dislocation, the distal portion of the brachial artery may become compressed between the rigid aponeurosis of the biceps and the dislocated bones structures.⁷ Additionally, the signs of ischaemia are usually attenuated in cases of sufficient periarticular circulation and more rarely the collateral circulation can completely mask the impairment of blood flow.⁵

Based on these hemodynamic parameters, this mechanism of vascular trauma has been described as injuries of the “pink pulseless hands”.⁸ Instead of frank ischaemia, these patients have subtle signs such as palpable but reduced pulses, decreased capillary refill time and reduced pulse oximetry readings.⁹ Similarly, Guler et al.¹⁰ reported normal capillary refill and radial artery pulsation in a patient with total disruption of the brachial artery from a closed elbow dislocation. These data emphasize the need to maintain a high index of clinical suspicion in these types of trauma because frank arterial trauma can exist with only subtle signs of ischemia. However, in cases that severe ischemic symptoms are present, emergent arterial reconstruction is indicated without the need for any imaging delay. Even in cases where limb viability is not immediately threatened, a delay in restoring full perfusion may lead to long-term complications of limb ischaemia such as Volkmann’s contracture, cold intolerance and reduced range of motion. Therefore, most authors recommend mandatory operative exploration for these injuries.^{8,9}

A relationship has been established between arterial

lesions resulting from elbow dislocation and the following findings: absence of the radial pulse on palpation before the joint reduction; presence of other systemic lesions and exposed dislocation of the elbow.^{11,12} In the case presented here, we encountered a complete rupture of brachial artery. It is well known that significant arterial injury can exist without a detectable change in distal pulses or evidence of ischemia in 10% of the proven arterial injuries.¹³ Due to rarity of this complication and the variable clinical presentation, the presence of distal pulse is not merely an absolute confirmation of an intact artery; rather early diagnosis depends on high index of clinical suspicion.¹⁴

Angiography confirms and localizes the injury in order to plan the operative intervention. However, this may not be readily available under emergent conditions or it can be redundant in order to avoid any further delays in timely revascularization. Despite the fact that it is operator-dependent, Doppler ultrasound offers a reasonable alternative to computed tomography angiography. In addition, it can differentiate arterial transection from entrapment or thrombosis by detecting gap between two transected ends.¹⁵

There is now sufficient evidence in the literature to recommend vascular repair in all cases^{2,5,10} even in those in which the limb had appeared to be viable in the clinical examination. A cadaveric study on the vascular anatomy about the elbow noted that at least one arterial anastomosis occurred after dislocation of the elbow.¹⁶

Regarding the type of vascular reconstruction, it is recognized that primary repair of the injury is usually not possible because of the loss of artery length after its debridement. Most authors recommend resection of the damaged vessel segment and graft interposition using an inverted autologous vein segment (**Fig. 4B**). Fasciotomies are necessary in cases of severe soft tissue damage, extensive vas-

cular injury or delays in final management to decrease the risk of developing compartment syndrome. The ideal time of revascularization is 4 to 20 hours.^{2,5}

Immobilization of the elbow is necessary during the operation in order to enable meticulous suturing of the venous graft as well as in the postoperative period. Iordens et al.¹⁷ recommends that transarticular external fixation ensures maximum security of stability and facilitating local care, particularly after fasciotomy. In complex injuries, immobilization is required for 3 to 4 weeks. Early mobilization maximizes the range of motion and limits extension loss.⁶ Postoperative complications are secondary thrombosis and aneurysms, neurologic deficits, pin track infection, soft tissue damage, limitation of range of motion, hematoma during anticoagulation and redislocation.¹⁰⁻¹²

CONCLUSIONS

Acute posterior elbow dislocation is an emergent situation and must be a high index of clinical suspicion of vascular injury in these types of injuries of the elbow joint. A repeated vascular examination in the immediate period after trauma is recommended to prevent possibly any prolonged ischemic complications from an underdiagnosed vascular injury. Arterial reconstruction is always considered to be the gold-standard treatment in cases of vascular injury.

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Закрытый заднебоковой вывих локтя без перелома, ведущего к полному разрыву плечевой артерии

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Резюме

Травматическое повреждение сосудов плечевой артерии в результате закрытого полного вывиха локтя без перелома является необычной травмой. На основании клинических и рентгенологических данных требуется срочное лечение.

Мы представляем случай разрыва плечевой артерии со ступком в результате закрытого заднебокового вывиха локтя без перелома. Мы описываем раннюю оценку и хирургическое лечение.

Травма плечевой артерии из-за закрытого вывиха локтя без перелома встречается редко. Диагноз ставит дилемму, а операция – сложная задача, которую решила бригада ортопедов и сосудистых хирургов.

Ключевые слова

травма плечевого сосуда, закрытый вывих локтя, без перелома локтя
