Technique Report

OTA INTERNATIONAL
THE OPEN ACCESS JOURNAL OF ORTHOPAEDIC TRAUMA

OPEN

The use of a laminar spreader for the reduction of extra-articular distal radius fractures: A technical trick

Tarek A. Taha, MD, PhD*

Summary: Extra-articular distal radius fractures are often accompanied with shortening, loss of radial height, and radial displacement of the articular segment relative to the shaft of the radius, all seen in the coronal plane. Reduction can be somewhat challenging when reliance on traction and ligamentotaxis fails, especially in subacute or osteoporotic fractures. In this technical report, we describe a technique where application of a laminar spreader between the radius and the ulna in the metaphyseal region can easily reduce the fracture and help attain anatomic alignment in the coronal plane. An acute and a subacute fracture are shown for illustration of the technique.

Key Words: distal radius fractures, reduction, wrist fracture

1. Introduction

Distal radius fractures are among the most commonly encountered upper extremity fractures in orthopaedic practice.[1] Several classifications have been proposed for these fractures, which can be intra-articular or extra-articular.[2] One of the most common patterns of distal radius fractures is the extra-articular transverse fracture resulting in impaction of the articular segment onto the radial shaft, along with loss of radial inclination.[3] The typical displacement is apex anterior angulation of the articular segment, as well as radial displacement of the same segment relative to the proximal segment.

Several intraoperative maneuvers are used to address deformity during surgical reduction of distal radius fractures.[4] Some will reduce the fracture manually before implant application, while others will use the anatomic shape of the fixation implant to help with alignment restoration. For displacement in the sagittal plan, hyperextension of the wrist followed by traction, hyperflexion, and pinning can often restore volar tilt.[4] Other maneuvers secure the distal aspect of the plate to the articular segment and then bring the plate down to the shaft with a cortical screw to restore volar tilt.[5]

The reduction in the coronal plane can also be addressed by wrist manipulation.[4] With significant displacement and shortening, however, this maneuver may not always be successful. Another well-described technique is the Kapandji maneuver, where a K-wire is introduced into the fracture site on the radial side and used to lever the distal segment over the proximal segment and restore radial height and inclination.[6–8] This approach may be effective in young strong bone but often fails in older osteoporotic bone because the K-wire simply crushes the bone on the articular segment rather than lever it.

In this report, we describe a technical trick, where a laminar spreader is placed between the radius and the ulna to reduce a distal radius fracture in the coronal plane. We have found this technique useful in all types of bone, especially in osteoporotic patients, where K-wire maneuvers tend to be less effective.

2. Materials and Methods

The typical exposure for a distal radius fracture is the Flexor carpi radialis approach. An incision is made over the Flexor carpi radialis tendon. The dissection is carried down to the tendon, which is retracted ulnarly. The flexor pollicis longus muscle fascia is then incised and the muscle retracted ulnarly as well. This exposes the pronator quadratus, which is elevated off its insertion into the distal radius and moved in the ulnar direction. We routinely release the brachioradialis insertion in these extra-articular fractures to remove a deforming force that pulls the articular segment radially.

At this point, we place a laminar spreader between the distal radial shaft and the distal ulna proximal to the distal radio-ulnar joint (DRUJ), typically where this is good quality bone even in osteoporotic individuals. The spreader is then opened up while gentle traction is pulled on the thumb in an ulnar direction. This maneuver then brings the radial shaft in alignment with the articular segment, reducing the fracture in the coronal plane. We then pin the reduction from the radial styloid into the radial shaft with 1 or 2 K-wires.

With the above maneuver, the reduction in the sagittal plane is usually not achieved. We use the volar plate to restore alignment in that plane. The plate is applied and fixed distally to the articular fracture fragment with multiple screws. A cortical screw is then placed in the shaft to bring the plate down to the radial shaft. In doing so, the volar tilt is restored by this lift maneuver, commonly used in distal radius fracture reductions. We then place another

The author reports no conflict of interest.

Department of Orthopaedic Surgery, Ascension St. Mary's, Saginaw, MI.

** Corresponding author. Address: Tarek A. Taha, MD, PhD, Ascension St. Mary's, 4677 Towne Center Rd, Second Floor, Saginaw, MI 48604.*
E-mail: tahatarek78@gmail.com

OTAI (2023) e263

Received: 1 May 2022 / Accepted: 4 January 2023
Published online 30 March 2023

http://dx.doi.org/10.1097/OI9.0000000000000263

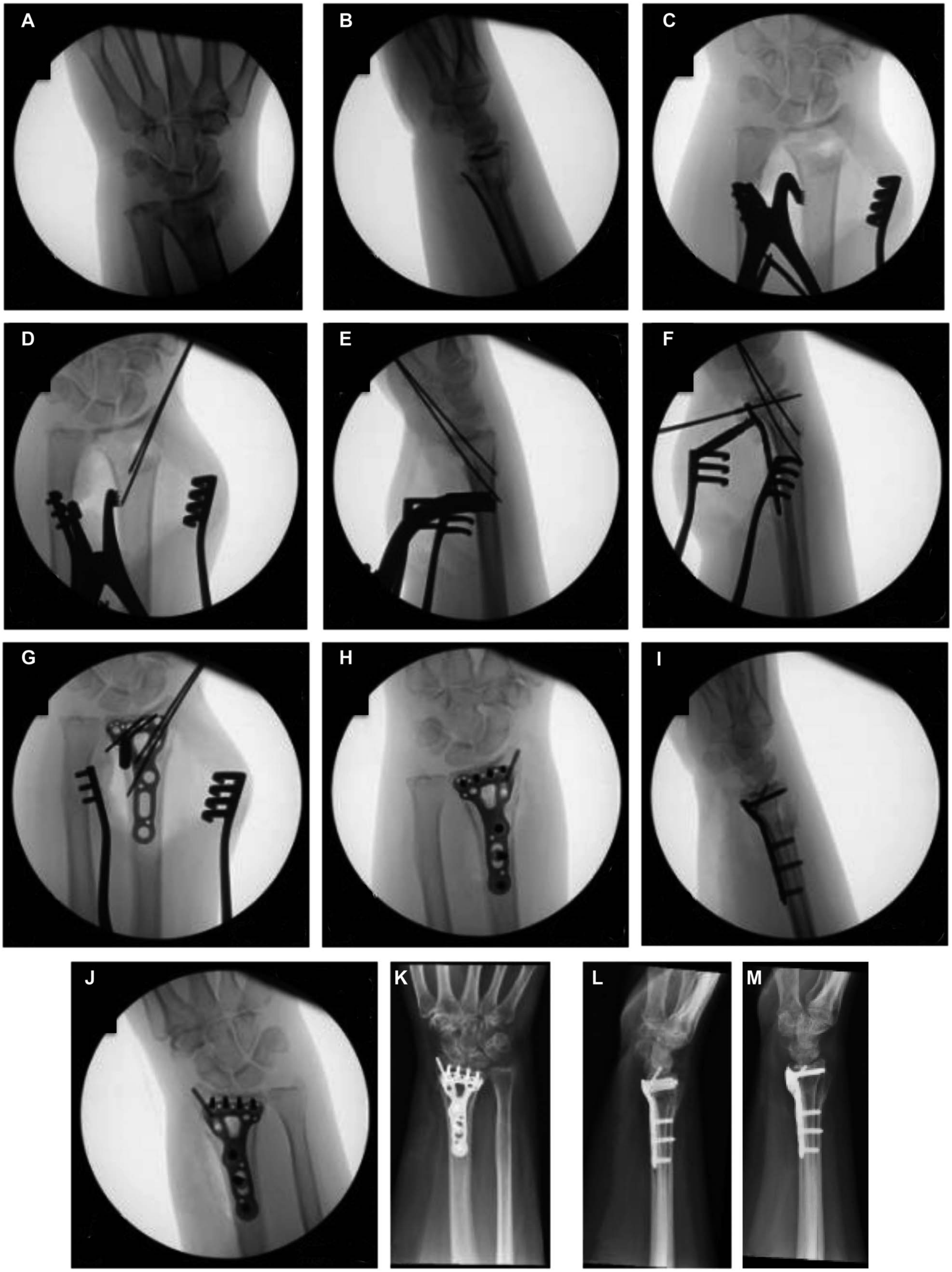

Figure 1. Acute extra-articular distal radius fracture with shortening, loss of radial height, and dorsal angulation (A,B). Image A shows the significant radial displacement of the articular segment relative to the shaft. Application of the laminar spreader between the radius and the ulna, with some traction on the thumb, shows significant correction of the deformity on the coronal view (C). Subsequent K-wiring once alignment is achieved (D,E). Application of the volar plate with fixation applied distally first (F,G). Final reduction and plate fixation (H-J). Fracture healing in anatomic alignment (K-M).

screw into the shaft to secure the construct rotationally. The laminar spreader and K-wires are then removed. Further screw placement is then completed as needed. Below is an illustration of the technique with 2 cases, one acute and the other subacute. Consent was obtained from both patients for publication of their cases.

2.1. Case 1

The patient is a 53-year-old female who presented with an acute traumatic extra-articular distal radius fracture. She had impaction with loss of radial height and inclination of her distal radius as well as radial translation and dorsal displacement (Fig. 1). She had mild apex volar angulation on the lateral view (Fig. 1). The laminar spreader technique was used to move the radial shaft radially, a maneuver that restored radial height and inclination on the coronal view. With the alignment in place, K-wires were used to provisionally hold the reduction in place. The laminar spreader could now be removed or until all fixation was in place. A volar plate was then applied and fixed to the bone proximally and distally. The anatomic plate restored the sagittal alignment as it is applied to the bone. Final fixation and bone healing are shown as well.

2.2. Case 2

The patient is a 60-year-old female who presented with a 3-week-old extra-articular distal radius fracture that was originally offered

Figure 2. Three-week-old distal radius fracture initially treated conservatively (A-D). Laminar spreader application shows correction of alignment with subsequent pinning. Note the stretch across the distal radio-ulnar joint (E). Final intraoperative images after removal of the wires and laminar spreader (F-H). Healed fracture in anatomic alignment (I,J).

closed treatment. She complained of a notable deformity and pain in her wrist (Fig. 2). Surgical treatment was offered to improve alignment and to hopefully alleviate discomfort. She had a similar approach to the patient in Case 1 but required some mobilization of early callus at the metaphysis. Her fracture was also stiffer and less mobile than Case 1. Once the laminar spreader was applied and opened, the radial shaft moved to a more anatomic position relative to the articular segment. The amount of force applied was evident by the separation noted at the DRUJ (Fig. 2). Once the reduction was attained, K-wires were again used to secure provisional alignment. Plate placement was followed with final fixation using screws. Note that the DRUJ was anatomic after the laminar spreader was removed. The DRUJ was also stable on examination at the end of the procedure. Healing and alignment are shown at 3-month follow-up.

3. Discussion

Impaction, loss of radial inclination, and radial displacement are common findings in distal radius fractures. These similar patterns are seen in both, young high-energy as well as older low-energy fractures. In both cases, when surgical indications are met, the goal is to restore radial height, inclination, and volar tilt.

We have found that in most distal radius fractures, the reason for the above alignment patterns is secondary to displacement of the shaft relative to the articular segment, rather than the other way around. Maneuvers that push the shaft radially are more successful in restoring radial alignment than ones that manipulate the distal segment. The relationship between the distal radius articular segment and the DRUJ is often well maintained, further supporting the notion that the articular segment is anatomically aligned relative to the joint but the rest of the forearm is not. By this token, maneuvers that mobilize the shaft, rather than the articular segment, may be more effective in regaining anatomical alignment.

The laminar spreader specifically addresses the shaft displacement relative to the articular segment. It is placed proximal to the metaphyseal fracture line between the radius and the ulna, in areas where bone is commonly intact and of good quality. The effectiveness of the maneuver is independent of osteoporosis, unlike levering techniques with K-wires, which often do not work in weaker bone. This maneuver becomes even more important when significant force is needed to restore coronal alignment, as in cases of malunions or nonunions. The integrity of the interosseous membrane is intuitively required to allow the correction with a laminar spreader to happen, and this structure is often intact in routine distal radius fractures and fracture nonunions/malunions. The distal oblique ligament of the interosseous membrane has been implicated as an important stabilizer of the DRUJ and the restoration of distal radial coronal position is likely to restore tension in that ligament.[9] We have not seen any obvious iatrogenic injury to the interosseous membrane created by "excessive" force of the spreader. The force needed to restore alignment does not seem to exceed the strength of the membrane to withstand it. Some short lived stretch may occur to restore alignment, but once the spreader force is released, the membrane seems to recoil back to its original tension, as evidenced by the lack of DRUJ disruption with this maneuver. Naturally, corrections of chronic deformities or nonunions/malunions are more challenging and may not be complete, even with the use of a laminar spreader, although the technique remains quite powerful in these scenarios.

We typically use a standard size laminar spreader with 6-mm serrated ends, but any spreader can be used. We recommend similar or smaller tipped spreaders to avoid too much dissection within the interosseous membrane while the instrument is being placed. Care should also be taken when placing the spreader to avoid injury to the anterior interosseous nerve and artery.

The limitations of this technique become evident if there is a disruption of the DRUJ. For the laminar spreader to effectively move the shaft over radially while keeping the distal segment anchored, an intact radio-ulnar joint is a prerequisite. If the joint is not intact, the ulna will separate from the distal segment while the spreader is being used, and the force needed to move the radial shaft radially might not be achieved. Distal radio-ulnar disruptions that compromise the DRUJ significantly are quite rare in extra-articular fracture patterns, which makes the technique we propose quite useful in most distal radius applications with the deformities described above. We also do not routinely use the laminar spreader in other types of distal radius fractures, particularly shear fractures, where displacement patterns are entirely different than the more common Colles fracture. The laminar spreader can be used in conjunction with other techniques for reduction, and it is often not a stand-alone trick. In fact, the technique is primarily useful for reducing radial translation of the distal fragment relative to the proximal fragment rather than overall reduction of the entire deformity.

The technique proposed with the use of a laminar spreader is very effective for extra-articular metaphyseal distal radius fractures. We believe the strength of this method is in its applicability to a wide range of ages independent of bone quality, as well as the fact that no additional expensive reduction tools are needed, and in its ability to target displacement of the shaft relative to the articular segment rather than the other way around.

References

1. Mauck BM, Swigler CW. Evidence-based review of distal radius fractures. *Orthop Clin North Am*. 2018;49:211–222.
2. Ilyas AM, Jupiter JB. Distal radius fractures—classification of treatment and indications for surgery. *Orthop Clin North Am*. 2007;38:167–173.
3. Szabo RM. Extra-articular fractures of the distal radius. *Orthop Clin North Am*. 1993;24:229–237.
4. Anderson AB, Tintle SM. Closed reduction techniques for distal radius fractures and appropriate casting methods. *Hand Clin*. 2021;37:239–245.
5. Lippross S. A technical note on the reduction of distal radius fractures with angular stable plates. *J Orthop*. 2019;16:113–117.
6. Jirangkul P, Jitprapaikulsarn S, Songpatanaslip T. Outcomes following temporary kapandji pinning technique and distal radial LCP fixation for intra-articular fractures of the displaced distal radius. *Tech Hand Up Extrem Surg*. 2019;23:38–43.
7. Trumble TE, Wagner W, Hanel DP, et al. Intrafocal (Kapandji) pinning of distal radius fractures with and without external fixation. *J Hand Surg*. 1998;23:381–394.
8. Weil WM, Trumble TE. Treatment of distal radius fractures with intrafocal (kapandji) pinning and supplemental skeletal stabilization. *Hand Clin*. 2005;21:317–328.
9. Dy CJ, Jang E, Taylor SA, et al. The impact of coronal alignment on distal radioulnar joint stability following distal radius fracture. *J Hand Surg*. 2014;39:1264–1272.