

CASE REPORT: PROMPT MANAGEMENT IN 35 YEARS OLD MAN WITH VASCULAR INJURY AT THE LEVEL OF BRACHIALIS ARTERY

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Abstract

Penetrating trauma to the upper extremity often results in vascular injuries that may also involve nerves and tendons. The brachial and ulnar arteries play a crucial role in arm function, requiring prompt and effective management to preserve limb viability. This study aims to report on the management of brachial and ulnar artery injuries caused by penetrating trauma and to emphasize the importance of timely intervention. 35-year-old male sustained lacerations to the right upper and lower arm due to broken glass, leading to numbness in the fingers and absent ulnar pulse. Clinical examination revealed hypesthesia, limited range of motion, and absent SpO₂ readings in the third to fifth fingers. Angiography confirmed a proximal brachial artery gap and nearly absent ulnar artery flow. The patient underwent emergency surgery, which revealed severed flexor tendons, muscles, and the ulnar artery. Results: Thrombectomy and vascular anastomosis were performed successfully, restoring blood flow. The procedure was completed without complications, and the patient showed satisfactory post-surgical recovery. Prompt diagnosis and surgical intervention are critical for the management of forearm arterial injuries. Timely repair within 6–12 hours significantly improve long-term outcomes by preserving circulation, preventing ischemic damage, and maintaining limb function. This case highlights the importance of early recognition and surgical intervention in arterial injuries due to penetrating trauma to ensure optimal functional recovery and minimize complications.

Keywords: Ulnar Artery, Vascular Injury

Introduction

Penetrating trauma to the upper extremity commonly leads to vascular injuries, which often also involve nerves and tendons (Jogiat & Strickland, 2021; Khumalo-Mugabi et al., 2020; Welsford & Wallner, 2021). Approximately 40% of all peripheral vascular injuries occur in the upper extremities, with 67% resulting from penetrating trauma. The brachial artery is affected in 40% to 55% of upper extremity injuries, the axillary artery in 6% to 23%, and the radial and ulnar arteries in 4% to 36%. Peripheral nerve injuries secondary to trauma have a prevalence of 1.3% to 2.8%, with males being more frequently affected, making up 68% of cases compared to 32% in females. The average age of affected individuals is 27 years (± 18.5). Among the causes of peripheral nerve injuries, 30% are due to lacerations from sharp objects and long bone fractures. Most nerve injuries, 73.5%, are located in the upper extremities, with the ulnar nerve being the most commonly affected (Villa et al., 2023). Civilian vascular injuries, which make up only 1% to 2% of all trauma-related injuries, show a notable prevalence of brachial artery involvement, accounting for around 30% of all vascular injuries in the upper extremity, although such cases are rarely documented in the literature (Sousa et al., 2022).

In light of the critical role the brachial artery and ulnar artery plays in maintaining arm function, it is essential to address its injury promptly and effectively (Fermawi et al., 2023; Shoemaker et al., 1997; Tsoucalas et al., 2020). Therefore, in this paper, we present a case about an approach to managing vascular injury case.

Previous studies have emphasized the significance of timely surgical intervention, with the need for early diagnosis and vascular repair to avoid long-term complications (Sousa et al., 2022; Fermawi et al., 2023). However, cases involving brachial and ulnar artery injuries due to penetrating trauma remain underreported in the literature. This study adds to the body of knowledge by reporting a case of a 35-year-old male with penetrating trauma to the right upper and lower arm, highlighting the effective management of the brachial and ulnar artery injury using thrombectomy and vascular anastomosis, and emphasizing the importance of early intervention. This study aims to report on the management of brachial and ulnar artery injuries caused by penetrating trauma and to emphasize the importance of timely intervention. 35-year-old male sustained lacerations to the right upper and lower arm due to broken glass, leading to numbness in the fingers and absent ulnar pulse.

Case Report

A 35-year-old man presented to the Emergency Department Dr. Moewardi Hospital with pain in the right upper and lower arm, 3 hours post-injury, when the patient was opening a cabinet and suddenly applied excessive force, causing their hand to be injured by broken glass, resulting in wounds on both the upper and lower right arm. The patient was brought to the emergency department by family members, where wound care and suturing were performed. However, due to persistent bleeding, the patient was referred to the emergency department of RSDM. Currently, the bleeding has stopped, but the patient reports numbness in the fingers of the right hand.

The patient underwent a primary survey with a clear airway and C-spine stabilization. Respiratory examination revealed a thoracoabdominal breathing pattern with a respiratory rate of 16 breaths per minute. Circulatory status was stable with a heart rate of 80 beats per minute, blood pressure of 138/90 mmHg, and an SpO₂ of 98% on room air. Neurologically, the Glasgow Coma Scale (GCS) was E4V5M6, with isocoric pupils (3mm/3mm) and a positive reaction to light, while lateralization was absent. The patient's body temperature was 36.5°C.

During the secondary survey, no abnormalities were found in the head, face, neck, thorax, abdomen, or spine. However, the upper extremities presented localized issues.



Figure 1. Upper right extremity at emergency department of Dr. Moewardi Hospital

In the right humerus region, the wound was sutured, measuring 15x0.5 cm, with no active bleeding but moderate contamination, swelling, and no deformity. The patient experienced pain on palpation, had normal neurovascular status (NVD), but presented with hypesthesia. The brachial and radial pulses were palpable, while the ulnar pulse was absent. SpO₂ readings were normal in the first and second fingers (95% and 96%, respectively), but absent in the third, fourth, and fifth fingers. The range of motion (ROM) at the elbow was limited due to pain. In the right antebrachium region, the wound was also sutured (7x0.5 cm), with similar findings: no active bleeding, moderate contamination, swelling, and no deformity. There was pain on palpation, NVD, and hypesthesia.





Figure 2. Pulse and saturation checking of digiti right manus. Absent of pulse and saturation starting from digiti III-V suspecting ulnar artery insufficiency

Again, the brachial and radial pulses were present, while the ulnar pulse was absent. SpO₂ readings in the first and second fingers were 95% and 96%, while readings in the remaining fingers were absent. Wrist ROM was also limited by pain. The MESS score for the upper extremity was 4, indicating a low-energy injury with reduced or absent pulses, systolic blood pressure greater than 90, and the patient being in the 30-50 age group. In terms of hard signs, there was no pulsation, severe hemorrhage, expanding or pulsatile hematoma, or audible bruit/palpable thrill. Soft signs included numbness, neurological deficits, difference in skin temperature, and absence of pulse oximeter readings in certain digits.

Patients then ordered to do an immediate angiography resulted in picture below. In the picture, there was shown a gap of blood flow in proximal brachialis artery and nearly empty flow in ulnar artery.

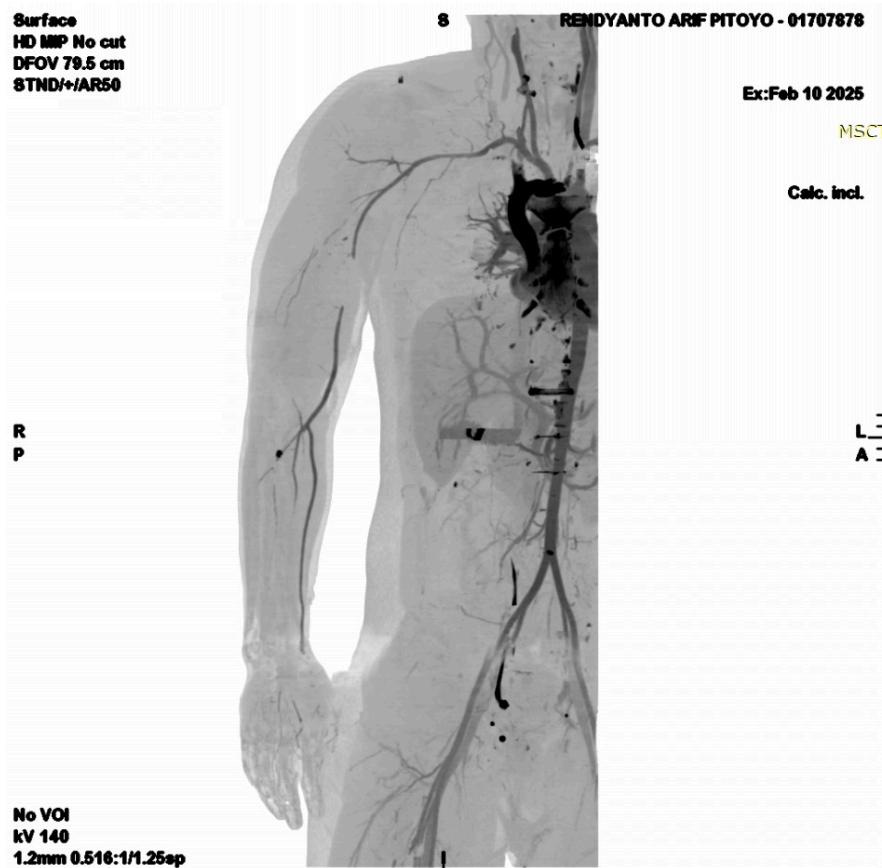


Figure 3. Angiography of Right Upper Extremity

Patient then sent to operating room to fix the vascular injury, preparing for exploration in the upper right extremity vasculature. The patient was positioned supine under general anesthesia. The operative field was prepared with aseptic technique and draped. An exploration was performed on the right antebrachium with an incision extending from the old wound. It was found that the flexor tendons and muscles were severed, and the ulnar artery was also cut. Thrombectomy was performed on the proximal segment of the ulnar artery, resulting in restored blood flow. Both the distal and proximal segments were spooled with heparin. A vascular anastomosis was then carried out, and the outcome was evaluated as satisfactory. The surgery was completed successfully.



Figure 4. Durante operation found a ruptured ulnar artery and ruptured flexor tendon

Results and Discussion

Arterial injuries at the forearm are relatively uncommon compared to other upper extremity injuries (Civan et al., 2021; Pasierbek et al., 2014; Thai et al., 2015), with stab wounds and injuries from broken glass being the main causes, this align with case presentation. Arterial bleeding along the wound path, the absence of a pulse distal to the injury, and a positive Allen test are typically sufficient for diagnosis. However, color Doppler ultrasonography (CDUS) can be used to confirm the diagnosis. Angiography, though an invasive procedure, is not practical for diagnosing acute trauma in patients. A thorough exploration of the wound edges and direct visualization of the two ends of the severed vessels can also help confirm the diagnosis (Keleş et al., 2017). In this case, angiography was done before the exploration in considering of multiple vascular injury in order to do the prompt operation sites.

The ulnar artery is a vital source of blood supply to the upper extremity and is often the primary arterial supply to the hand (Hutting & van Uchelen, 2018). It originates from the brachial artery at the level of the cubital fossa and travels deep to muscles such as the brachialis, pronator teres, and flexor carpi radialis. After giving off the common interosseous artery in the proximal forearm, it continues between the flexor digitorum superficialis (FDS) and flexor digitorum profundus (FDP). The ulnar artery gives off small cutaneous perforators along its path, which are useful for ulnar artery flap procedures. Typically well-protected in the proximal and mid-forearm, the ulnar artery may take a more superficial course in 1-3% of cases. At the distal forearm and wrist, it becomes superficial, covered only by skin and fascia, with the flexor carpi ulnaris tendon ulnar to it and the FDS tendons radially. It passes through Guyon's canal into the hand, where it forms the deep palmar arch by anastomosing with the radial artery, while also giving rise to the superficial palmar arch. The ulnar artery's branching patterns in the hand may vary, but the bifurcation into the deep and superficial arches typically occurs distal to the pisiform. In the forearm, proximal to the pisiform, the ulnar artery has no major branches that lead to significant bleeding, with the ulnar palmar carpal branch running deep to the FDP tendons and forming part of the palmar carpal arch. As such, pulsatile bleeding from a penetrating injury at the wrist is often due to damage to the ulnar artery (Safeek et al., 2022). The brachial artery, which supplies blood to the upper limb, bifurcates at the elbow into the radial and ulnar arteries, with the ulnar artery further splitting into anterior and posterior branches. Blood flow to the hand is established through the superficial and deep palmar arches, receiving contributions from both the radial and ulnar arteries. Sharp injuries to the ulnar artery often result in complete severing of the vessel ends, but these can usually be repaired by trimming the damaged vessel ends. Most upper limb vascular injuries are treated with primary repair, involving autologous artery interposition and suturing the forearm vessels with 8-0 nylon. The ulnar nerve, originating in the axilla as a continuation of the median cord of the brachial plexus, arises from the C8 and T1 nerve roots in the spinal cord (Villa et al., 2023).

Immediate action is crucial for better outcomes in cases of heavy bleeding and life-threatening conditions. The priority in first aid is to stop the bleeding, and definitive treatment should follow once the bleeding is controlled. Focus on the area of the injury when addressing bleeding. A tourniquet should be avoided, as it could damage the surrounding collateral circulation. The critical window for treating vascular injuries is 6-12 hours. While ischemia is evident on the skin, muscles and nerves are more resilient to it. The management of minor or asymptomatic arterial injuries remains debated. Some surgeons advocate for repair of all detected arterial damage, while others suggest non-surgical intervention if certain clinical and radiological criteria are met, such as low-

velocity injury, minimal damage to the arterial wall (less than 5mm), no active bleeding, and intact distal circulation. This approach is especially suitable for young patients with collateral circulation, where monitoring through vascular imaging can track healing or stabilization. When surgically managing peripheral arterial injuries, preparation must include not only the injured extremity but also the healthy contralateral limb in case a venous autograft is required. Typically, a longitudinal incision is made directly over the injured vessel and extended as necessary either proximally or distally. The degree and mechanism of trauma determine the arterial reconstruction technique. Fix Interposition graft, bypass graft, end-to-end anastomosis, and lateral suture patch angioplasty can all be used to treat vascular injuries. An extra-anatomic bypass graft is useful in patients with extensive soft tissue injury or sepsis. Grafts are needed to prevent constriction or stress on the blood vessel anastomosis if the arterial loss is more than 1.5 cm. In general, autogenous vein grafts are preferred for treating vascular problems (Nego et al., 2023).

Recent research, however, has shown that vessel repair produces superior outcomes. Because patients who had artery ligation experienced a greater loss of bone mass, muscle mass, and strength, Bassetto has proposed that anastomosis is always preferable to ligation (Keleş et al., 2017).

Conclusion

Forearm arterial injuries, though rare, require prompt diagnosis and intervention to prevent ischemic damage. Clinical signs like arterial bleeding, absent distal pulses, and a positive Allen test are typically sufficient for diagnosis, with imaging used for confirmation when needed. The ulnar artery is a key blood supply to the hand and is vulnerable, especially at the wrist. Surgical repair, including end-to-end anastomosis, interposition grafts, and bypass grafts, is preferred over ligation to preserve circulation and function. The critical treatment window is 6–12 hours. Studies show that vessel repair leads to better long-term outcomes than ligation, preventing muscle and bone mass loss while maintaining limb strength.

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