

Ligamentous Reconstruction for Post-traumatic Chronic Instability of Distal Radioulnar Joint

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Abstract

Introduction: Disorders of the distal radioulnar joint (DRUJ) are a common source of ulnar-sided wrist pain. The ulnar side of the wrist has often been likened to the lower back because of the difficulties involved in establishing a specific diagnosis for pain at both sites and therefore in prescribing an effective treatment plan.

Aim: The aim of the study was to analyze the clinical and functional results of ligamentous reconstruction in cases of post-traumatic chronic instability of DRUJ.

Materials and Methods: Twenty-one cases of chronic instability of dorsal radioulnar joint were included for this prospective study. Bunnell–Boyes procedure and Adam's procedure were performed.

Results: Bunnell–Boyes procedure: Out of 11 patients, 5 patients had excellent wrist score at follow-up, 3 patients had good wrist score, 3 cases of dorsovolar instability for which Bunnell-Boyes procedure was done had only marginal improvement (fair grade) post operatively. Preoperatively, all patients had either fair (or) poor score. Adam's procedure: Out of 10 patients, 4 patients had excellent wrist scores, 4 patients had good wrist score and 2 cases of old Colle's fracture the patients had pain during extreme range of pronation and supination movements and recurrence of instability of DRU during follow up (fair grade). All these patients had good stability, pain-free good range of pronation, and supination movement.

Conclusion: The goals of chronic instability of DRUJ management are to restore stability and pain-free rotation. Ligamentous reconstruction achieves these goals. The Bunnell–Boyes procedure is ideal for dorsal instability. The Adam's procedure gives better results for dorsal and volar instability.

Key words: Distal radioulnar joint, Distal radius fracture, Distal radioulnar joint injuries

INTRODUCTION

Stability of the distal radioulnar joint (DRUJ) is provided by bony architecture and by soft tissues such as the triangular fibrocartilage complex (TFCC), the joint capsule, and surrounding muscles. The most common cause for DRUJ instability is a distal radius fracture.¹ Although instability after accurate reduction and fixation of the distal radius is relatively uncommon, it is important to evaluate DRUJ stability after treatment of

a distal radius fracture. Patients with DRUJ instability after a malunion of the distal radius fracture usually present with loss of forearm rotation, prominence of the ulnar head, weakness, or ulnar-sided wrist pain.^{2,3} A dorsally angulated malunion usually presents with volar displacement of the ulna and volar instability, and a volarly angulated malunion usually presents with dorsal displacement of the ulna that may limit forearm supination. Patients may present with chronic DRUJ instability without a history of a distal radius fracture. The most common history is a traumatic event involving a fall on the outstretched hand or an unexpected forcible rotation of the wrist. Patients usually report ulnar-sided wrist pain of a mechanical nature that is increased with wrist positions and activities that reproduce the mechanism of injury such as forearm rotation or ulnar deviation of the wrist. Localized swelling, crepitus, weakness, and a sense of instability may exist. In severe

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cases, there may be a painful clunk and loss of rotation due to chronic subluxation. In addition, patients with ulnar impaction syndrome with a considerably large ulnar-positive variance may have instability symptoms in addition to typical ulnar abutment symptoms.^{4,5}

Aim

The aim of the study was to analyze the clinical and functional results of ligamentous reconstruction in cases of post-traumatic chronic instability of DRUJ.

MATERIALS AND METHODS

Twenty-one cases of chronic instability of dorsal radioulnar joint were included for this prospective study. The inclusion criteria for surgery were patients with ulnar-sided wrist pain and instability to perform their usual occupational duties, clinical evidence of DRUJ instability, patients who had failed to improve with conservative management consisting of internal splinting and wrist therapy.

Exclusion Criteria

Patients who had radiological evidence of DRUJ or ulnocarpal osteoarthritis, perioperative evidence of erosions in the articular cartilage of the sigmoid notch or ulnar head were excluded. The mean follow-up was 11.5 months. Dominant hand (right side) was involved in 6 patients and in 15 patients the nondominant (left side) was involved. Among 21 patients, all patients gave a history of injury. Nine patients had initial treatment by plaster immobilization for 10 days to 2 weeks. Two patients had associated Colles' fracture treated by "K-" wire fixation elsewhere. Rest of cases was treated as just sprains elsewhere. All patients were diagnosed as chronic DRUJ instability based on their history, clinical assessment, and radiological findings.

RESULTS

Among 21 patients, 14 were males and 7 were females. The age group varied from a minimum of 21 years to a maximum of 45 years. The mean age group is 31.3 years. 10 patients had dorsal instability alone, whereas 11 patients had both dorsal and volar instability.

All presented with ulnar-sided wrist pain (or) weakness and were unable to perform their usual occupational duties. All had mild tenderness on palpation of the DRUJ, radial to the ulnar styloid dorsally and palmarly and a positive "piano key" sign. On anteroposterior translation in neutral, supination, and pronation, 11 patients had increased palmar and dorsal instability of the DRUJ as compared to opposite, uninjured wrist.

Table 1: Distribution of instability

Instability	Bunnell-Boyes procedure (%)	Adam's procedure (%)
Dorsal	72.7	20
Dorsal+volar	27.3	80

Table 2: Distribution of Mayo wrist scores

Mayo wrist score	Bunnell's procedure	Adam's procedure
Pre-operative	64.1±5.8	85.9±8
Post-operative	62±3.5	86±8.8
P value	0.232	0.942

Table 3: Distribution of stability

Stability	Bunnell-Boyes procedure (%)	Adam's procedure (%)
Stable	81.8	90
Unstable	18.2	10

Table 4: Distribution of grade

Grade	Bunnell-Boyes procedure (%)	Adam's procedure (%)
Excellent	45.5	40
Good	27.3	40
Fair	27.3	20
Poor	0	0

The other 10 patients had dorsal instability only Table 1. A prominent ulnar head was noted in 8 patients. Grip strength was diminished in all patients. Supination and pronation were restricted in 6 patients, but all patients had pain at extremes of supination and pronation. Posteroanterior radiographs in neutral rotation showed widening of the DRUJ in 8 patients, but all patients had some degree of subluxation of the ulnar head compared to the uninjured side on weight bearing lateral radiographs in pronation and supination.

Bunnell-Boyes Procedure

There were no intraoperative complications. Postoperatively, one patient developed transient paresthesia and altered sensation in the distribution of the dorsal cutaneous branch of the ulnar nerve, but this resolved spontaneously a month after surgery. This was probably caused by retraction of the nerve during surgery.

Out of 11 patients, 5 patients had excellent wrist score at follow-up and 3 patients had good wrist score. Preoperatively, all patients had either fair (or) poor score. Eight patients improved in all components of the wrist score except range of supination and pronation movements which improved from fair to good rating

only Table 2. Three cases of dorsovolar instability for which Bunnell–Boyes procedure was done had only marginal improvement (fair grade) postoperatively. Out of 3 patients, 2 patients had recurrence of instability and 1 had restricted pronation and supination movements. All but two patients were satisfied with the outcome of surgery, and indicated they would undergo the surgery again if necessary.

None of the patients had radiological evidence of DRUJ widening except for the two patients who developed recurrent instability Table 3. The two patients were not willing for any further surgical procedures.

Adam's Procedure

There was no intraoperative complication. Postoperatively, patient had prolonged stiffness following post-operative immobilization for 12 weeks, having failed to return for removal of the cast at 6 weeks. He was lost to follow-up after 13 weeks.

Out of 10 patients, 4 patients had excellent wrist scores and 4 patients had good wrist score. All these patients had good stability, pain-free good range of pronation and supination movement.

In the two cases of old Colles' fracture the patients had pain during extreme range of pronation and supination movements and recurrence of instability of DRUJ during follow-up (fair grade) Table 4. Possible causes of failure in these two patients are insufficient tensioning of the graft and rupture or loosening of the graft during initial mobilization. These patients were not willing for any further surgical procedures.

DISCUSSION

Bunnell–Boyes procedure has both anatomic and physiological approach. It gives excellent results for dorsal instability, however, it is not ideal, when there is both dorsal and volar instability, as evidenced by our study results.⁵ Adam's procedure effectively reconstructs the anatomy of both dorsal and palmar radioulnar ligaments of the TFCC simultaneously. It gives better results, when there is both dorsal and volar instability. However, it is a technically demanding procedure. In their short-term follow-up, Adams and Berger (2002) reported that stability was restored in 12-14 patients with grip strength improving to 85% normal.⁶

The DRUJ is the distal articulation of the biarticulate rotational arrangement of the forearm where the ulna is fixed segment and the radius rotates around it in supination

and pronation. The peculiarity of this joint is it allows simultaneous rotation and anteroposterior translation.⁷ Stability of the DRUJ is provided by the joint surface morphology, the joint capsule, the dorsal and palmar radioulnar ligaments, the interosseous membrane, and the musculotendinous units, primarily the extensor carpi ulnaris (ECU) and pronator quadratus.^{8,9} The difference in radii of curvature of ulnar head and the sigmoid notch causes translation of ulna volarly in supination and dorsally in pronation.

Pathological instability can be acute or chronic and is a result of soft tissue injury or osseous malunion or a combination of both. Chronic DRUJ instability is a painful and disabling condition with reduced hand grip, restricted rotation of forearm and pain on axial loading.

Isolated dislocation of DRUJ is relatively rare entity described only as case studies and case series in literature. In that, the dorsal dislocation is more common than volar.

The usual mechanism for dorsal subluxation and dislocation is hyperpronation and extension, with a tightened ECU and ulnar carpal ligaments, which pull the ulnar head out through the dorsal capsule. TFCC avulsion and attenuation of the palmar radioulnar ligament also allow this dislocation.¹⁰

CONCLUSION

The goals of chronic instability of DRUJ management are to restore stability and pain-free rotation. Ligamentous reconstruction achieves these goals. The Bunnell–Boyes procedure is ideal for dorsal instability. The Adam's procedure gives better results for dorsal and volar instability.

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