



Case report

Brachial artery injury due to closed posterior elbow dislocation: case report[☆]



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ABSTRACT

An association between closed posterior elbow dislocation and traumatic brachial artery injury is rare. Absence of radial pulse on palpation is an important warning sign and arteriography is the gold-standard diagnostic test. Early diagnosis is essential for appropriate treatment to be provided. This consists of joint reduction and immobilization, along with urgent surgical restoration of arterial flow. Here, a case (novel to the Brazilian literature) of an association between these injuries (and the treatment implemented) in a 27-year-old male patient is reported. These injuries were sustained through physical assault.

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Lesão da artéria braquial decorrente de luxação posterior fechada do cotovelo: relato de caso

RESUMO

A associação da luxação posterior fechada do cotovelo com a lesão traumática da artéria braquial é rara. A ausência do pulso radial à palpação é um importante sinal de alerta e a arteriografia é o exame diagnóstico padrão-ouro. O diagnóstico precoce é essencial para a providência do tratamento adequado, que envolve a redução e a imobilização articular, além do restabelecimento cirúrgico urgente do fluxo arterial. É relatado um caso inédito na literatura brasileira da associação dessas lesões (e do tratamento feito), ocorrida em um paciente de 27 anos, do sexo masculino, após ter sido vítima de agressão física.

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Introduction

Traumatic dislocation of the elbow is a common orthopedic injury, and this accounts for around 20% of all joint dislocations.¹ Injuries to arteries occur in 5–13% of all elbow dislocations, especially in cases of exposed dislocation or penetrating trauma.² On the other hand, closed dislocations are only rarely associated with vascular injuries.¹

A clinical diagnosis of brachial artery injury associated with closed dislocation of the elbow not only is an infrequently observed combination, but also may be difficult to diagnose, even if there is a high degree of suspicion.^{3,4} Nonetheless, making this diagnosis early on is essential in order to provide the appropriate treatment, given that delayed diagnosis is the main factor for worsening of the prognosis.⁵

Starting in 1913, only a few cases of this association have been described. A survey of the literature conducted in 2009 showed that only 40 cases had been reported in the literature in English and French.⁴ In Portuguese, we did not find a single case. In the following, we report the case of a patient who was treated at our service with this condition.

Case report

A 27-year-old man who had been the victim of physical aggression less than two hours earlier was brought to our emergency service. Upon physical examination, in addition to increased volume of the left elbow and intense pain on mobilization, the ipsilateral hand presented slightly decreased temperature, the peripheral capillary perfusion was slightly slower than normal and, on palpation of the pulses, the ulnar pulse was diminished and the radial, absent. The neurological examination on the limb was normal and, except for small scratches, the skin was intact.

A diagnosis of posterior dislocation of the elbow was made (Fig. 1), and the joint was promptly reduced in a closed manner. However, the vascular clinical condition continued unaltered.

After assessment by the vascular surgery team, angiotomography of the limb was performed. This showed complete occlusion of the brachial artery (Fig. 2).

Through emergency exploratory surgery, stretching of the brachial artery (which had progressed with consequent thrombosis) was diagnosed, located around 3 cm proximally to its bifurcation into the radial and ulnar arteries (Fig. 3). This condition was treated by means of resection of the lesion and construction of a brachio-brachial anastomosis using an inverted graft from the saphenous vein, harvested from the ipsilateral lower limb (Fig. 4). Fasciotomy of the volar compartment of the forearm was performed because of its severe edema. Transarticular external fixation of the elbow was also performed (Fig. 5).

The patient evolved well from a vascular point of view. The radial and ulnar pulses returned before the end of the operation, along with normalization of the peripheral capillary perfusion rate, color and temperature of the extremity. These signs of patency of the arterial flow were maintained until after the definitive removal of the external fixator (six weeks after the first operation), which confirmed the success



Fig. 1 – Lateral radiograph of the left elbow, showing posterior dislocation and soft-tissue edema.

of the anastomosis. The cutaneous borders of the fasciotomy were brought together again and successfully sutured one week after the vascular surgery.

It needs to be noted that because of socioeconomic issues, the patient failed to return for outpatient follow-up after the external fixator had been removed. Therefore, we are unable to report on the patient's complete evolution, especially with regard to elbow function.

Discussion

Although the elbow is the second⁶ or the third^{1,2,5} most commonly dislocated joint in the human body, the literature consists of only a few limited case reports on vascular lesions resulting from this injury.⁴ Therefore, the frequency of occurrence of this association is difficult to estimate.^{2,4} However, it is now known that the majority of the cases of injuries to arteries, especially the brachial artery, occur in cases of exposed dislocation.¹⁻³ However, in this study, we will only discuss occurrences of this injury in cases of closed dislocation, as occurred in the present case report.

The literature shows that the site of brachial artery injury is typically in its more distal portion, just a few centimeters above its bifurcation into the radial and ulnar arteries,³⁻⁵ as was found in our case (Fig. 3). The lesion site can be explained by the anatomy: in cases of posterior dislocation of the elbow, the distal portion of the brachial artery may become compressed between the rigid aponeurosis of the biceps and the dislocated bone structures, particularly the distal epiphysis of the humerus.³⁻⁵

The interruption of the arterial flow may be clinically just as evident as the dislocation that produced it, with absence of the radial and ulnar pulses and a pallid hand. However, the clinical condition may be more baffling and the



Fig. 2 – Three-dimensional reconstruction from computed angiography of the left upper limb. Note the loss of continuity of filling of the brachial artery (white arrow) and maintenance of partial filling of the arteries distal to the elbow (outlined arrow), probably due to partial residual integrity of the collateral arterial circulation of the elbow.

diagnosis may be more difficult, even after joint reduction.¹⁻⁴ This may be explained by incomplete thrombosis or by provisional compensation for the irrigation, through the collateral arterial circulation.⁴ IN a study published in 1992, Endean et al.² established a positive predictive statistical relationship between arterial lesions resulting from elbow dislocation and the following findings: (1) absence of the radial pulse on palpation, before the joint reduction; (2) presence of other systemic lesions; and (3) exposed dislocation of the elbow. Therefore, a full systematic clinical evaluation of the patient, particularly in relation to limb vascularization, should be performed both before and after the joint reduction.^{2-4,6}

After reduction of the elbow, which should be performed as early as possible, any doubts regarding vascular patency would justify performing arteriography or angiography (Fig. 2), which is the gold-standard complementary examination for diagnosing arterial interruption.³⁻⁶ There is some discussion in the literature regarding whether there is a role for Doppler ultrasonography among these patients. Some authors⁴ have advocated its use, while others^{2,3} have not recommended it,

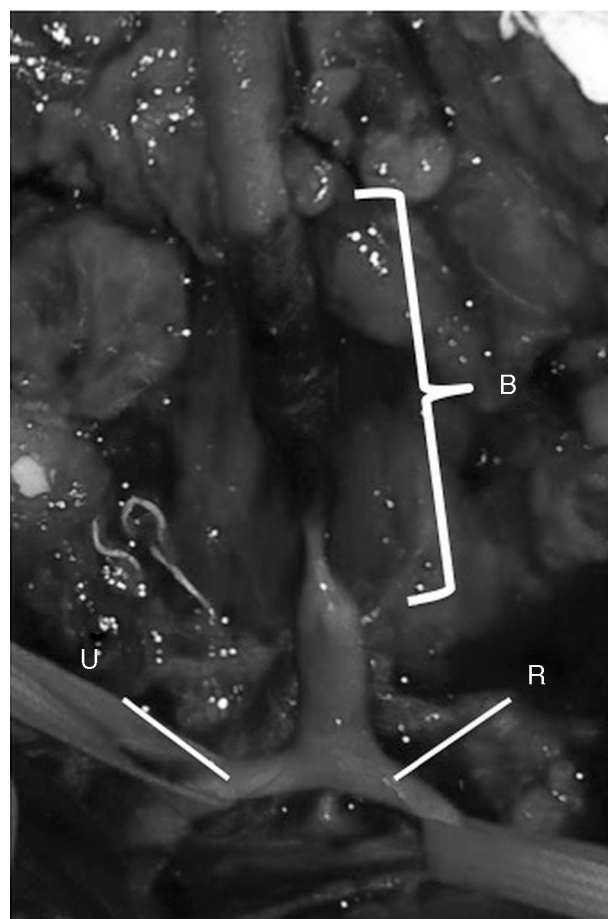


Fig. 3 – Left elbow, anterior view. Intraoperative photo of the thrombotic brachial artery (B), a few centimeters above its bifurcation into the ulnar (U) and radial (R) arteries.

under the justification that it is an examination that is difficult to perform on injured limbs. The neurological examination should also be performed both before and after the reduction and should be directed toward the median, radial and ulnar nerves.^{1,4}

After closed reduction of the elbow has been performed, and after the diagnosis of arterial injury has been confirmed, the patient should undergo emergency surgical treatment.^{1-5,7-10} Before the Korean War (1950-1953), the form of management from a vascular point of view that was best accepted in these cases can be summarized as arterial ligation. The distal perfusion of the limb remained dependent on the collateral arterial circulation of the elbow.² However, this management led to reports of evolution to gangrene of the forearm and/or other complications that culminated in unsatisfactory functional results, such as secondary thrombosis of the arterial circulation of the elbow, compression due to an extensive hematoma, ischemia of the limb upon exercise and intolerance of cold.^{4,7} Therefore, there is now sufficient evidence in the literature (and irrefutable evidence, according to Ayel et al.⁴) for recommending vascular repair in all cases,^{1-5,7-10} even in those in which the limb had appeared to be viable in the clinical examination.^{2,7} In relation to other cases, the study by Louis et al.⁷ made a very important

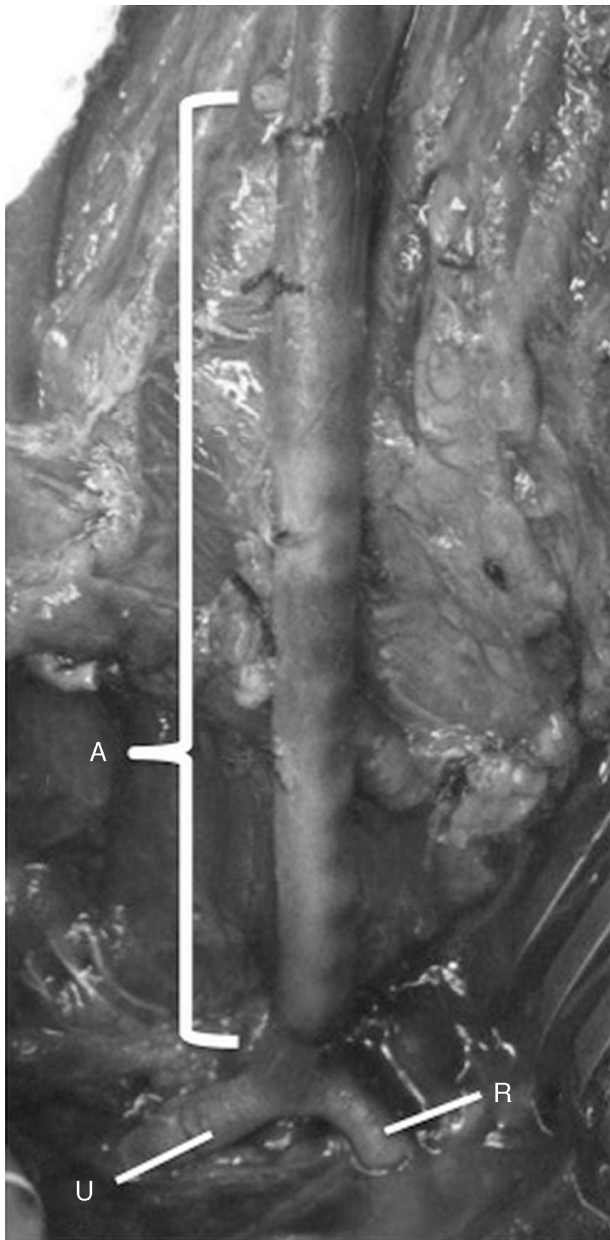


Fig. 4 – Left elbow, anterior view. Intraoperative photo of the brachio-brachial anastomosis (A) constructed using an autologous graft from the saphenous vein, immediately proximal to its bifurcation into the ulnar (U) and radial (R) arteries.

contribution toward consolidating this approach. These authors published an anatomical study on the patency of the collateral arterial circulation of the elbow and two very important findings from this were: (1) the collateral circulation of the elbow was shown to be vital for maintaining distal perfusion of the limb after injury to the brachial artery; (2) in all the cases studied, injury to at least one arterial anastomosis occurred after dislocation of the elbow. Arterial ligation is an approach reserved for cases that require immediate attention to other injuries or that present severe hypovolemic shock.⁸



Fig. 5 – Lateral radiograph of the left elbow after reduction and transarticular external fixation.

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.^{3,4} Most authors have recommended resection at the injury site and construction of an anastomosis using an inverted autologous venous graft (Fig. 4), preferably from the saphenous vein of an uninjured lower limb.^{1,3-5} The indications for fasciotomy in the literature consulted consisted of increased compartmental pressure in the forearm, very severe edema of the elbow due to severe injury to the soft tissues and a very long interval (greater than four hours, according to Bongard et al.¹⁰) between the trauma and the surgery.²⁻⁴

In cases of neurological injury, many authors have recommended that an expectant attitude should be taken. Endean et al.² and Grimer and Brooks⁹ reported that complete spontaneous improvement of these lesions is common. On the other hand, there are authors¹ who have shown in their series that none or almost none of their patients achieved neurological recovery. Such results may suggest that a change to this approach is needed.

From an orthopedic point of view, there is no doubt that the elbow should be reduced as soon as the diagnosis of dislocation has been confirmed. However, discussion continues with regard to how the joint immobilization should be implemented and whether ligament repair is necessary.

Immobilization of the elbow is necessary both during the operating, to enable meticulous suturing of the venous graft, and during the postoperative period. The latter enables healing of the graft, such that a process of “transformation into an artery” can be achieved.⁴ Platz et al.¹ recommended

that transarticular external fixation should be used in all cases, thereby ensuring maximum security of stability and facilitating local care, particularly after fasciotomy. This recommendation is concordant with our opinion. However, other authors^{3,4} who evaluated elbow stability after reduction only performed external fixation if the joint was unstable. Otherwise, they used a splint extending from the axilla to the palm.

Lastly, it is worth discussing the approach toward capsule-ligament injury. For acute dislocation of the elbow to occur, fracturing of the bone structures or breakage of one or both collateral ligaments is necessary.⁶ In cases of simple posterior dislocation of the elbow, some authors have been of the opinion that ligament repair does not provide any advantage after reduction has been performed.⁵ However, other authors^{4,6} have recommended that a varus/valgus stability test and a test on the susceptibility toward repeated dislocation at the final degrees of extension should be conducted. When these tests are positive for instability, ligament repair is indicated. There is even another argument in favor of repair in cases of instability, especially in cases of associated injury to the brachial artery: the anteromedial surgical access that is needed for vascular repair enables access to the medial capsule-ligament structures.^{1,4}

Conflicts of interest

The authors declare no conflicts of interest.

REFERENCES

1. Platz A, Heinzelmann M, Ertel W, Trentz O. Posterior elbow dislocation with associated vascular injury after blunt trauma. *J Trauma*. 1999;46(5):948-50.
2. Endean ED, Veldenz HC, Schwarcz TH, Hyde GL. Recognition of arterial injury in elbow dislocation. *J Vasc Surg*. 1992;16(3):402-6.
3. 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(6):1230-2.
4. 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(5):343-51.
5. Seidman GD, Koerner PA. Brachial artery rupture associated with closed posterior elbow dislocation: a case report and review of the literature. *J Trauma*. 1995;38(2):318-21.
6. Mercadante MT, Fratti SR. Protocolo de manuseio da luxação traumática aguda de cotovelo. *Rev Bras Ortop*. 2003;38(1/2):1-11.
7. Louis DS, Ricciardi JE, Spengler DM. Arterial injury: a complication of posterior elbow dislocation. A clinical and anatomical study. *J Bone Joint Surg Am*. 1974;56(8):1631-6.
8. Orcutt MB, Levine BA, Gaskill HV, Sirinek KR. Civilian vascular trauma of the upper extremity. *J Trauma*. 1986;26(1):63-7.
9. Grimer RJ, Brooks S. Brachial artery damage accompanying closed posterior dislocation of the elbow. *J Bone Joint Surg Br*. 1985;67(3):378-81.
10. Bongard FS, White GH, Klein SR. Management strategy of complex extremity injuries. *Am J Surg*. 1989;158(2):151-5.