

Brachial Artery Dissection Caused by Closed Elbow Dislocation in a Snowboarder: A Case Report and Review of Literature

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ABSTRACT

This report describes a rare case of brachial artery dissection associated with closed elbow dislocation caused by a snowboarding injury. After peripheral ischaemic findings in the right upper extremity were confirmed, urgent duplex-sonography was performed to diagnose the brachial artery injury. Urgent revascularisation surgery was promptly performed, and arterial dissection was diagnosed by intraoperative findings, in which the adventitia of the brachial artery was intact and the intima was disrupted. In this case, because there was no golden time window before undertaking urgent revascularisation surgery, duplex-sonography was very useful for making an emergency diagnosis. To diagnose arterial dissection, because the adventitia of the brachial artery is intact, it is necessary to perform arteriotomy to identify intimal disruption in the brachial artery. When diagnosing traumatic elbow dislocation, it is important to suspect arterial dissection.

Key words arteriotomy; duplex-sonography; intimal disruption

One of the most serious complications associated with elbow dislocation is vascular injury. Brachial artery injury associated with closed elbow dislocation is rare, with an incidence of 0.47%.¹ Among the previous case reports of brachial artery injury associated with elbow dislocation,^{2–6} arterial transection has been the most frequently documented and brachial artery dissection most rarely. To the best of these authors' knowledge, only 2 patients with brachial artery dissection associated with closed elbow dislocation have been reported, and neither of these cases was caused by a snowboarding injury.^{2, 7} Among snowboarding injuries, there have been few reports of brachial artery injury associated with elbow dislocation. Regarding brachial artery

dissection in a snowboarder, there have been no reports. This current presentation documents a rare case of brachial artery dissection associated with closed elbow dislocation caused by snowboarding injuries. A review of the literature is also presented.

PATIENT REPORT

A 35-year-old man, who was an athlete at the expert level of amateur snowboarding, fell backward by the near the downward edge of the valley while snowboarding and experienced hyperextension and dislocation of his right elbow. He immediately felt severe pain and noticed elbow deformity. He promptly reduced the elbow dislocation by himself and then was treated with fixation using a triangular bandage and transported from the mountain by ski patrollers. He then drove to the hospital by automobile about 4 hours after the injury. His history was significant for surgery for posterior dislocation and medial and lateral collateral ligament rupture of his left elbow caused by snowboard injury at another hospital at age 25 years.

The initial physical examination revealed overall swelling especially in the right elbow, a slightly white colour, a cold sensation in the region from the forearm to fingers and impalpable pulsation of the radial and ulnar arteries in the right extremity. Capillary refill was preserved but delayed, indicating incomplete ischemia. There was severe pain on movement and restricted range of motion of the right elbow, as well as severe tenderness in the medial and lateral epicondyles and instability on varus and valgus stress tests.

Plain radiographs showed neither fracture nor dislocation of the right elbow, whereas stressed radiographs demonstrated instability under both varus and valgus stresses (Figs. 1A and B). Magnetic resonance imaging (MRI) revealed the mid-substance tear of the medial collateral ligament and the avulsion of the lateral collateral ligament around the insertion to the humerus (Fig. 1C). Hematologic examination showed an increase in creatine phosphokinase concentration and all other laboratory findings were within normal limits. Because of a suspected arterial injury based on the physical

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Abbreviation: MRI, magnetic resonance imaging

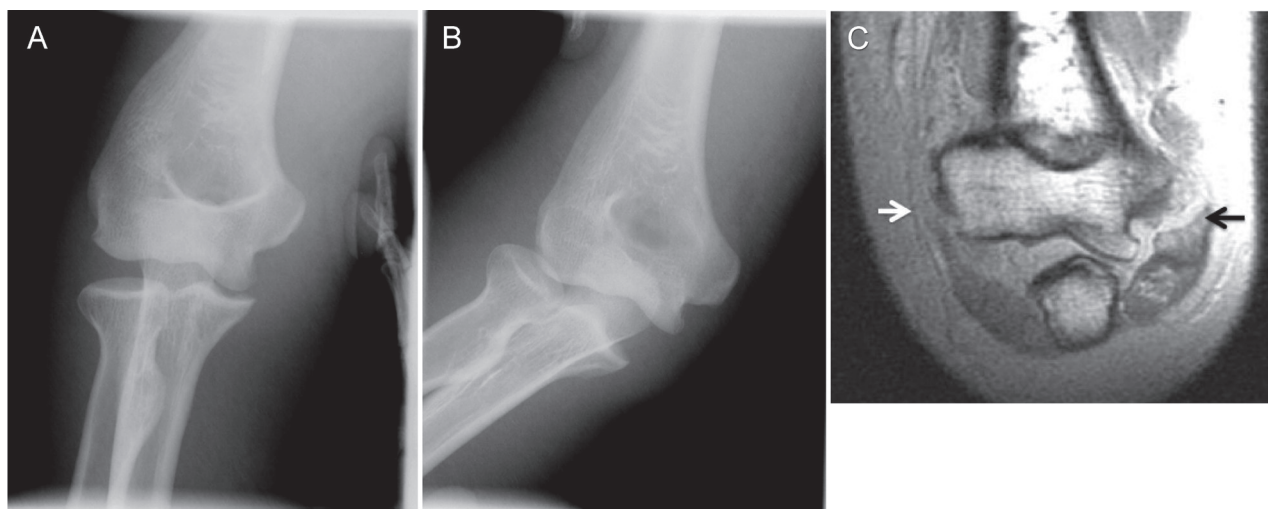


Fig. 1. Stress radiographs (A) (B) and magnetic resonance imaging (C) of the right elbow. Stress radiographs showing both: (A) varus and (B) valgus instabilities. T1-weighted magnetic resonance imaging (C) showing the mid-substance tear of the medial collateral ligament (black arrow) and the avulsion of the lateral collateral ligament from its attachment to the lateral humeral epicondyle (white arrow).

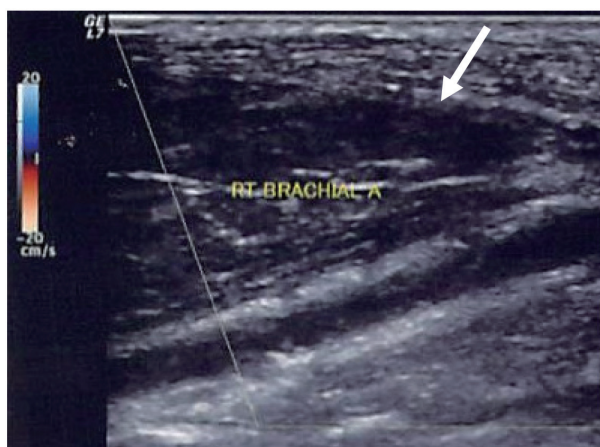


Fig. 2. Duplex-sonography before the revascularisation surgery. Duplex-sonography showing the lack of blood flow in the right brachial artery (arrow) at a slightly proximal level relative to the right elbow.



Fig. 3. Intimal disruption was identified in the brachial artery from a slightly proximal site relative to the right elbow to a slightly proximal site to the bifurcation of the radial and ulnar arteries (arrow).

findings, a duplex-sonography of the upper extremity was subsequently performed. A lack of blood flow was observed in the right brachial artery at a slightly proximal level relative to the elbow joint (Fig. 2) and the distal radial and ulnar artery. Thus, the diagnosis was made of right brachial artery injury and rupture of the medial and lateral collateral ligament in the right elbow after closed dislocation of the elbow. At that time, it was not possible to diagnose whether the arterial injury was a transection or an acute occlusion.

The patient underwent urgent revascularisation

surgery at 5.5 hours after injury. During the surgery, the authors confirmed that the adventitia of the brachial artery was preserved and that the artery was continuous. Vascular duplex-sonography was used to identify the location of a lack of blood flow. Once arteriotomy was complete, intimal disruption was identified in the brachial artery from a slightly proximal site relative to the right elbow to a slightly proximal site to the bifurcation of the radial and ulnar arteries (Fig. 3), resulting

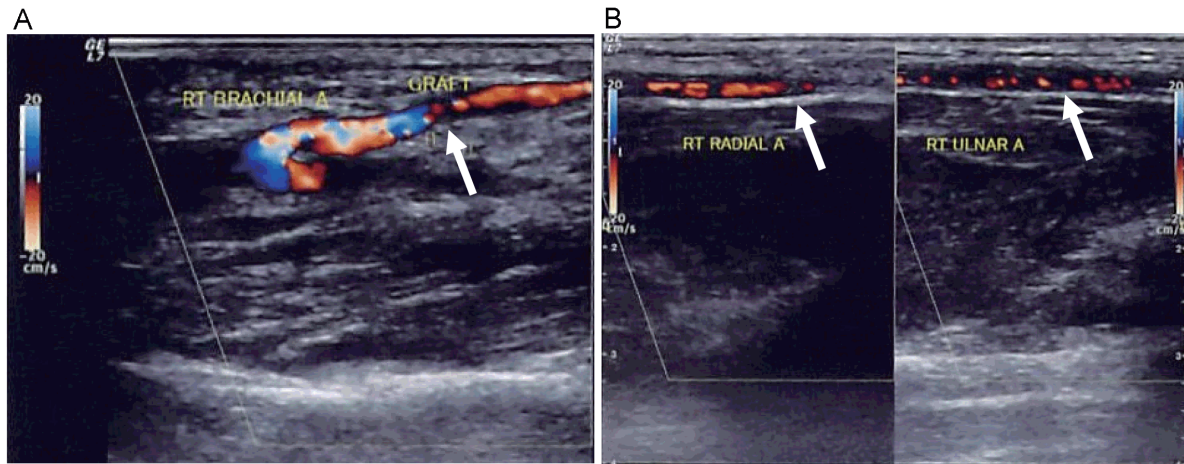


Fig. 4. Duplex-sonography 6 weeks after the revascularisation surgery. Duplex-sonography showing favourable blood flow inside: (A) the graft (arrow) and (B) the radial and ulnar arteries (arrow).

Table 1. Summary in previous reports of brachial artery dissection associated with elbow dislocation

References	Age	Sex	Radial pulse	Arteriography	Type of dislocation	Treatment of artery	Mechanism of injury
Endean et al.	21	M	Absent	Yes	Closed posterior	Vein graft	MVA
Dabboussi et al.	71	M	Present	Yes	Closed posterior	Vein graft	Fall

M, male; MVA, motor vehicle accident.

in arterial occlusion caused by the intimal flap. Based on these findings, a diagnosis of acute occlusion due to arterial dissection of the right brachial artery was made. Then, the authors performed bypass surgery between the proximal occlusion site in the right brachial artery and the radial artery using a reversed saphenous vein interposition graft.

Ligament repair surgery for the right elbow was scheduled for 1 week after the revascularisation surgery. During the ligament repair surgery, an injury was identified to the flexor-pronator muscle groups and anterior articular capsule, as well as a tear of the medial and lateral collateral ligaments in the mid-substance and its attachment to the lateral humeral epicondyle. A repair was made to the medial collateral ligament with end-to-end suture and the lateral collateral ligament was reattached by placing the suture anchor.

In follow-up 6 weeks after the revascularisation surgery, duplex-sonography of the right upper extremity showed favourable blood flow inside the graft (Fig. 4A) and the radial and ulnar arteries (Fig. 4B). In addition, 1 year after the ligament repair surgery, no instability was observed in the right elbow, and the range of motion was improved without a difference between the left and right sides. The patient returned to his pre-injury level

of activity in snowboarding with no concerns.

DISCUSSION

Most cases of the brachial artery injuries associated with elbow trauma occur together with open dislocation and fracture in cases of high-energy trauma such as motor vehicle collisions and falls from a height.¹⁻⁴ Therefore, regarding the type of arterial injury, arterial transection has been the most frequently reported.^{2, 3, 5, 6} In this case, the definitive diagnosis was brachial artery dissection associated with closed elbow dislocation. To the best of these authors' knowledge, brachial artery dissection associated with closed elbow dislocation has been reported in only 2 patients (Table 1).^{2, 7} Endean et al.² reviewed their experience of patients with elbow dislocation to investigate risk factors for arterial injury. In their case group, intimal flap of brachial artery was found in 1 of 8 patients with brachial artery injury associated with elbow dislocation. The 1 case of brachial artery dissection was caused by injury sustained in a motor vehicle collision, in which the patient experienced closed dislocation and a radial pulse could not be palpable at the first visit. Dabboussi et al.⁷ documented a rare case report of occult closed posterior elbow dislocation with intimal rupture of the brachial artery. In that case,

the patient fell and experienced closed dislocation, and his radial pulse was initially palpable, but slightly weak. Both of these reports diagnosed arterial dissection by intraoperative findings, in which the adventitia of the brachial artery was intact and the intima was disrupted. In this current case, the patient was also diagnosed with arterial dissection based on intraoperative findings. To diagnose arterial dissection, because the adventitia of the brachial artery is intact, it is necessary to perform arteriotomy to identify intimal disruption in the brachial artery. By preoperative duplex-sonography findings, arterial injury was confirmed to have occurred for some reason, but it was not possible to diagnose whether the arterial injury was a transection or an acute occlusion.

Among snowboarding injuries, brachial artery injury associated with elbow dislocation has been rarely reported,⁸⁻¹⁰ and to the best of these authors' knowledge, the case has been reported in only 1 patient.¹⁰ Masionis et al.¹⁰ published a rare case in which delayed thrombosis of the brachial artery was associated with closed elbow dislocation in a snowboarder, although not a case of arterial transection. This current case was brachial artery dissection, which has not been previously reported. The authors speculated that the injury mechanism in falls during snowboarding is not as high-energy as that which occurs in motor vehicle collisions, so it is not likely to lead to brachial artery transection. In this case, an excessive extension force was also applied to the brachial artery at the level of the elbow, leading to arterial intimal disruption and then artery dissection, without arterial transection. In addition, because the patient had previous experience with dislocation of the contralateral elbow, he was able to reduce the elbow dislocation promptly by himself and immobilize using a triangular bandage in the appropriate limb position. We consider that as the elbow was deformed for a shorter period of time due to the dislocation, the brachial artery running was compressed for a shorter period of time, so it may have reduced the degree of ischemia caused by arterial injury.

In cases of brachial artery injury associated with elbow dislocation, there are some cases with poor peripheral ischaemic findings.^{2, 5, 7, 10} Perry et al.⁶ reported that pulses distal of the site of the lesion were still palpable for 10% of the patients with vascular injuries. This finding may be explained by the rich collateral circulation around the elbow, enabling the preservation of peripheral blood flow at this site, which is less likely to involve ischaemic changes compared with other sites.^{1, 3, 6} The rich peri-articular collateral circulation can mask the findings of acute arterial injury. When diagnosing traumatic elbow dislocation, it is important

to suspect the neurovascular injury. Fortunately, in this case the peripheral ischaemic findings were obvious, so brachial artery injury was suspected. If vascular injury is suspected, duplex-sonography or arteriography should be performed immediately. Duplex-sonography is not an invasive examination, and it is faster and easier than arteriography.^{10, 11} In this case, arteriography was not performed because there was no golden time window before urgent revascularisation surgery. An expert vascular surgeon performed a duplex-sonography immediately, and made an accurate diagnosis of the brachial artery injury.

In conclusion, the patient described herein presented a very rare case of brachial artery dissection associated with closed elbow dislocation caused by snowboarding injuries, and this report is the first to document this injury setting. When diagnosing traumatic elbow dislocation, it is important to suspect the arterial dissection.

Consent for publication: The patient was informed that data concerning the case would be submitted for publication, and he provided consent.

The authors declare no conflict of interest.

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