CASE REPORT

Posterior Interosseous Neuropathy Related to a Loose Distal Biceps Cortical Button: A Case Series

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Abstract

Posterior interosseous nerve (PIN) injury is an uncommon yet debilitating complication following distal bicep tendon repair. There are case reports of acute intraoperative PIN injury related to retractor placement, drill trajectory, and nerve incarceration. We report three cases of delayed PIN neuropathy in the setting of a loose cortical button. All patients had resolution of their pain with removal of the cortical button and decompression of the radial tunnel. The purpose of this case series is to: 1) highlight the possibility of a loose cortical bicep button as the cause of proximal forearm pain and PIN neuropathy in the early or late postoperative timeframe; and 2) emphasize the importance of proper surgical technique and use of intraoperative fluoroscopy to assure the cortical button is well-fixed and flush with the radial shaft.

Level of evidence: IV

Keywords: Cortical button, Distal biceps repair, Endobutton, PIN, Posterior interosseous nerve

Introduction

Distal bicep ruptures are relatively uncommon.[1] Most injuries occur from forceful eccentric contraction at the tendo-osseous junction, where the biceps is predisposed to degeneration.[2] Surgical repair is generally recommended to maximize functional outcomes.[3,4] Repair methods include transosseous sutures, suture anchors, interference screws, and cortical button fixation using either a single or two-incision approach.[1,4–6]

An uncommon iatrogenic complication is posterior interosseous nerve (PIN) injury.[4–6] Presumed mechanisms include retractor placement, drill injury, and cortical button incarceration.[5,7,8] Alternatively, delayed PIN injury has been associated with heterotopic ossification and may be due to proximity to the cortical button.[5] In this article, we present three patients with delayed or persistent PIN neuropathy related to a loose cortical button.

Case Presentation 1

A 46-year-old male underwent a two-incision distal biceps repair using a cortical button 12 months prior at another facility. Postoperatively, the patient reported PIN-innervated musculature weakness, which improved by 90% within a few days. However, 4 months later, he developed recurrent weakness with thumb and finger extension. He presented with 3/5 strength of extensor carpi ulnaris (ECU) and extensor indices proprius (EIP) muscles, and 0/5 strength of extensor pollicis longus (EPL) and extensor digitorum communis (EDC) muscles. Additionally, he endorsed dysesthesias in the dorsal radial sensory nerve distribution. Radiographs of the elbow demonstrated what appeared to be a well-positioned cortical button [Figure 1].

Given the findings of a progressive PIN palsy, the patient underwent radial tunnel decompression, PIN neurolysis, and cortical button excision through a posterior approach. Intraoperatively, the cortical button was loose but secured by the suture. The PIN was adjacent to the cortical button and appeared fibrotic [Figure 2]. On postoperative day

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(POD) 11, EIP and ECU strength improved to 4/5 and dysesthesias resolved. Motor strength to EPL and EDC improved to 3/5 at 6 months postoperatively.

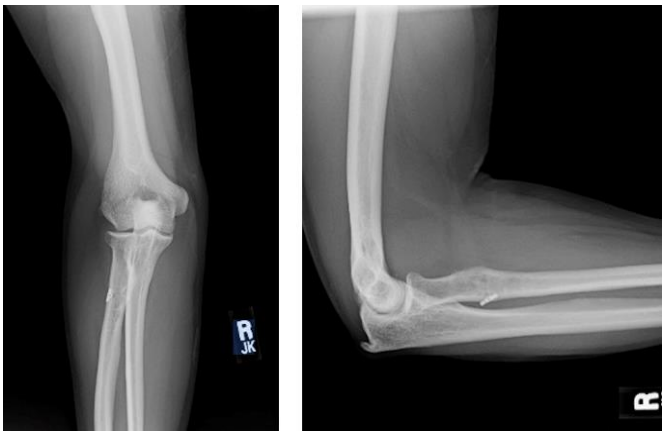

Figure 1. Anteroposterior and lateral radiographs of the right elbow demonstrating what appears to be a well-positioned cortical button

Figure 2. Intraoperative image demonstrating the cortical button (arrow) just deep to the posterior interosseous nerve. The nerve (asterisk) is located just adjacent to the freer elevator

Case Presentation 2

A 47-year-old male developed severe pain along his radial styloid, exacerbated by forearm supination, immediately after a single-incision distal biceps repair with a cortical button by another surgeon. His pain initially improved. However, 2 weeks postoperatively, he developed worsening pain radiating proximally to his lateral elbow and paraesthesias along his dorsal hand.

Physical examination revealed crepitus along the anconeus with forearm pronosupination and pain within the common extensor musculature with resisted wrist extension. Muscle strength was 5/5 throughout. Semmes Weinstein monofilament sensory exam of the volar and dorsal hand was identical bilaterally. On standard elbow radiographs, the cortical button resided along the radial neck, oriented transverse to the shaft, but appeared flush. Radiographs in varying degrees of forearm rotation demonstrated a cortical button lying off the radial cortex [Figure 3]. An MRI showed the cortical button with surrounding edema. It was adjacent to, but not in direct contact with the PIN.

Figure 3. Anteroposterior and lateral radiographs of the right elbow demonstrating a cortical button sitting off the cortex of the radial neck

Given the concern for a loose cortical button causing radial neuritis at 9 months postoperatively, the patient underwent radial tunnel decompression and cortical button excision through a posterior approach. Intraoperatively, the cortical button was loose but remained attached to the suture. It was adjacent to but did not impinge on the PIN with forearm rotation. By 2 weeks postoperatively, his radial styloid pain and dorsal hand paresthesias resolved.

Case Presentation 3

A 54-year-old female underwent single-incision distal biceps repair with a cortical button 6 years prior at an outside facility. Postoperatively, she developed dysesthesias along her dorsal forearm and hand that waxed and waned over the years, but became more frequent. She had tenderness over the radial tunnel, a Tinel's sign radiating to the dorsal hand, and forearm pain with resisted long finger extension. There was no tenderness over the lateral epicondyle or pain with resisted wrist extension. She had 5/5 strength of PIN-innervated musculature, except for the EPL which was 4+/5. Semmes Weinstein monofilament sensory exam of the volar and dorsal hand was identical bilaterally.

Elbow radiographs demonstrated a loose cortical button, lying 3.6 mm off the radius [Figure 4]. There was no evidence of radial nerve impingement at the button or within the radial tunnel on MRI. Electrodiagnostic studies demonstrated mild cubital and moderate carpal tunnel syndrome, but no evidence of radial neuropathy. Provocative tests for cubital and carpal tunnel syndrome were negative.

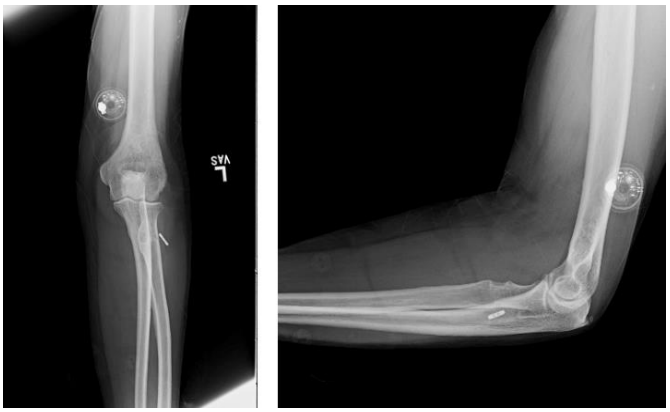

Figure 4. Anteroposterior and lateral radiographs of the left elbow demonstrating a loose cortical button

Given concern for long-standing radial tunnel syndrome, the patient underwent radial tunnel decompression and cortical button excision through a posterior approach. The cortical button was attached to the suture but loose within the soft tissues. It was 8mm from the PIN and did not contact the PIN during forearm or wrist motion [Figure 5]. However, the PIN appeared constricted at the Arcade of Frohse [Figure 6]. Complete resolution of her forearm pain occurred by her first postoperative visit. At 2 months postoperatively, EPL remained at 4+/5 strength.

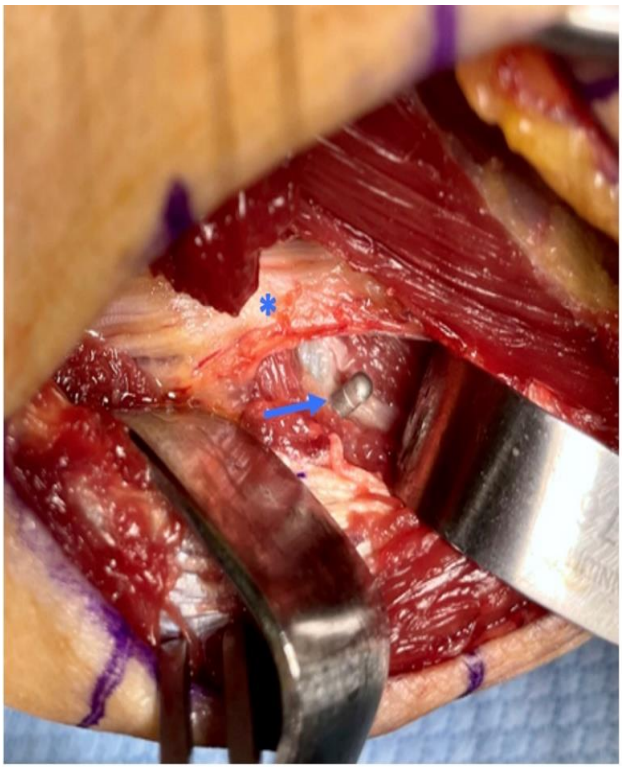

Figure 5. Intraoperative image demonstrating a loose cortical button still attached to the suture (arrow) that is not in direct contact with the posterior interosseous nerve (asterisk)

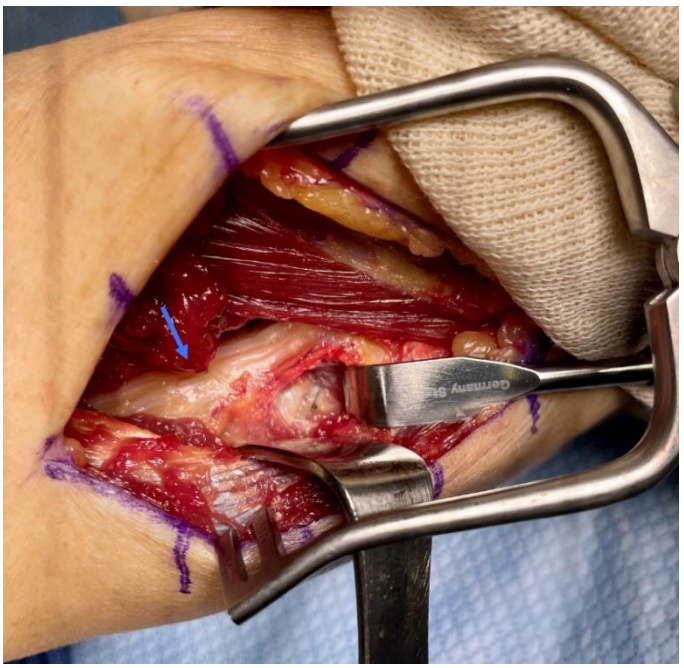

Figure 6. Intraoperative image demonstrating constriction of the posterior interosseous nerve at the Arcade of Frohse (arrow)

Discussion

Posterior interosseous nerve injury is a debilitating complication of distal bicep tendon repair. Suggested mechanisms include aberrant retractor placement, compression from heterotopic ossification, incarceration under a cortical button, and laceration from guidewire or drill placement.[5,7,8] In a retrospective study of 51 distal bicep ruptures managed with cortical button fixation, 42% developed neurological complications with 4% involving the PIN.[5] One case of PIN injury was attributed to retractor placement and the other was due to gradual compression from heterotopic ossification.[5]

Lo et al. demonstrated that drilling through the dorsal cortex of the radius, directed distal or radial to the bicipital tuberosity, was in closer proximity to the PIN compared to an anterior-to-posterior trajectory.[7] Drilling in an ulnar direction also places the PIN at less risk for injury.[7,9,10] Due to the location of the PIN around the radial tuberosity, the cortical button can contact the nerve during placement.[11] In a study of 12 cadaveric arms, the cortical button contacted the PIN in 50% of specimens during deployment and was seated within 6mm and 2mm of the nerve in 91.7% and 6.7% of specimens, respectively.[12]

The PIN may become incarcerated when the cortical button is flipped on the dorsal cortex of the radius intraoperatively.[7] This would likely present with immediate weakness or paralysis. Alternatively, if the cortical button is loose or loosens in time, transient irritation may occur with arm motion, resulting in weakness or pain. Interestingly, all three of our patients developed PIN neuropathy in the setting of a loose cortical button with only one presenting with

prominent PIN-innervated muscle deficits. The other two experienced pain and dysesthesias with only subtle weakness. With irritation and swelling of the radial nerve, it is plausible that radial tunnel syndrome can develop from PIN entrapment. In fact, in one patient, the PIN was located relatively distant from the loose cortical button but was constricted at the Arcade of Frohse, suggesting that this was the mechanism of her pain.

It is unclear if the cortical buttons for our patients were improperly secured along the cortex during the index procedure or loosened over time. Two patients had their index procedure at an outside facility where operative reports and imaging were not accessible and, for the third patient, intraoperative fluoroscopic evaluation of the button was not performed. While it has not been reported, it is feasible that the suture could rupture leaving the cortical button loose. The suture was attached to the button in all of our patients, though it was impossible to determine if it ruptured elsewhere in the construct. Proper tensioning of the cortical button and confirmation of placement using intraoperative fluoroscopy can help reduce PIN-related complications.

Patients presenting with new PIN-innervated muscle weakness and radiographs demonstrating a loose cortical button are relatively straightforward to diagnose. However, those with vague symptoms of pain are more challenging. We used patient-reported histories, physical examinations, radiographs, MRI, and electrodiagnostic studies to help clarify the diagnosis. However, additional studies may be warranted. For example, one patient required multiple rotational radiographic views to demonstrate the loose button. Ultrasound and diagnostic injections are frequently used in our practice to diagnose atypical neuropathies, such as radial tunnel syndrome, as electrodiagnostic studies may be unreliable.[13,14] Ultrasound can detect edema, fibrosis, and subtle changes in nerve diameter as well as the location of the nerve in relation to the cortical button with forearm rotation.[15] Relief of pain following a corticosteroid injection around the proximal PIN would also help support the diagnosis of radial tunnel syndrome.[16]

Conclusion

In conclusion, PIN injury is a known complication following cortical button fixation of distal bicep tendon ruptures. However, most reports attribute the injury to factors other than a malpositioned or loose cortical button, as presented in this series. All three patients developed PIN neuropathy in the setting of a loose cortical button, each with slightly different presentations and operative findings. The first patient had a fibrotic-appearing nerve with significant motor deficits. The second patient likely experienced irritation of the nerve with forearm rotation. The last patient most likely sustained chronic PIN-irritation and swelling leading to radial tunnel syndrome. All three patients improved with button excision and radial tunnel decompression.

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