Case Report

Delayed presentation of complete arterial transection treated with interposition graft: A case report

Gregory R. Stettler, Cenea Kemp, Franklin Wright, Erik Peltz⁎

Department of Surgery, University of Colorado, Denver, United States of America

A R T I C L E I N F O

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A B S T R A C T

Introduction: Traumatic arterial injuries have a high degree of morbidity if left untreated. Frequently, arterial injuries are found soon after injury due to either subjective complaints or objective findings. Opportunity for delayed repair of vascular injury is a rare event as irreversible ischemia occurs at such early time points.

Case report: We report a case of delayed presentation of complete arterial transection of the brachial artery due to penetrating trauma, but without classical hard signs of vascular injury. Trajectory, symptoms, and pulse exam prompted further evaluation. Successful reverse saphenous vein interposition grafting of the transected artery returned normal blood flow to the affected extremity with preserved function.

Conclusion: This case of delayed presentation of arterial transection is significant as delayed identification of arterial injury is rare. Furthermore, it demonstrates the need for clinicians to have a high index of suspicion in patients with traumatic limb injuries who present in a subacute or delayed fashion with increasing pain and worsening of initial physical exam findings.

Introduction

Traumatic vascular injury of the extremity is well described, with penetrating mechanisms accounting for the majority [1,2]. Penetrating injuries are likely to result in vessel laceration or transection presenting with overt clinical manifestation, while blunt injuries often have subtle or no clinical findings at presentation [1,3]. Blunt injuries impart a stretch or shear force mechanism to the arterial wall which may result in intimal damage with subsequent dissection, thrombosis, or pseudoaneurysm formation [1]. In contrast, penetrating trauma results in either partial or complete arterial transection presenting with “hard”, or overt signs of injury including external bleeding, expanding hematoma, pulselessness, pallor, paresthesia, pain, paralysis, or a palpable thrill/audible bruit, and almost always necessitate immediate intervention [4]. Injuries without overt signs of vascular compromise may be missed during initial evaluation and these present with either recurrent hemorrhage in the early postinjury period, or at later time points, with pseudoaneurysm, traumatic arteriovenous fistula (AVF), thromboembolism, or arterial occlusion [5]. Upon a review of the literature, a description of delayed presentation following a complete brachial artery transection was not identified.

Case presentation

A previously healthy 19-year-old male presented to an outside hospital Emergency Department (ED) with a single gunshot wound through the right arm and into the right axilla. Upon arrival to the ED, the patient was awake and alert. He was able to protect his

⁎ Corresponding author at: 12631 E. 17th Avenue, C-305, Aurora, CO 80045, United States of America.
E-mail address: erik.peltz@ucdenver.edu (E. Peltz).

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airway, had equal breath sounds in bilateral hemithoraces without crepitus, and received 2 L of crystalloid fluid for resuscitation. On secondary survey, pertinent exam findings included radial artery pulses only able to be identified by Doppler exam (left > right). A small non-expanding hematoma was also present in the right arm. There was concern for partial ulnar and median nerve injury with weakness and sensory deficit of the right upper extremity. A foreign body was palpable below the right scapula with an anterior-posterior chest x-ray demonstrating multiple radiopaque densities projecting over the right posterior and lateral chest as well as the right upper arm medially. There was no evidence of hemopneumothorax. Imaging of the right humerus showed no bony abnormality. The patient was admitted to the ICU for neurovascular checks and was subsequently discharged on postinjury day (PID) #1.

On PID#5, the patient presented to our institution in the outpatient surgical clinic with complaints of decreased strength, sensation, and increased pain in his right arm. Physical exam findings were similar to those described at the outside hospital. However, the right radial pulse was weak and a radial-to-radial arterial index was found to be 0.75. The reduced strength of radial pulse and diminished arterial-to-arterial index, in combination with the neurologic findings, was concerning for a missed vascular injury. A CT angiography (CTA) with run-off of the right upper extremity was obtained that showed a 7 cm filling defect of the right brachial artery from the proximal third of the humerus to the mid shaft consistent with brachial artery occlusion or transection. There was reconstitution of the brachial artery at the mid-humerus with run-off to the hand (Figs. 1 and 2). Given the findings and symptomatology, the patient was taken urgently to the OR for exploration and revascularization.

An open approach to the right brachial artery was performed and proximal and distal vascular control were achieved. A hematoma surrounding the mid brachial artery was opened allowing for identification of a 3.5 cm gap in the brachial artery (Fig. 3A). The median and ulnar nerve were identified without evidence of transection. Fogarty thrombectomy was performed both proximally and distally which resulted in brisk back bleeding and pulsatile antegrade flow. A reverse saphenous vein interposition graft was used to re-establish vascular continuity (Fig. 3B). Completion angiography identified an intact proximal and distal anastomosis with run off to the level of the hand. Following reconstruction, the patient had bounding radial and ulnar pulses in the right upper extremity as well as triphasic Doppler signals. The post-operative course was uncomplicated and the patient was discharged home in stable condition on post-operative day #2 with improvement in sensory and motor function.

**Discussion**

Traumatic vascular injury is well described with an incidence of 1–5% of all traumatic injuries [6,7]. Fortunately, missed vascular injuries are a rare occurrence and require a high degree of clinical suspicion to avoid [6,7]. These missed vascular injuries present
early with recurrent hemorrhage or at later time points with pseudoaneurysm, traumatic AVF, thromboembolism, or arterial occlusion [5]. The goal in treatment of any trauma patient is the rapid identification and treatment of injuries, as delay is associated with increased morbidity and mortality. Open surgical repair of traumatic vascular injuries remains the “gold standard”, however advancements in technology and skill sets have allowed endovascular techniques to be applied to the acute surgical management of this patient population [8]. In the case of hard signs of vascular injury, the decision for intervention is mandated by urgent intervention to control hemorrhage and prevent irreversible ischemia or limb loss. However, if “soft” signs are present (history of arterial bleeding at the scene or in transit, proximity injury to an artery, small nonpulsatile hematoma over an artery, or neurologic deficit in an adjacent distribution), further diagnostics may be necessary [4]. In these patients, as part of the physical exam, an ankle-to-brachial or arterial-to-arterial index (Doppler arterial pressure distal to injury/Doppler arterial pressure in uninvolved upper extremity) can be useful in helping determine the need for diagnostic imaging with a proposed cutoff of ≤0.9 [4]. During this patient's subacute presentation, he exhibited “soft” signs of vascular injury with an arterial pressure index of 0.75, which was concerning for vascular injury and prompted further imaging leading to diagnosis and urgent surgical re-vascularization of his extremity.

Fig. 2. Legend – Three-dimensional reconstruction of CTA of great vessels and right upper extremity. A large defect is seen in the brachial artery with re-constitution distal to the injury.

Fig. 3. Legend – Intra-operative images of complete brachial artery transection. A.) Prior to revascularization a defect can be seen between forceps B.) After placement of reverse saphenous vein interposition graft (between forceps), distal flow was re-established.

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diagnostic dilemma in this 19-year-old patient's early evaluation was the apparent preservation of perfusion to the hand without overt pain, pallor, paresthesia or pulselessness. Preserved distal perfusion in a young, healthy, patient would not be anticipated in the setting of a complete proximal occlusion as young patients do not exhibit the same propensity for collateral flow as older adults. This collateralization of blood flow is more often identified in older patients, especially those with slowly progressive peripheral vascular disease [9]. This patient had adequate collateral blood supply to allow sufficient flow to the distal right upper extremity to prevent acute limb-threatening ischemia. The decrement in blood flow however contributed to progressive symptoms and threat to limb viability and long-term function.

Conclusion

This case report is significant as the delayed presentation in a young patient is unique and should serve as an example that clinicians must remain vigilant with a high index of suspicion for vascular injury even in the absence of “hard” signs. Both in the acute and subacute evaluation of these patients, guidelines such as the Western Trauma Association “Evaluation and Management of Peripheral Vascular Injury” [4] may provide a framework for sequential diagnostics to optimize early identification of injury and direct therapy. These guidelines also allow for exclusion of vascular trauma in a portion of patients presenting with soft signs of injury.

Author contribution

G.R.S participated in the care of the patient, drafted, and critically revised the manuscript. C.K drafted and critically revised the manuscript. F.W and E.P participated in the care of the patient, drafted, and critically revised the manuscript.

Disclosure

The authors have nothing to disclose.

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