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Trauma Rounds

Case Reports from the Mass General Hospital and Brigham & Women's Hospital

A Quarterly Case Study | Volume 2, Winter 2011

Intra-articular Distal Radius Fractures

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Your patient comes in after a mechanical fall onto an outstretched hand. A significant deformity of the wrist and edema are noted clinically and the patient's discomfort is obvious. Radiographs demonstrate a displaced, dorsally angulated distal radius fracture with loss of radial height, radial translation, and intra-articular involvement. You see the patient, perform an appropriate clinical workup, reduce and splint the fracture.

While this may sound familiar, the treatment of a *standard* distal radius fracture may be varied and can provide a challenge for even the most experienced surgeon.

Distal radius fractures have a bimodal distribution, occurring due to high energy trauma in the younger population (under 25 years) and following low energy falls from standing height in older patients. This latter population often have decreased bone density, increasing their risk of fractures from seemingly minor trauma. Identifying and treating osteoporosis is necessary to prevent future fractures. We generally refer these patients to their PCP's or recommend an endocrine evaluation as we begin our treatment.

Surgery is most often indicated for a) displaced fractures which cannot be adequately reduced, and b) for fractures which can be reduced but do not maintain the reduction. Many options exist, including closed reduction and percutaneous pinning, external fixation (spanning and non-spanning), dorsal plating, fragment specific (multiple plate) fixation, intramedullary fixation, spanning internal fixation, and volar locked plating.[1] Fortunately for our patients, a skilled surgeon familiar with these techniques can achieve a satisfactory outcome by choosing any one of several treatment options for the particular fracture pattern.

Above: Post-injury PA view of the wrist demonstrates a displaced comminuted intra-articular distal fracture. CT scan was later obtained to better understand the fracture pattern for surgical planning.

Below: Intraoperative radially inclined lateral view of the wrist demonstrates reduction of the fracture and restoration of the articular congruity. View also confirms that locking screws are placed extra-articularly.

Increasingly, volar locked plating has gained popularity for its reliability, low complication rate, and ability to allow more rapid return of motion and function.[2] Assuming appropriate reduction and positioning are achieved, the volar locked plate will allow early mobility even in osteoporotic or comminuted bone. It can be an excellent choice with desirable outcomes.

For addressing comminuted intra-articular distal radius fractures, there are several techniques I have found helpful with achieving appropriate reduction and stability, even with significant fragmentation. These techniques are:

1. Mobilize Fracture Fragments

This may require release of the brachioradialis insertion to allow the radial styloid to be brought back out to length. In fractures which are 3-4 weeks from injury, this may require significant freeing of the dorsal soft tissues and early callus, which can be easily accessed from the volar approach by placing a bone holding clamp on the diaphysis and pronating it out of the way.

2. Use Intact Structures to Build Support

The ulnar head can provide good support for the lunate facet fragment(s) which can be brought out to length and provisionally pinned to the distal ulna by traversing the DRUJ. Similarly, the articular congruity at

the radiocarpal joint can be re-established using the intact template of the proximal articular surface of the proximal carpal row. Any depressed segments can be tamped up to restore the joint. Occasionally a dorsal *peek hole* incision can be used to visualize those segments; sometimes I find the use of a wrist scope helpful in seeing the segments arthroscopically.

3. Build the Fracture Back to the Plate

A third technique is to use the plate to *help* you. If it is not possible to achieve provisional reduction with C-wires, you could place the plate on the volar aspect of the distal radius and secure it to the diaphysis with C-wires through the plate. This allows for easy plate adjustment without making large drill holes. The articular segments are then *reassembled* starting ulnarly. The surgeon can work through the fracture from the radial aspect and use a freer or other elevator to manipulate the volar lunate facet fragment into place. If there is a coronal split, the dorsal ulnar piece will need to be reduced at the same time. A C-wire is then placed through the plate into those segments. It may be appropriate to then place the locking screws into those fragments to achieve initial ulnar stability. Any intervening central fragments are reduced by tamping them up to restore the joint surface if needed and then reducing them to the lunate facet. By flexing the wrist and placing a rolled towel underneath, the fracture fragments are manipulated to deliver them up to the plate until they can be fixed there, allowing for restoration of the volar tilt, which will be predetermined by the implant choice. The radial styloid is reduced last; the surgeon should be aware that if it is challenging to reduce, there may be a rotatory component to the malpositioning rather than just length and flexion/extension issues. Sometimes, bone grafting is indicated due to large voids in the metaphyseal region.

Above: Post-operative PA view of the wrist shows reduction of the articular surface. The lunate facet is restored to its appropriate height and secured to the plate with two locking screws.

There are rare times when I use a provisional external fixator to provide longitudinal traction, which then frees my hands to manipulate and fix the articular segments.

Important Considerations with Comminuted Fractures

Try to position the plate such that the locking screws are just under the subchondral bone. This allows for a better *rafting* or supportive effect and minimizes settling of the fracture. This technique has the obvious risk that the hardware could be placed too distal and the locking screws could broach the joints (both radiocarpal and DRUJ). But this risk can be easily avoided with careful attention to screw placement through serial intraoperative fluoro imaging. The view I depend on substantially to determine my subchondral screw placement is the lateral view taken with the forearm radially inclined (~ 23 degrees), which allows a true tangential view of the articular surface. Many volar plating systems have multidirectional locking screw capability allowing the surgeon greater flexibility to position the plate more distally and still get locking capability, whereas the standard fixed angle locking screw trajectory would put those screws into the joint.

Summary

Volar locked plating technique typically provides adequate stability to allow for an early range-of-motion rehabilitation protocol. With restoration of the fracture alignment and stabilization, most patients will have an excellent prognosis for healing and return of function.

References

1. Nana AD, et al, *Plating of the Distal Radius.* J Am Acad Orthop Surg 2005; 13:159-171.

2. Rozental TD, et al, *Functional Outcomes for Unstable Distal Radial Fractures Treated with ORIF and Percutaneous Fixation. A Prospective Randomized Trial.* J Bone Joint Surg Am. 2009; 91(8):1837-46.

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