



Brachial Artery Injury during Surgical Repair of Distal Biceps Rupture: A Report of Two Cases

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Abstract

Distal biceps tendon ruptures are a result of an eccentric load onto a flexed elbow and can lead to loss of flexion and supination strength. Surgical treatment is a well-accepted treatment that can improve flexion and supination strength, however, can be associated with a number of surgical complications. The case presented here describes a vascular injury sustained during a distal biceps tendon repair. The manuscript provides a background on distal biceps tendon ruptures, treatment options, and the complications associations with a tendon repair. The vascular complication described occurred during a tendon repair and highlights a number of surgical pearls that can help prevent a complication.

Keywords: Brachial artery injury; Distal biceps repair; Distal biceps rupture

Introduction

Distal biceps rupture often occurs in middle-aged men, typically as a result of a large eccentric load applied to a flexed elbow. Non-operative management of a distal biceps rupture leads to loss of approximately 20-30% flexion strength and up to 40% supination strength [1-5]. Surgical repair of a distal biceps rupture is a well-accepted treatment modality in young active patients, allowing for restoration of the anatomy of the biceps tendon and flexion and supination strength of the elbow [2,6]. Surgical repair provides excellent subjective and objective results, and early surgical repair have been advocated [3]. Significant complications of distal biceps repair have also been reported, such as lateral antebrachial nerve palsy, superficial radial nerve palsy, posterior interosseous nerve palsy, heterotopic ossification, and re-rupture. However, despite the proximity of the vascular structures, an arterial injury has never been reported in literature to our knowledge. The cases presented describe an injury to the brachial artery and highlight the complications that can arise during surgical repair of the distal biceps tendon rupture.

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Case Presentation

Case 1

53 year-old male presented for evaluation of left elbow pain after two consecutive injuries to his left elbow. The first occurred when he caught a heavy object with his left forearm and felt immediate pain and a pop in his left elbow. The second incident occurred a week later while doing heavy lifting and he felt a pop in his left elbow, followed by ecchymosis and pain in the left antecubital fossa. Examination revealed full active ROM of his left shoulder, marked tenderness in the left distal biceps area, with no palpable left distal bicep and weakness with resisted supination. MRI of the left elbow revealed a complete tear of the biceps tendon at the distal attachment site, with retraction 8 to 10cm proximally with thickening and heterogeneous fluid surrounding the torn tendon (Figure 1).

The patient elected to have operative treatment. Fluoroscopy was used to identify the radial tuberosity and a transverse incision was made slightly medial to avoid the lateral antebrachial cutaneous nerve (LABCN). Marked scarring was noted in the distal biceps tendon. Scar tissue was noted extending up into the biceps. However, despite vigorous dissection proximally, the distal biceps tendon stump could not be identified. Profuse bleeding was noted and attempts to identify the source of the bleeding were made. The tourniquet was deflated and a brachial artery injury was identified. The two ends of the injured vessel were clamped for hemostasis and distal perfusion verified with doppler ultrasound. A primary brachial artery repair was performed in concert with vascular surgery restoring distal flow. Examination of the repair did not reveal any leakage. The distal biceps tendon could not be identified and a biceps-to-brachialis tenodesis was performed. The patient was observed for compartment syndrome prior to discharge. He was followed closely post-

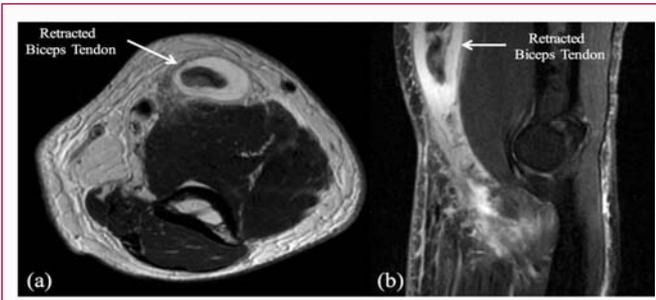


Figure 1: (a) Axial and (b) Sagittal magnetic resonance imaging (MRI) of the left elbow demonstrating a distal biceps tendon rupture.

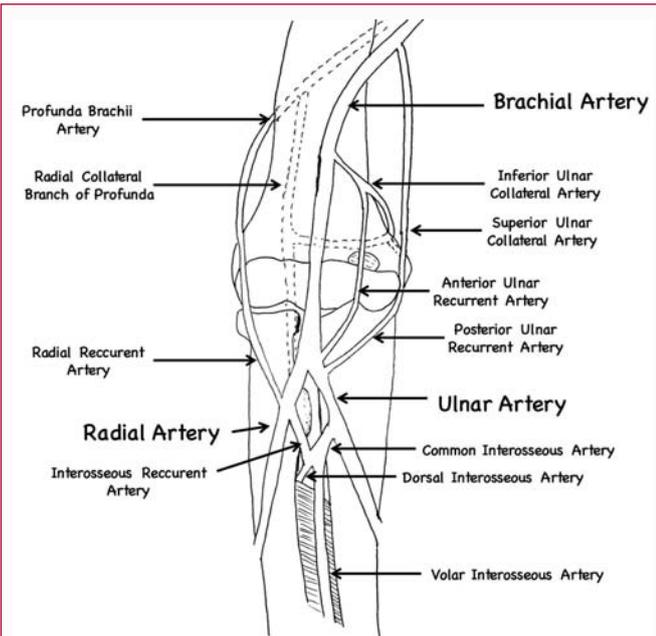


Figure 2: Brachial artery anatomy illustration, depicting the collateral blood supply around the elbow.

operatively and did well with minimal pain, stating his arm felt strong but fatigues easily. He denied complaints of paresthasias and had a 2+ palpable radial pulse.

Case 2

63-year-old male presented as a transfer to our facility with concern for limb ischemia and compartment syndrome after a distal biceps tendon repair. The patient underwent a distal biceps tendon repair at a stand-alone surgery center and developed swelling in the recovery room along with an absent radial artery pulse. The patient returned to the operating room for wound exploration at which time an artery laceration was discovered. Due to the poor perfusion of the patient’s hand, the patient was emergently transferred to the main hospital. Upon arrival, he had generalized fullness of the forearm. Pulses were intact proximally along the brachial artery until the antecubital fossa, past which there were no palpable, or dopplerable radial or ulnar artery pulses. CT angiogram revealed brachial artery occlusion proximal to the elbow joint with no distal perfusion. The patient was taken back to the operating room in concert with the vascular team for right upper extremity limb ischemia. A large hematoma was evacuated and the brachial artery and its trifurcation were in the field of view. A radial artery and an interosseous artery transection were discovered along with an ulnar artery thrombosis, with no distal flow. An embolectomy was

performed followed by primary repair of the radial artery laceration and ligation of the interosseous artery transection. The radial artery pulse was immediately reestablished with excellent perfusion to the hand. Attention was turned to the dusky muscular tissue throughout the forearm. Given these findings and the risk of reperfusion injury it was felt most appropriate to release the volar, dorsal, and mobile wad compartments. The flexor carpi radialis muscle was mobilized to provide coverage of the vascular repair and negative pressure therapy was initiated. He returned to the operating room for repeat irrigation and debridement followed by dorsal wound closure and skin grafting of the volar wound. He did well postoperatively with excellent perfusion of his hand but developed partial anterior interosseous nerve palsy with extensor lag of his ring and small finger.

Discussion

To our knowledge this is the first report of a brachial artery injury during a distal biceps tendon repair. The brachial artery arises as an extension of the axillary artery after the distal aspect of teres major muscle and terminates at approximately one centimeter distal to the elbow joint giving rise to the radial and ulnar arteries [7]. It is on average 26.29 cm long and divides into its terminal branches, the radial and ulnar arteries, at a mean of 2.99 cm distal to the intercondylar line [7]. It runs with the median nerve during its descent to the elbow joint and the artery is medial to the humerus proximally. It then courses anteriorly eventually lying in between the humeral epicondyles at the level of the elbow joint [7]. During its course, it gives off a number of

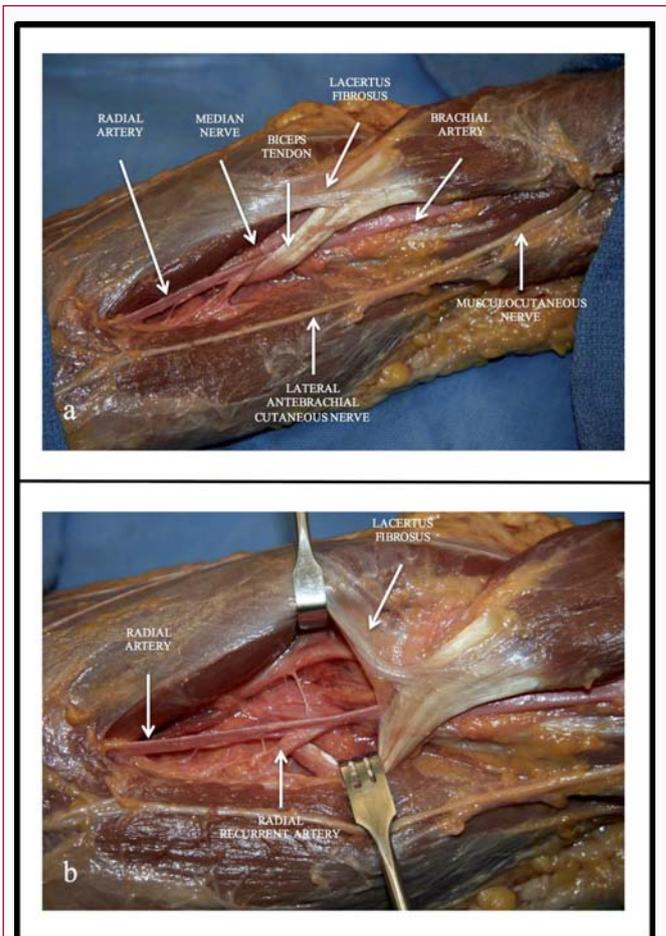


Figure 3: (a) Cadaveric dissection illustrating the close proximity of the brachial and radial artery to the distal biceps tendon. (b) Closer view of the distal biceps tendon and its relationship to the brachial and radial artery.

different branches including the profunda brachii, nutrient artery of the humerus, superior ulnar collateral artery, inferior ulnar collateral artery, various muscular branches and terminates into the radial and ulnar arteries. The anterior radial collateral, superior ulnar collateral and inferior ulnar collateral arteries provide a rich collateral blood flow to the distal extremity consisting of seven vessels (Figure 2) [8,9]. Due to the close proximity of the vessels to the biceps tendon, they can theoretically be injured in the surgical exposure of the radial tuberosity for repair (Figure 3).

Bain et al. [10] used cadaveric specimens to study the distance of the neurovascular structures to the biceps tendon. The superficial branch of the radial nerve was on average 15mm from the biceps tendon, posterior interosseous nerve (PIN) was on average 18mm away, median nerve was 12mm away, radial artery was 12mm away, and ulnar artery was 6mm away. This study highlighted the proximity of these structures to the biceps tendon and cautions against cavalier dissection during exposure of the radial tuberosity.

Although distal biceps repair is a relatively safe procedure to perform, there are a number of potential complications that can arise. The risk of encountering complications increases as the repair is delayed and range from 8-44% [2,3,11]. Specifically, there is a higher incidence of complications with delay greater than 4 weeks [11]. Early operative treatment allows for an easier retrieval of the biceps tendon versus delayed treatment, where visualization of the tendon is obscured by scar tissue [11]. Complications described in the literature include nerve injury, persistent anterior elbow pain, heterotopic ossification (HO), rerupture, and radioulnar synostoses⁴. Injury to the LABCN is the most frequently described nerve injury as it is frequently encountered on the lateral aspect of the anterior incision [3]. Injury to the LABCN can lead to a painful neuroma formation or paresthesias in the anterolateral aspect of forearm. Although rare, median and radial nerve palsies have been reported during surgical exposure [3]. Rerupture of the distal biceps tendon after surgical repair is very rare due to the protected rehabilitation programs along with the reflex inhibition of the surrounding musculature [12]. Heterotopic ossification has been reported in up to 10-15% of cases and involves growth of the bone in nonosseous locations [2,13]. Injury to the surrounding vasculature is a risk but no cases to our knowledge have been described in the literature. Cain et al. [11] retrospectively reviewed 198 patients with distal biceps ruptures treated surgically and evaluated time from injury to repair, surgical technique, and complications. There was a 36% complication rate, which included lateral antebraichial cutaneous nerve paresthesias in 26%, radial sensory nerve paresthesias in 6%, posterior interosseous nerve palsy in 4%, symptomatic HO in 3%, superficial infection in 2%, and rerupture in 2% [12]. A higher complication rate was associated with a repair performed more than 28 days after rupture [11].

Brachial artery injury can occur during exposure of the radial tuberosity. Any profuse bleeding during radial tuberosity exposure or proximal dissection can be a result of a vascular injury. These cases are the first to our knowledge with a report of vascular injury during a distal biceps tendon repair and emphasize important lessons one should keep in mind while performing this procedure. The vessels are in close proximity to the distal biceps tendon and the surgeon should be careful not to perform an extensive dissection to find the tendon stump. The dissection field should remain superficial to retrieve the distal stump as deep dissection can injure the vessels in close proximity (Figure 3). Following the repair and prior to closure, the tourniquet ought to be deflated to ensure hemostasis. If hemostasis

is not obtained careful surgical exploration must be performed to identify the source of bleeding. A vascular injury was realized in case one after deflating the tourniquet. Failure to deflate the tourniquet prior to closure can result in a complication similar to the one observed in case two, which further lead to the development of limb ischemia and compartment syndrome.

The vascular injury should be clamped to provide temporary hemostasis. Pulses in the radial artery can be palpated to ascertain distal arterial flow and doppler ultrasound should be used to verify distal perfusion in the radial and ulnar arteries. The proximal and distal ends of the injured vessels need to be debrided followed by primary arterial repair. If an immediate primary repair is unable to be performed, the vessels can be tied off leaving long tails so that they can be easily identified. The collateral blood flow consisting of approximately seven vessels is able to provide adequate perfusion distally even with an acute brachial artery transection [14]. The patient should be transferred emergently to a tertiary care center where an emergent vascular repair can be performed. The arterial repair should be inspected for any leaks and distal flow in the radial and ulnar arteries verified with Doppler ultrasound. Serial examinations of the forearm should be performed for the development of compartment syndrome. The surgeon should have a low threshold for performing compartment releases as done in case two. Reperfusion injury after vascular repair can cause further damage to the extremity necessitating compartment releases. It is important to follow the patient closely post operatively to monitor the patency of the vascular repair. Appropriate anti-coagulation in concert with vascular surgery needs to be provided to prevent thrombosis of the vascular repair.

Conclusion

Surgical repair of a distal biceps rupture is an acceptable method of treatment as it is a relatively safe procedure, which provides restoration of flexion and supination. Complications associated with surgical repair of the distal biceps rupture include nerve damage, anterior elbow pain, heterotopic ossification, rerupture, and radioulnar synostoses. Brachial artery injury is a rare complication of distal biceps rupture repair that should be identified quickly, clamped to control bleeding, and repaired primarily. Distal extremity perfusion should be verified using Doppler ultrasound to identify arterial flow in the radial and ulnar arteries. These cases highlight the importance of vigilant surgical dissection when performing a distal biceps repair and deflating the tourniquet prior to closure.

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