Treatment of Chronic Unreduced Posterior Elbow Dislocation With an Internal Joint Stabilizer

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Summary: Chronic unreduced elbow dislocations remain difficult to treat with a high rate of complications. This injury is rare in the United States; more often, it is seen in underdeveloped countries where many patients seek traditional treatment from local bone setters before ever seeing an orthopaedic surgeon. Common surgical options involve open reduction with soft tissue repair, transarticular cross-pinning, or stabilization with hinged external fixation. The purpose of this report is to present successful surgical management of a patient with a chronic elbow dislocation treated with an internal joint stabilizer of the elbow.

Key Words: chronic elbow dislocation, elbow instability, internal joint stabilizer of the elbow

INTRODUCTION

Chronically unreduced elbow dislocations remain difficult to manage with complications of persistent pain, instability, and stiffness. These injuries are defined as 3 or more weeks out from injury and can be divided into 2 categories—subluxation and complete dislocation.1,2 Chronic posterior subluxation is the most common of the 2 and is associated with fracture-dislocations. On the other hand, unreduced complete dislocations are rarely seen in the United States; they are more commonly seen in underdeveloped countries where access to health care is limited. Due to either illiteracy or poor health education, patients often attempt other methods of treatment by native bone setters before evaluation by an orthopaedic surgeon.1–6 Although rare in developed countries, chronic dislocations more often present as initially unrecognized injuries in unresponsive polytrauma patients or in patients who either fail to seek early medical attention or are lost to follow-up.7 These injuries often present with gross deformity, pain, and limited motion, with two-thirds of patients presenting with an elbow flexion arc of less than 40 degrees.8 After weeks of dislocation, closed reduction becomes more difficult and riskier due to soft tissue contractures and localized osteopenia, resulting in a higher chance of producing an iatrogenic fracture.6

Early studies recommended open reduction only for patients presenting within 3 months of injury.3–5 More recently, authors have presented functional results with elbows more than 3 months out from injury with the recommendation of open reduction in all chronically unreduced elbows, with some even recommending open reduction for dislocations 10 days out.1–3,9 Early treatment options included ligament repair/reconstruction or transarticular cross-pinning with Kirschner wires (K-wires) to maintain elbow stability. Both methods often require at least 2 weeks of immobilization before permitting active motion.3–5 Obviously, those undergoing transarticular pinning cannot be mobilized until the K-wires are removed. Hinged external fixation has widely been used with success, but it also comes with a rather high complication rate most associated with pin track infection, pin loosening, and pin malalignment.10–13

A more recently described surgical technique involves temporary internal stabilization while allowing for immediate postoperative mobilization. Orbay and Mijares14 introduced an early model of an internal joint stabilizer using a hinged internal Steinman pin—a manually constructed device for internal temporary joint stability while still allowing for early elbow motion. Using a fully implanted device, the common pin complications associated
with external fixation and transarticular pinning were avoided. Since then, the internal hinged device has been developed into the internal joint stabilizer of the elbow (IJS-E), a device specifically designed to be used as a temporary hinged fixator (IJS-Elbow stabilization system; Skeletal Dynamics Inc, Miami, FL). The purpose of this case report is to present results of this rather novel system in treating a patient who presented with a chronic unreduced elbow dislocation.

**Patient Information**

A 34-year-old, right-hand dominant, incarcerated man presented to clinic with continued right elbow pain after being involved in a motor vehicle collision 3 weeks prior. Before incarceration, he worked in construction building houses. He was a half-pack-per-day smoker and reported an alcohol history of 28 beers per week. He was seen at an outside hospital immediately following the initial injury. Here, he was reportedly diagnosed with a right elbow dislocation, which was then closed reduced and splinted. Thereafter, he was taken to jail where he reported removing the splint himself before later reapplying it due to discomfort. The patient was evaluated by the operative surgeon (A.J.S.) at his initial outpatient clinic visit. He reported pain with any attempted movement of the elbow; he was neurovascularely intact distally in all distributions and had no other injury. Radiographs obtained in clinic showed a posteromedial dislocation of the ulnohumeral and radiocapitellar joints without associated fracture (Fig. 1). Due to the questionable duration of dislocation, assumed to be 3 weeks out from injury, the decision was made to perform open reduction with internal stabilization using an IJS-E. He was placed in a posterior long arm splint in clinic; closed reduction was not attempted at this time due to concern of causing an iatrogenic fracture. He returned 4 days later for operative fixation.

**Surgical Technique**

The patient was placed supine on a radiolucent table with a bump under the ipsilateral shoulder. A nonsterile tourniquet was used for hemostasis. The operative arm was prepped and draped in standard sterile fashion. The arm was flexed over the chest on a bump. Exposure was established through the anconeus approach, as described by Landrum et al. An incision was made over the posterior distal humerus and proximal ulna, starting 10 cm distal to the tip of the olecranon and extending 5 cm proximally. A full-thickness soft tissue flap was developed down to the level of the forearm fascia, working radially to find the interval between the anconeus and extensor carpi ulnaris. The flap was developed from the lateral epicondylo to the apex of the anconeus to allow for full exposure. The interval between anconeus and extensor carpi ulnaris was then divided distal to proximal. The intermuscular plane was followed proximally, exposing the radiocapitellar joint capsule. The interval between anconeus and flexor carpi ulnaris was then developed from the apex of anconeus proximally along the subcutaneous border of the ulna. The anconeus was then elevated from the underlying subperosteum starting from the distal apex and working proximally and radially toward the lateral epicondyle. An L-shaped arthrotomy was then made overlying the radiocapitellar joint extending from the lateral epicondylo to the base of the annular ligament, with special care not to damage the underlying articular cartilage. The radial collateral ligament origin was found to be stripped from the distal lateral humerus. The annular ligament was also traumatically avulsed from its ulnar insertion. The arthrotomy was then extended proximally along the greater sigmoid notch, giving a better view of the ulnohumeral joint. A large fibrotic clot was present within the joint and extensive arthrofibrosis within the medial side of the joint. This was found to be blocking reduction. He was noted to have sheared cartilage from the medial trochlea and the proximal ulnar articular surface. The fibrotic clot and sheared cartilage were debrided from within the joint. The fibrotic medial joint capsule was then elevated off the periosteum through the exposure. The elbow was then reduced but remained unstable. Any stress caused redislocation, so the reduction was provisionally pinned in place with several transarticular K-wires.

Once concentric reduction was obtained, attention was then turned to implanting the IJS-E. The IJS-E was implanted in the recommended fashion per the manufacturer’s surgical technique guide. The axis centering guide was used to locate and mark the anatomic center of the lateral capitellum. Once obtained, the axis guide was then inserted into the medial ulnohumeral joint by applying a slight varus stress to open the radiocapitellar joint. The K-wire guide was then inserted into the axis guide and locked in place. A 1.5-mm K-wire was advanced under orthogonal fluoroscopy to help guide placement of the pin through the isometric center of the distal humerus, with special care to not penetrate the far...
Intraoperative radiographs. Anteposterior (A) and lateral (B) views show the elbow concentrically reduced with the IJS-E in proper alignment.

FIGURE 2. Intraoperative radiographs. Anteposterior (A) and lateral (B) views show the elbow concentrically reduced with the IJS-E in proper alignment.
Maheswaran and Kamalnathan presented 7 patients in India with old unreduced elbow dislocations of 7–30 weeks out from injury. All were initially seen by local bone setters with traditional treatments of massage or manipulation and immobilization. At 6 months out from surgery, the patients averaged a flexion–extension arc of 65 degrees with concentric reduction maintained in all elbows. There was a 43% complication rate with persistent subluxation seen in 1 patient (14%). Anderson et al presented 32 patients with chronic elbow dislocation between 1 and 34 months without associated articular fracture treated at 2 tertiary centers in Ethiopia. The authors developed a technique involving a combined medial and lateral approach and did not repair nor reconstruct ligaments. Final mean flexion–extension arc was 101 degrees and pronation–supination arc was 121 degrees. All elbows remained stable without subluxation or redislocation.

Recent surgical techniques for the management of unstable elbows aim to establish immediate stability while allowing for early range of motion. By maintaining a concentric reduction, the collaterals then have time to heal or scar back to the epicondyles. Arafiles described the use of tendon graft as a reconstructed “cruciate” ligament to provide immediate ligamentous stability. Eleven patients were treated at an average of 11 months out from injury with a final mean flexion–extension arc of 105 degrees and pronation–supination arc of 113 degrees. Recurrent instability was seen in 64% of patients.

Stabilization with hinged external fixators has shown positive results in patients with elbow fracture–dislocations; however, this is less often used in developing countries due to higher costs and decreased availability. Jupiter and Ring describe 5 patients with chronic dislocations between 6 and 30 weeks from initial injury. Patients were stabilized with hinged external fixation, and collateral ligaments were not reconstructed. All elbows maintained concentric reduction with a final mean flexion–extension arc of 123 degrees and full forearm rotation.

Duckworth et al reported a 42% rate of persistent instability in ligamentous elbow dislocations when treated with collateral ligament repair alone. Heterotopic ossification was seen in 17% of the patients who underwent ligamentous repair. They found external fixation to be the preferred treatment over intra-articular cross pinning. Hinged external fixation allows for stable active motion while avoiding the inherent risks of cross-pinning, including further articular damage and intra-articular pin track infections. On the other hand, Ring et all found hinged external fixation to have a higher rate of complications compared with cross-pinning. Cheung et al retrospectively reviewed 100 patients treated with external fixation and reported a 25% complication rate with the majority relating to pin track infection and pin loosening or malalignment. Potini et al reported a 57% complication rate in patients treated with hinged external fixation, with 29% requiring further fixation due to persistent instability.

The early design of the IJS-E involved manipulating a Steinman pin in the operating room to then be used as an internal fixator. Orbay and Mijares presented 10 patients with acute elbow fracture–dislocations. There were no reported cases of postoperative instability.

**FIGURE 3.** Follow-up radiographs at 2 weeks out from surgery. Anteroposterior (A) and lateral (B) views show maintained concentric reduction with no change in IJS-E alignment.

**FIGURE 4.** Final follow-up radiographs at 6 months after IJS-E explantation. Anteroposterior (A) and lateral (B) views show maintained concentric reduction of the elbow.
instability or redislocation. This was later developed into the IJS-E, no longer depending on the surgeon’s craftsmanship to create the implant. In the first multicenter trial by Orbay et al., it was reported that only 1 of 24 patients (4%) treated with the IJS-E experienced persistent subluxation. The immediate joint stability provided by the IJS-E allowed for early motion and rehabilitation to help combat the onset of stiffness. Complications were limited to 1 patient developing transient median and ulnar nerve palsy, and another patient developing a questionable infection that resolved with oral antibiotics. External fixator pin placement can be challenging with the risk of worsened instability with misplacement; however, Sochol et al. found IJS-E implantation to be more easily reproducible because placement is under direct visualization.

It is imperative to restore a stable concentric joint when managing traumatic elbow instability to minimize further permanent damage to the articular cartilage. Although purely ligamentous dislocation lacks the bony disruption often associated with terrible triad-type injuries and other fracture–dislocation patterns, this injury shares similar complications of recurrent instability and reduced range of motion. Reduction of chronic dislocations is complicated by contraction of the triceps tendon, medial and lateral collateral ligaments, and anterior and posterior capsules. Fibrotic soft tissue forms throughout the joint and must be excised to regain concentric reduction; however, removal of this tissue may cause further instability. Through the use of the IJS-E, our patient maintained concentric reduction throughout all follow-up visits with functional range of motion and without complications.

CONCLUSIONS
The IJS-E offered safe surgical treatment of this patient’s traumatic elbow instability with excellent results. It allowed for early range of motion and was effective in maintaining elbow stability. We believe the use of this relatively novel system should be explored more.

REFERENCES

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