Technical Tips for (Dry) Arthroscopic Reduction and Internal Fixation of Distal Radius Fractures

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Contrary to general belief, arthroscopic assisted reduction in distal radius fractures can be done in an expeditious manner and with minimal consumption of operating room resources. This article presents the steps for a pleasant arthroscopic experience in detail. The technique proposed combines the benefits of rigid fixation with volar locking plates (for the extra-articular component) and arthroscopic control of the reduction (for the articular component). It is important that the operation be carried out using the dry arthroscopic technique. However, arthroscopy is just an addition to conventional methods. Thorough knowledge of and facility with classic techniques of distal radius fracture treatment is essential for a good result. *(J Hand Surg 2011;36A:1694–1705. Copyright © 2011 by the American Society for Surgery of the Hand. All rights reserved.)*

Key words Wrist arthroscopy, distal radius fracture, intra-articular fracture, volar locking plate.

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RESTORING THE JOINT ANATOMY is the main goal after an articular distal radius fracture, and fluoroscopy has some inherent inaccuracy.[1–4] On the other hand, the arthroscope allows us to see inside the joint with light and magnification. Nevertheless, despite well-performed comparative published studies[2,5,6] that support the use of the arthroscope when dealing with articular distal radius fractures, there is general resistance to use the arthroscope.[7] This is sometimes justified as resulting from a small risk of compartment syndrome, or the fact that it is time- and resource-consuming. The unvoiced reason, however, lies in the technical difficulties and cumbersomeness of combining the classic (wet) wrist arthroscopy with the open reduction and internal fixation part itself. On the one hand, massive tissue infiltration makes the latter extremely awkward; on the other hand, water running out through the incisions and portals obliges us to combine the less effective Kirschner-wire and external fixation methods,[2,5,6,8–10] limiting the use of the more stable volar-locking plate[11,12] when arthroscopy is used.

Arthroscopy without distending the joint with water (so-called "dry" arthroscopy)[13] has many advantages over the wet (classic) technique but is practiced by few surgeons.[14,15] This is understandable because, as a principle, one avoids changing an efficient and familiar technique for another that seems to add no benefit. Yet, there is no other single field in wrist arthroscopy where the dry technique can make such a huge difference and ease the procedure, compared with the wet technique, as when dealing with articular fractures of the wrist. Dry arthroscopy permits an unimpeded combination between the open fixation part and the possibility of watching the cartilaginous reduction and any associated soft tissue injury.

The purpose of this article is to present technical tips for using the arthroscope when dealing with distal radius fractures. Because it is important to be acquainted with the dry technique, the first part of this report is devoted to familiarizing the reader with its intricacies, and the second part to the fracture treatment itself.

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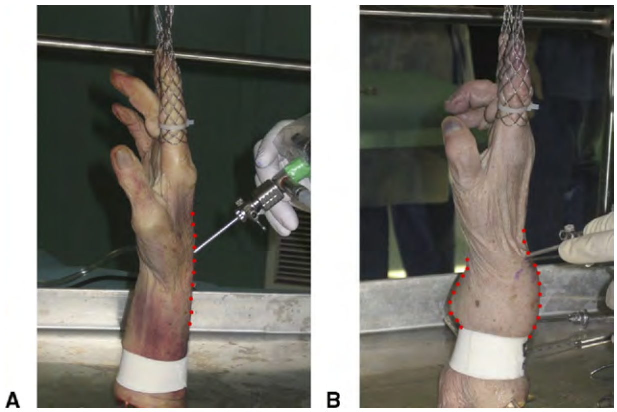

FIGURE 1: A Minimal deformity of the wrist after 1 hour of dry arthroscopy, compared with the hand shown in **B** that was operated on for the same amount of time but using the classic (wet) technique. (Pictures taken during a teaching course with cadavers in Strasbourg. Both were operated on by students simultaneously in different working posts). (Copyright © 2011 by Dr. Piñal.)

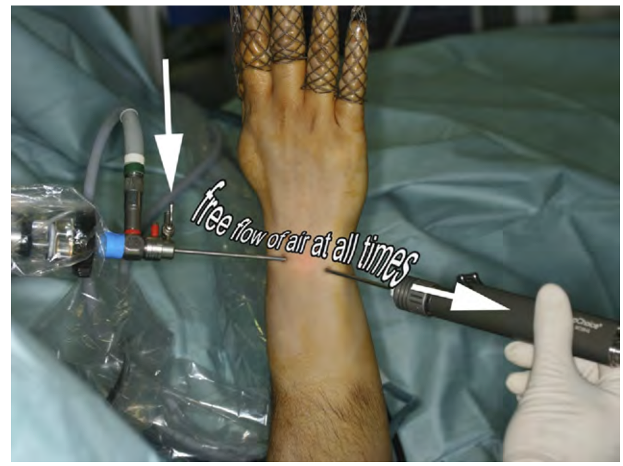

FIGURE 2: The valve of the scope should be open at all times to allow air to circulate freely. (From del Piñal F, Mathoulin C, Luchetti C, eds. Arthroscopic management of distal radius fractures. Berlin: Springer Verlag, 2010. Copyright © 2009 by Springer-Verlag, with kind permission of Springer Science+Business Media.)

DRY ARTHROSCOPY

There are many advantages to carrying out the operation dry. Not only will one avoid the risk of compartment syndrome, but much more important, soft tissue extravasation is eliminated, facilitating any combined open surgery as the tissues maintain their original properties (Fig. 1). In addition, portals can be made much larger because the constant loss of vision owing to leakage and bubbles is avoided.

The main shortcoming comes from the fact that if one is not able to get rid of the blood in the joint and it splashes at the tip of the scope that obscures vision in an expeditious manner, surgery becomes more difficult and the surgeon will give up the dry technique. Intuitively, one would think that removing the scope and wiping off the lens with a wet sponge is a good way to achieve clear vision. Although effective, this maneuver is time-consuming, and in a fracture, there may be so much blood that the maneuver may need to be repeated an exasperating number of times. Based on our experience with more than 700 dry wrist arthroscopies, and seeing how others in the laboratory and surgery struggle with the same difficulties over and over again, I recommend the following tips[16] that are critical for a smooth procedure, some of which are improvements on our previous publication[13]:

- The valve of the scope's sheath should be kept open at all times to allow air to circulate freely inside the joint. Otherwise, the shaver's suction will not function properly or the capsule will collapse inward owing to the power of the suction, resulting in blocked vision. This is critical and cannot be overemphasized (Fig. 2).
- Suction is necessary to clear the field, but paradoxically, suction might also blur the vision by stirring up the contents of the joint (debris, blood, or remaining saline) that may stick to the tip of the scope. It is critical, therefore, to open the suction of the shaver or burr only when there is the need to aspirate something. Suction power should be locked when not needed. The valve of the sheath of the scope should be open at all times but suction power should only be working when needed.
- Avoid getting too close with the tip of the scope when working with burrs or osteotomes, to avert splashes that might block vision. Minor splashes can be removed by gently rubbing the tip of scope on the local soft tissue (capsule, fat, and so forth).
- When a clear field is needed, so as to see a gap or stepoff, we *formerly* recommended drying out the joint with neurosurgical patties.[13] However, we rarely resort to this technique now and prefer to connect a syringe with 5 to 10 mL saline to the side valve of the scope and then aspirate it with the synoviotome, to get rid of blood and debris. Pressure on the plunger of the syringe is unnecessary, because the negative pressure exerted by the shaver will suck the saline into the joint, thus preventing any extravasation (Fig. 3). Once all the water has been aspirated, the syringe is removed, and again the suction power of the shaver is enough to dry out the joint sufficiently, allowing

A

B

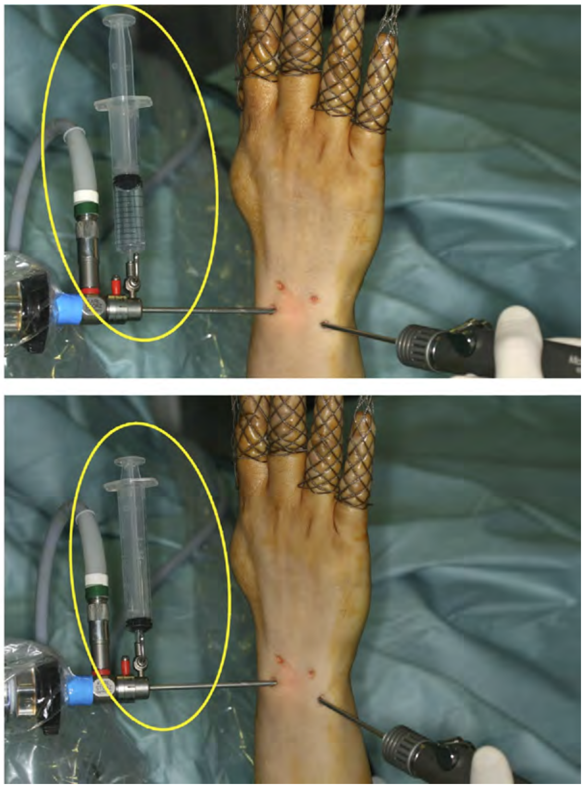

FIGURE 3: Method used to wash out the joint and clear it of blood. **A** Notice that the negative pressure exerted by the shaver is sufficient to aspirate the saline without extravasation of water **B**. (From del Piñal F, Mathoulin C, Luchetti C, eds. Arthroscopic management of distal radius fractures. Berlin: Springer Verlag, 2010. Copyright © 2009, with kind permission of Springer Science+Business Media.)

A

B

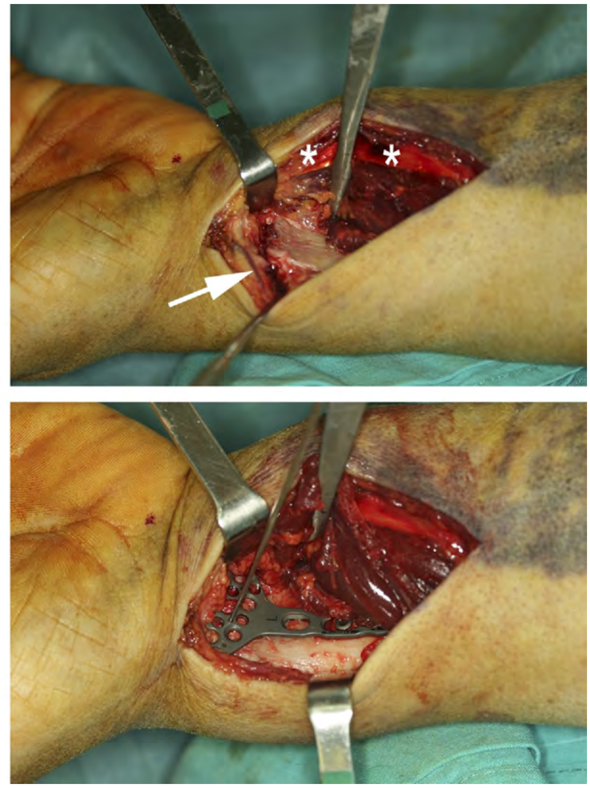

FIGURE 4: Access to the radius for plate positioning. **A** Close dissection with a knife will keep the sheath of the FCR intact (asterisks) and sufficient fat will be provided for protection of the radial artery (arrow). **B** Reduction of the metaphyseal component has to be ensured before insertion of the Kirschner wire into the plate. The fracture with the screws inserted into the stem and the Kirschner wires (2 or more) maintaining articular reduction is now ready for arthroscopic fine-tuning.

the surgeon to work. This maneuver should be repeated as necessary throughout the procedure because it is much quicker than struggling with blood in the joint or trying to dry it out with the patties, as we used to recommend.

- An important waste of time occurs when the synoviotome, burr, or any other instruments connected to a suction machine clog because the aspirated debris dries out. When this happens, the operation has to be stopped, to dismount and irrigate the synoviotome to dislodge the debris. The operating room nurse may avoid this by clearing the tubing with periodic saline aspiration from an external basin; the surgeon may avoid it through joint irrigation.
- Finally, one must understand that at most times vision will never be completely clear but will still be sufficient to safely accomplish the goals of the procedure. Having a completely dried field except for specific times during the procedure is unnecessary and wastes valuable time; we rely more on irrigation-suction as explained above.

The technique can be summarized in these 3 fundamental tips:

- The valve of the scope should be open at all times.
- The suction of the shaver or burr should be closed except when needed.
- The joint should be irrigated as needed to remove debris and blood.

SURGICAL TECHNIQUE

The operation can be scheduled on the first day without the need for a delay for fracture clotting because there is risk of neither bleeding nor compartment syndrome with the dry technique. After 3 weeks, the fragments are healed in impacted fractures and an osteotome is needed to cut the fragments.[17] A computed tomography scan can be helpful in fragment delineation and for orientation purposes. Finally, the assistance of another surgeon is invaluable until one is familiar with the logistics of this operation, and it is essential in the more complex fractures.

Except in some specific fractures, such as radial styloid, that are managed with cannulated screws through a transverse incision in the styloid (under arthroscopic control),[18] fractures are managed with the following protocol.[18,19]

Under axillary block, the arm is exsanguinated and tourniquet is applied. Access to the radius is carried out through a 6- to 8-cm incision radial to the flexor carpi radialis sheath (FCR) with a 1-cm radial-directed back cut in the proximal wrist crease. The space between the FCR and radial vessels is developed. Dissection should expose distally the most distal aspect of the radius, past the watershed area (a soft tissue interface distal to the pronator quadratus insertion), but obviously not violating the volar ligaments. The pronator quadratus and the most distal fibers of the flexor pollicis longus are elevated subperiosteally and reflected ulnarly (Fig. 4A).

A volar locking plate is provisionally applied and stabilized to the shaft of the radius by inserting, at this stage, only the screw into the elliptical (dynamic) hole on the stem of the plate. This will permit some adjustment at the time of later plate setting. The reduction of the volar epiphyseal fragments is done by standard maneuvers: traction and volar flexion. The dorsal fragments are manually compressed to the plate that acts as a mold. Customarily, several attempts and maneuvers are needed before the best reduction is obtained, as judged by fluoroscopic views and by direct observation of the metaphyseal component of the fracture. The articular fragments are then secured to the transverse component of the plate by inserting Kirschner wires through the auxiliary holes (Fig. 4B). Once the reduction is considered ideal and it appears that no improvement is attainable without carrying out an arthrotomy, the surgeon should proceed to assess the joint under arthroscopy. Before suspending the hand, however, to avoid secondary displacement by traction of the plate, at least another screw should be inserted into the stem of the plate to lock it in position. The aim of this first

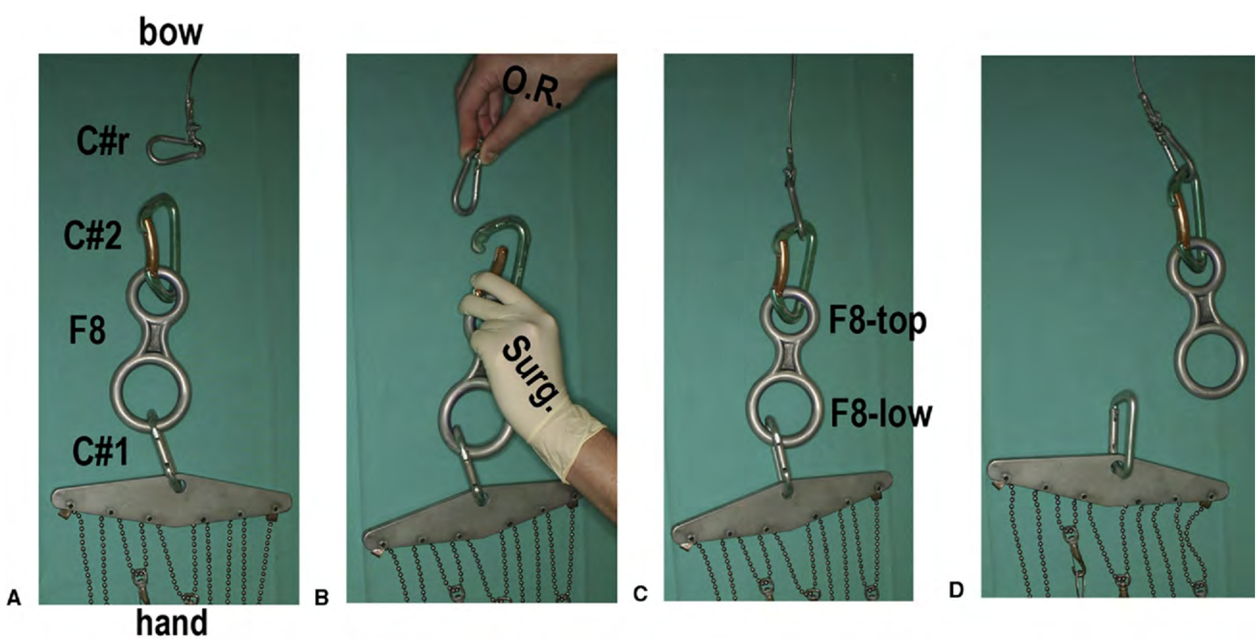

FIGURE 5: Method for maintaining sterility when changing from a vertical traction position, suitable for arthroscopy, to a standard surgical position, with the hand flat on the table. **A** The hand, held with Chinese traps, hangs from carabiner 1 (C#1), a figure-of-eight descender (F8), carabiner 2 (C#2), and the bow's rope carabiner (C#r). **B** (Carabiners and figure-of-eight descenders can be purchased at any climbing shop.) The surgeon, under sterile conditions, connects C#2 to C#R, which is held by the operating room personnel. **C** During arthroscopy, only the lower hole of F8 is considered sterile (F8-low) because the other hole (F8-top) comes into indirect contact with C#R. **D** To transfer the hand to a horizontal position, the surgeon unfastens C#1. To put the hand into traction again, the surgeon needs only to fasten C#1 to F8-low, which will maintain sterility at all times. All but C#R are sterile. (Reprinted from del Piñal F, García-Bernal FJ, Delgado J, Sanmartín M, Regalado J, Cerezal L. Correction of malunited intra-articular distal radius fractures with an inside-out osteotomy technique. J Hand Surg 2006;31A:1029–1034, with permission of the American Society for Surgery of the Hand. Copyright © 2006.)

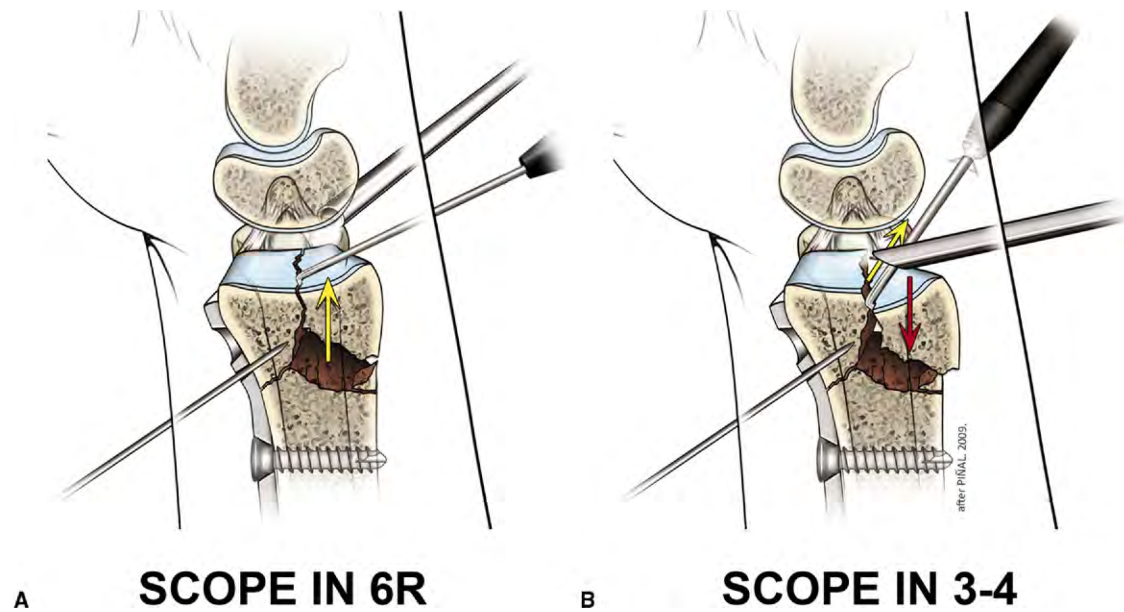

FIGURE 6: A If the scope is placed in 6R, it will rest on top of the ulnar head, providing a stable platform from which to work, thus avoiding conflict with the reduction. **B** Instability of the scope and conflict of space during the reduction (yellow and red arrows) are inevitable when the scope is placed in any other portal. (Copyright © 2011 by Dr. Piñal.)

part of the operation is to have most of the articular reduction done and the fragments stabilized by the Kirschner wires. Radial length, volar tilt, and inclination should be corrected by the plate; arthroscopy cannot expect to correct extra-articular malalignment.

The hand is suspended from a bow, the fingers pointing to the ceiling, with a custom-made system that allows easy connection and disconnection from the bow without losing sterility.[17] Countertraction is usually 7 to 10 kg but can be more in tight wrists. No adverse effects have been noticed, perhaps because the traction is evenly distributed to all fingers. This system has the advantage of its availability and price (€8 for each karabiner). Furthermore, it is easy to fasten and unfasten to check using fluoroscopy (Fig. 5).

I use the 2.7-mm/30° angle scope for most cases. In tight wrists, I seldom use a 1.9-mm/30° angle because the field of vision is reduced. Because of swelling, portals after fractures are slightly more difficult to establish than in a standard arthroscopy case. By deeply pressing hard with the surgeon's thumb, the surgeon can feel the Lister tubercle and a void (the radiocarpal joint) distal to it, which corresponds to the 3–4 portal location. I prefer small transverse incisions to create the portals as they heal with minimal scarring, and which do not require suturing at the end of the operation. The entrance of the portal is enlarged with a mosquito; the scope is introduced and directed ulnarly to establish another portal for triangulation. I always use 6R as my ulnar portal to avoid interference with the reduction of the dorsoulnar radius (see below), which will occur if the 4–5 portal is used. This portal is established by recognizing the proximal rounded surface of the triquetrum, with the surgeon's thumb. The mosquito glides on this surface to enter the radiocarpal joint as distal as possible. By doing so, one will skip the triangular fibrocartilage that, when detached from the dorsal capsule or the fovea, acts as a trapdoor, blocking the entrance into the radiocarpal joint.

A 2.9-mm shaver is inserted into 6R to aspirate blood and debris, and the joint is washed with saline by connecting a 10-mL syringe to the valve of the scope, as explained above. Once the elements that need to be mobilized are identified from the 3–4 view, the scope is swapped to 6R, where it will stay until the entire fixation is done. In this position, on top of the ulnar head, the scope will have a steady point to rest upon and will not impede reduction or displace reduced fragments (Fig. 6, left). If the scope is left in the 3–4 (or 4–5) portal, it will rest on an unstable point, will create space conflict during the reduction, and will tend to displace the reduced fragments (Fig. 6, right). Although useful for assessing the dorsal rim fractures, the volar-radial portal[5,14] can be supplanted by the 6R portal. The scope is advanced volarly; from there, the lens is turned dorsally, providing an acceptable view of the dorsal rim. Doing so avoids the need to change portals and the risk of redisplacing reduced (but not yet rigidly fixed) volar fragments.

Except in the most complex cases, only 1 or 2

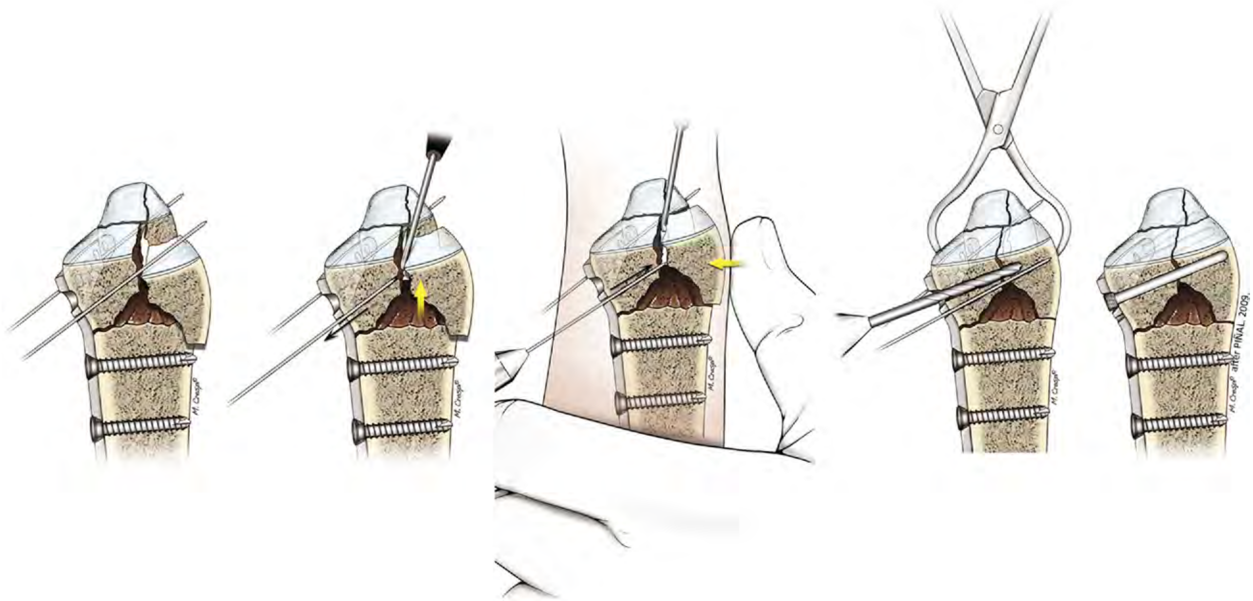

FIGURE 7: Author's technique to reduce depressed fragments. (Copyright © 2011 by Dr. Piñal.)

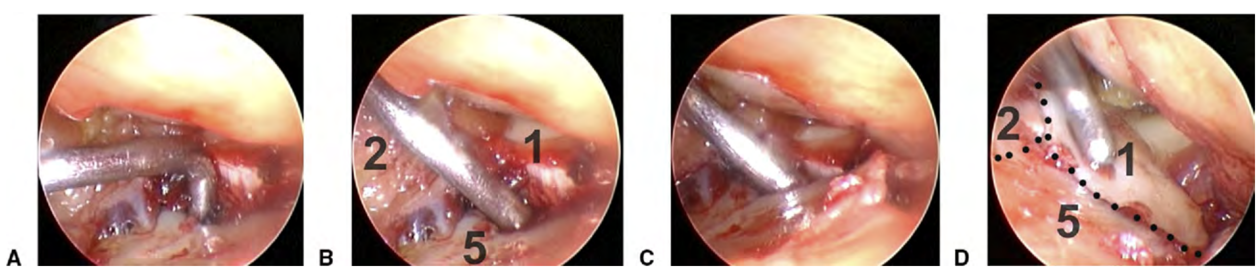

FIGURE 8: Reduction of a depressed fragment in the scaphoid fossa. From left to right: **A** The shoulder probe is gauging the stepoff (3 mm), **B** hooking the depressed fragment, **C** elevating it, and **D** leveling it to the rest of the joint. (Scope in 6R, viewing radially in a right wrist. 1, volar rim of the scaphoid fossa; 2, dorsal rim; 5, scaphoid fossa.) (Copyright © 2011 by Dr. Piñal.)

fragments will need to be addressed arthroscopically, and most commonly it will be so because they are depressed. Several authors recommend inserting an instrument into the metaphysis proximal to the fragment, through an accessory dorsal skin incision, and pushing distally to elevate the fragments. I find this maneuver rough and awkward, with the additional risk to the extensor tendons and to the joint itself when the instrument penetrates into it. My preferred technique is to hook the fragment with a shoulder or a knee probe inserted into the 3–4 portal and to pull distally (Fig. 7). The fragment is released from the plate by backing out the specific Kirschner wire that kept it secured, and then hooking and lifting the fragment with the shoulder probe, slightly overreducing it. At this point the surgeon maintains reduction by compressing volarward the reduced fragment with the thumb (or a bone tenaculum) while the other surgeon pushes in the Kirschner wire slowly to the dorsal cortex, taking care not to impale the extensor tendons (or the other surgeon's thumb). Once the joint is reduced, locking pegs or screws in critical places are inserted under arthroscopic control (Fig. 8).

Overdistracted fragments respond well to partial release of traction and pushing downward on the fragment with a flat instrument, such as a Freer periosteal elevator. The surgeon's thumb or a bone tenaculum can maintain the reduction while definitive fixation is carried out. Small dorsal rim fragments do not need to be fixed because they are stabilized by the pressure exerted by the extensor tendons and do not bear weight. Unstable dorsal fragments can be fixed by the locking pegs or screws of the plate itself, only when large enough to guarantee that the screws will not overshoot the dorsal rim and cause extensor tendon irritation. Others have suggested independent dorsopalmar inserted screws. However, I find this nearly impossible to accomplish

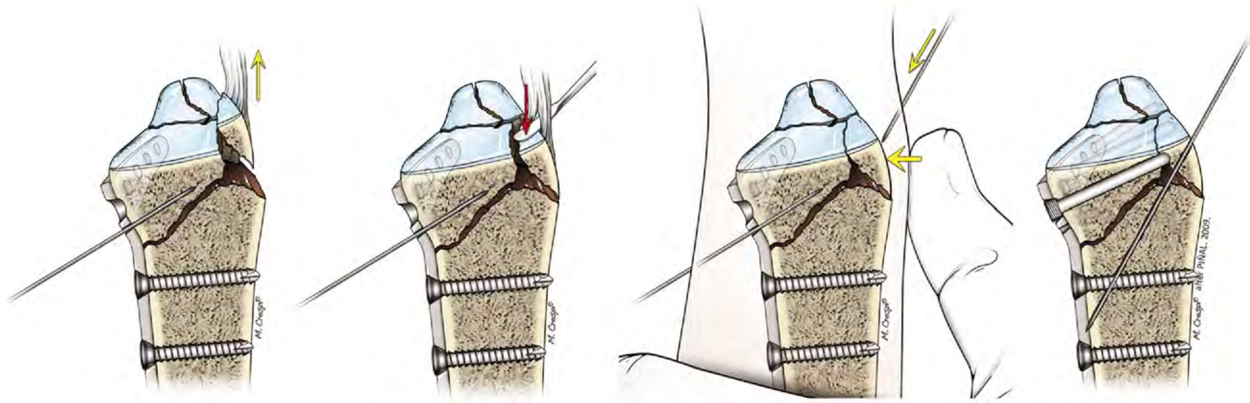

FIGURE 9: Technique of arthroscopic reduction of elevated dorsal rim fragments. Notice that a Freer is used to level the fragment, while the surgeon closes the gap with the thumb. (From del Piñal F, Mathoulin C, Luchetti C, eds. Arthroscopic management of distal radius fractures. Berlin: Springer Verlag, 2010. Copyright © 2009, with kind permission of Springer Science+Business Media.)

because the screw has to skip the track of the locking screws and not impinge on the plate itself. For this reason, I prefer a less elegant fixation with Kirschner wires introduced dorsal to palmar. These wires are left percutaneously and are removed in the office at 3 to 4 weeks. Usually, patients are allowed flexion of the wrist but no extension, to avoid skin irritation by the Kirschner wire (Fig. 9).

Large dorsal fragments that look distracted on fluoroscopy are rarely so. What in fact happens is that the anterior fragment (generally the volar-ulnar fragment) remains dorsally rotated. Clues to help recognize this deformity are the absence of collapse in the dorsal cortex and the loss of angulation of the so-called Medoff's "teardrop angle" (Fig. 10).[20] In those cases, the anterior fragment is derotated and elevated to the dorsal fragment rather than depressing the dorsal one in an attempt to level the joint. This is done in a way similar to that used for dorsal depressed fragments, but obviously the Kirschner wire should be removed completely from the plate before this anterior fragment can be mobilized (Figs. 11, 12).

Free osteochondral fragments are at times extremely unstable, and once reduced, sink into the metaphyseal void. To prevent this, we create a supporting hammock by inserting the distal layer of locking pegs in the plate. The fragments are kept slightly overreduced and then impacted using a Freer elevator, or by releasing the traction and using the corresponding carpal as a mold. A grasper can be useful to grab and twist a severely displaced fragment (Figs. 13, 14).

Only in the most comminuted cases will several fragments continue to be displaced after the fluoroscopic part of the operation. Backing out all the Kirschner wires and attempting to reduce and fix all fragments at the same time is an impossible endeavor in our hands. We recommend a step-by-step procedure beginning from ulnar to radial in most cases (Fig. 15).

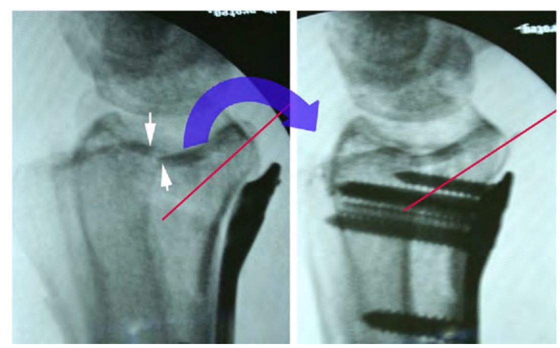

FIGURE 10: A Fluoroscopic view of a pseudoelevated dorsal fragment creating a stepoff at the lunate facet (arrows). Notice, however, that the dorsal cortex is restored without gaps and that the "tear angle" is slightly increased. Both of these point to a malrotated volar fragment. **B** After the antero-ulnar fragment was derotated, anatomic restoration of the lunate fossa was achieved (normal "tear angle"). (Copyright © 2011 by Dr. Piñal.)

With the scope sitting on top of the ulnar head, the keystone lunate fossa is first re-reduced (Fig. 15A). Before the scope is advanced radially, the lunate fossa is made stable by inserting 1 or 2 locking pegs or screws in the ulnar part of the plate (Fig. 15B). The radial part of the joint is now fine-tuned under arthroscopic guidance (Fig. 15C). Once reduced, locking screws are inserted to stabilize the scaphoid fossa, providing a stable articular surface (Fig. 15D). A similar technique should be used when the metaphysis is so comminuted that it will not offer support to the joint.

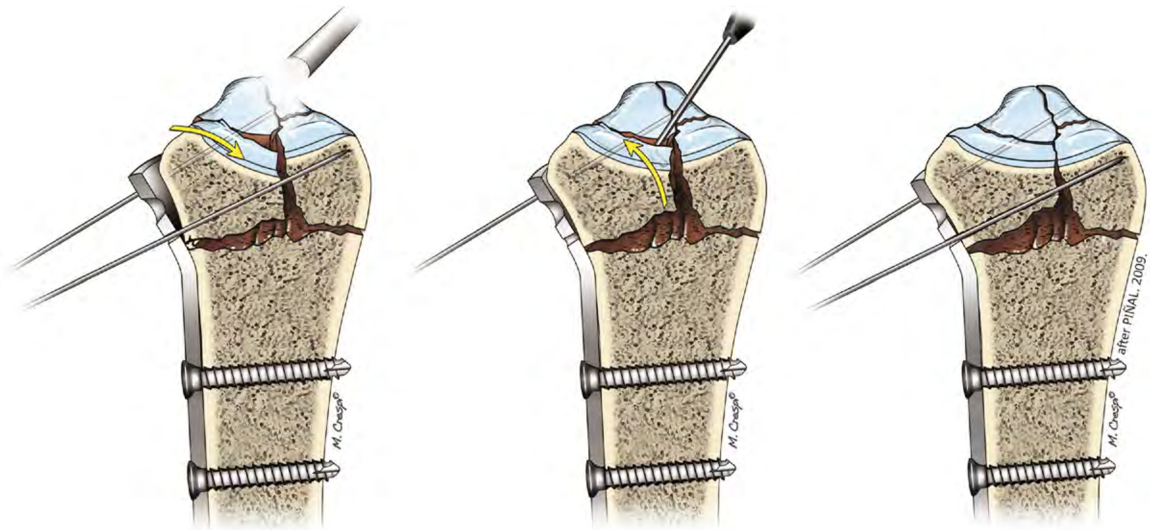

FIGURE 11: Author's technique for reduction of an anterior malrotated fragment. Notice that reduction of this fragment requires complete removal (not just partial backing out) of the corresponding Kirschner wire. (Copyright © 2011 by Dr. Piñal.)

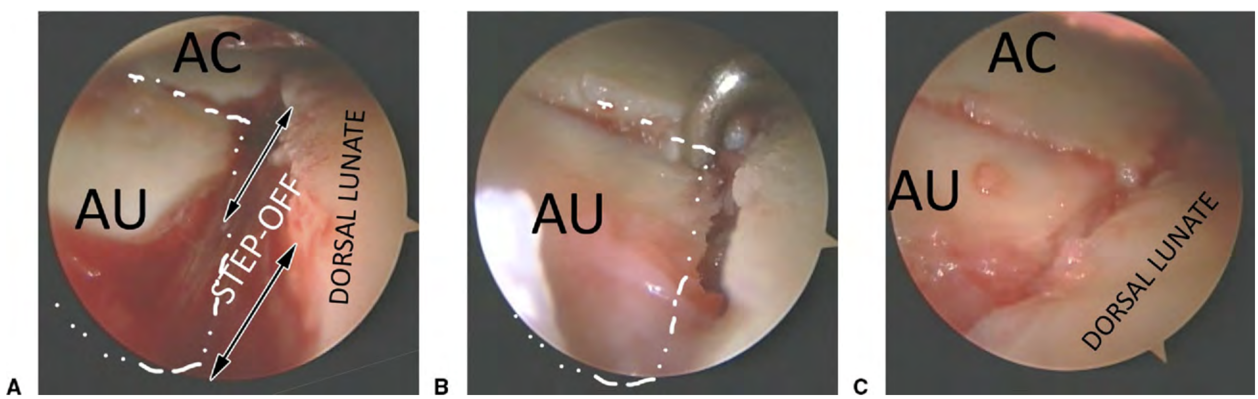

FIGURE 12: Correction of a pseudoelevated dorsal fragment. **A** Although the dorsal lunate fossa fragment is apparently elevated and responsible for a stepoff of about 3 mm, the displacement is actually due to malrotation of the antero-ulnar fragment of the lunate fossa (AU) and less so of the antero-central lunate fossa (AC). **B** With a shoulder probe inserted through the 3-4 portal, the anterior fragment is being derotated. **C** The 2 volar components of the lunate fossa (AU and AC) are now leveled to the dorsal fragment. (Copyright © 2011 by Dr. Piñal.)

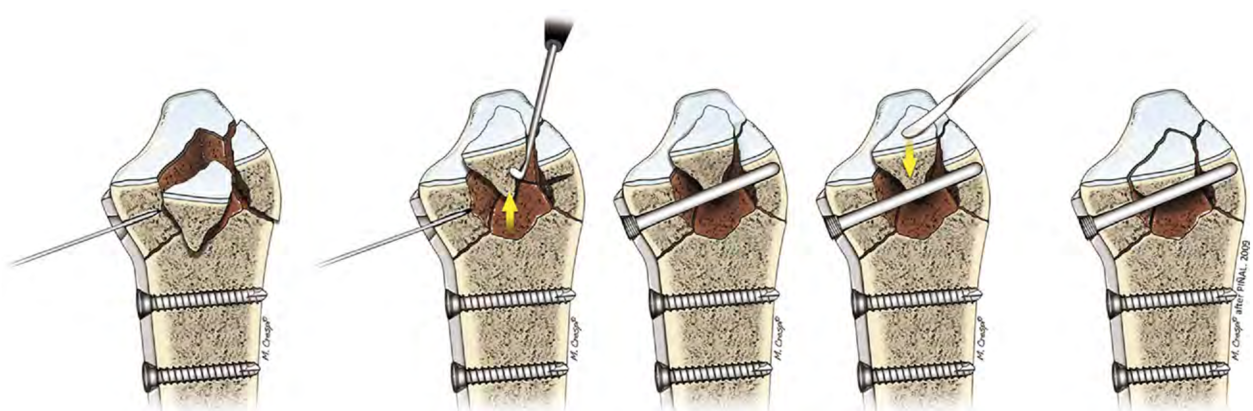

FIGURE 13: Management of free osteochondral fragments according to the author's technique. (Copyright © 2011 by Dr. Piñal.)

Surgical Technique

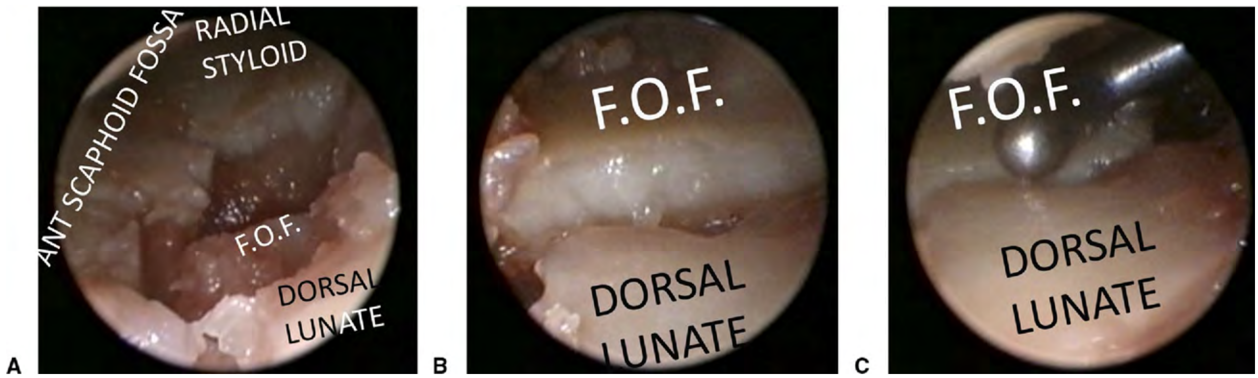

FIGURE 14: A A free osteochondral fragment (F.O.F.) has sunk into a metaphyseal void in the scaphoid fossa. After several attempts of reduction, with no support, the fragment did not resist stress of the probe and sank again every time. **B** After a supporting hammock of locking pegs was created, the free osteochondral fragment is now shown overreduced before being leveled by the probe **C**. (Copyright © 2011 by Dr. Piñal.)

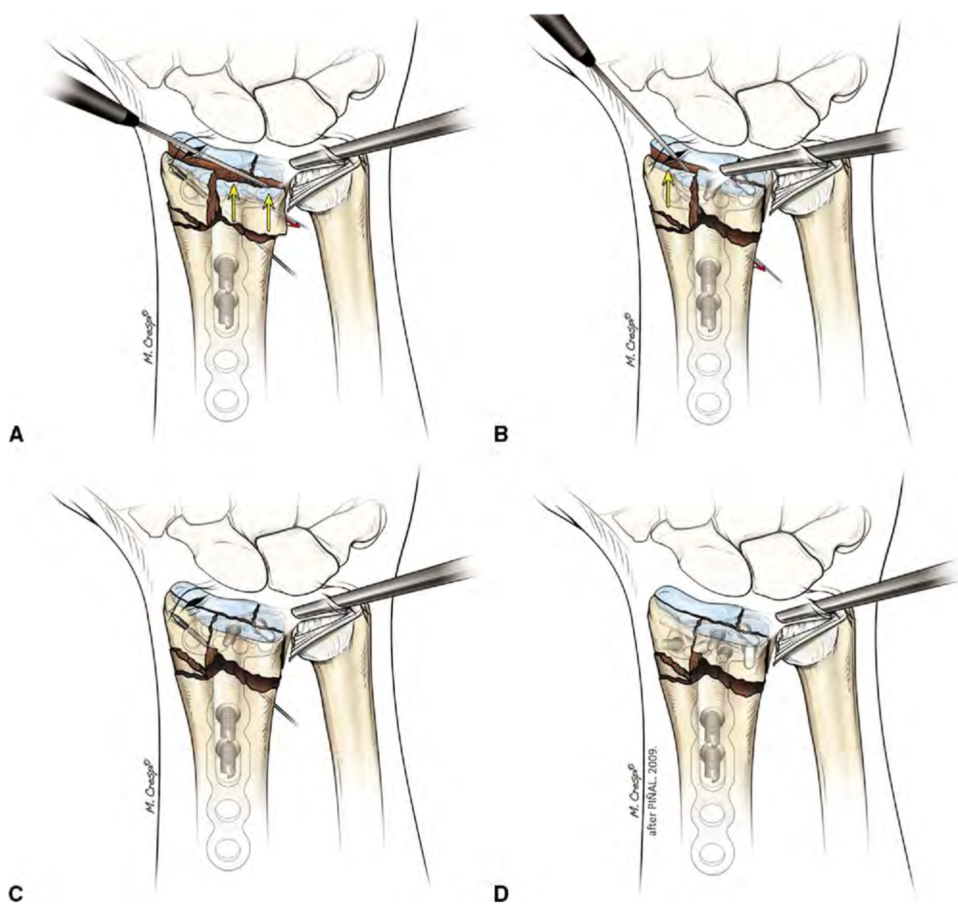

FIGURE 15: A–D Technique for reduction when many fragments remain unreduced. (From del Piñal F. Treatment of explosion-type distal radius fractures. In: del Piñal F, Mathoulin C, Luchetti C, eds. Arthroscopic management of distal radius fractures. Berlin: Springer Verlag, 2010:41–65. Copyright © 2009, with kind permission of Springer Science+Business Media.)

Management of triangular fibrocartilage injuries and concomitant ligamentous injuries[16,21] is beyond the scope of this report but has important prognostic implications if it is not addressed.[22,23] This part of the operation is always performed after the radius has been rigidly fixed. In this way, no risk of secondary displacement will exist. Furthermore, distal radioulnar joint instability can be assessed only after the radius has been reduced.[24]

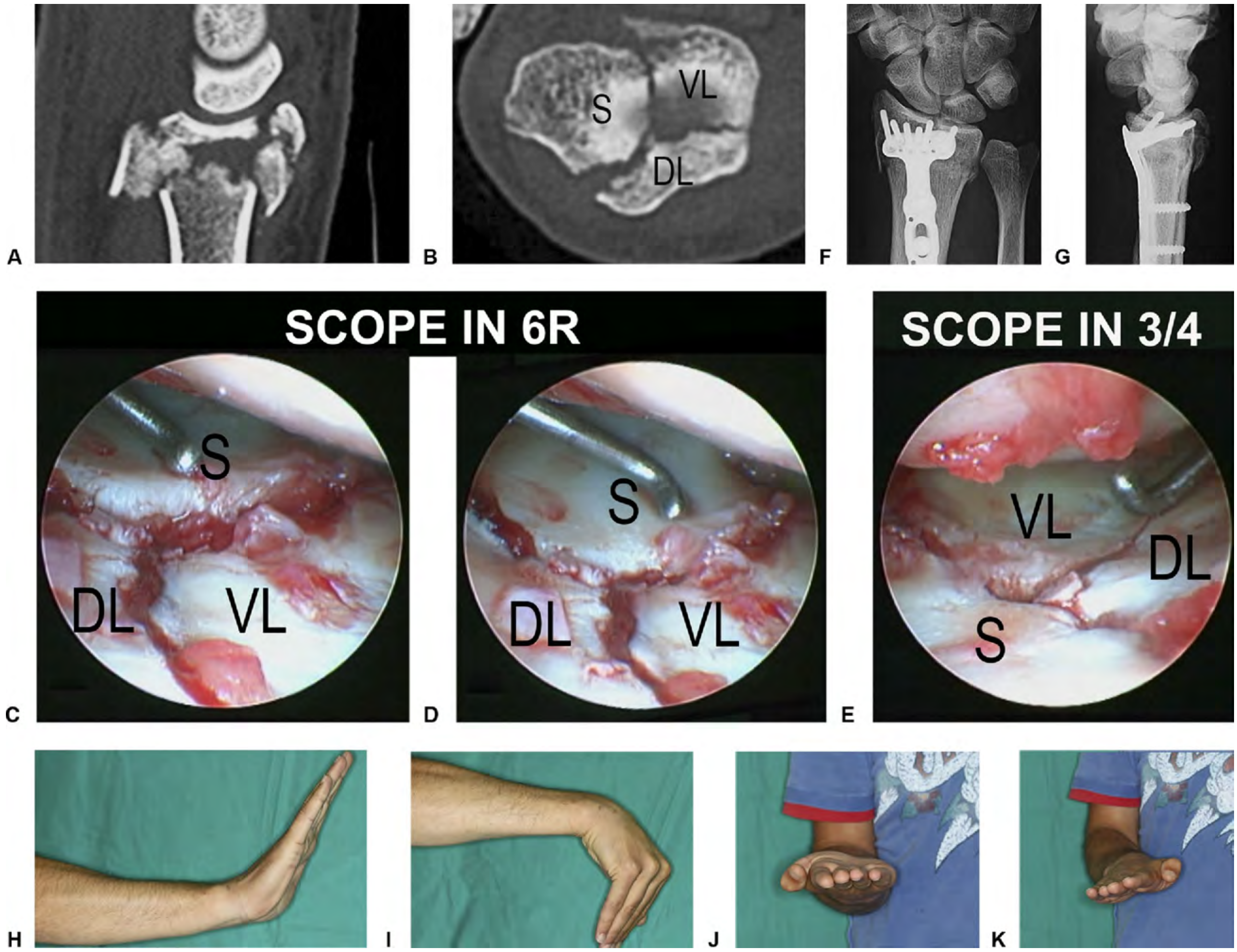

FIGURE 16: Achieving ulnar stabilization first (Fig. 15) is important in cases of metaphyseal comminution, to have a stable platform for the scope to sit on, and for carrying out the rest of the reduction. **A**, **B** Preoperative computed tomography scan. **C** To have a clear view of the unreduced scaphoid fossa (S), the scope (inserted in 6R) has been advanced into the joint and sits on top of the stable lunate fossa. (DL, dorsal lunate fragment; VL, volar lunate fragment.) **D** Leveling of scaphoid fossa to the rest of the radius will be followed first by Kirschner wires and later by inserting critical pegs under arthroscopic control. **E** Radius surface from the 3-4 portal after fixation. Assessment of the ulnar side of the joint can now proceed safely on top of the stable radius without risking loss of reduction. **F**, **G** Immediate postoperative radiograms. **H–K** Range of motion at 8 weeks postoperatively. (Copyright © 2011 by Dr. Piñal.) (See the Video, available on the *Journal's* Web site, at www.jhandsurg.org.)

At the end of the arthroscopy, thorough flushing of the joint is carried out. The pronator quadratus is sutured radially to its remnants or to the brachioradialis tendon with 2 or 3 resorbable stitches, if available. The volar skin is closed in a single layer with subcuticular 3-0 nylon. The portals do not need to be sutured because they will heal with a minimal scar. A protective splint is provided and is removed 1 or 2 days later. Self-directed active and assisted exercises are encouraged at that time. A removable plastic splint is fabricated, to be worn only when at risk of further trauma. After 4 or 5 weeks, any limitation of arc of motion is addressed by assisted exercises under the supervision of a physiotherapist. Exceptions are made in the cases of additional fixation required for dorsal rim fixation where 3 weeks of extension blocking is required. Concomitant soft tissue injuries also modify the aftercare.

CASE EXAMPLE

A 31-year-old, right-handed man sustained a comminuted metaphyseal articular fracture (C32 of the AO classification) while working. I applied a volar locking plate, taking care to restore metaphyseal length. Arthroscopic fine-tuning of the lunate fossa was followed by insertion of locking screws, to have an ulnar platform for the scaphoid fossa reduction and avoid intraoperative axial collapse (Fig. 16). I addressed the scaphoid fossa fragment and inserted a locking screw into the

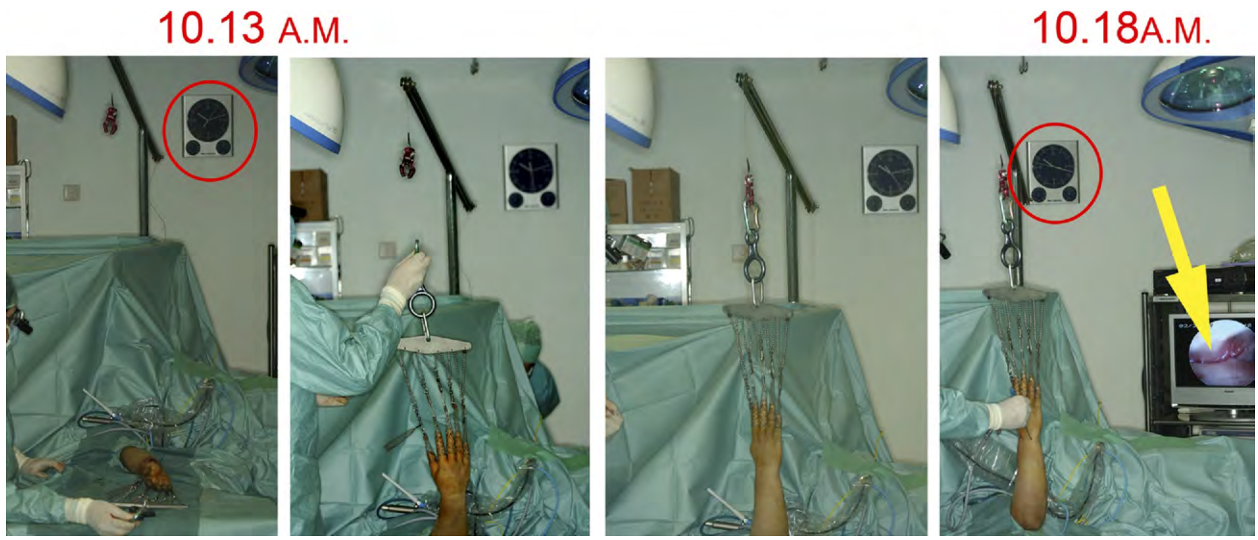

FIGURE 17: In this sequence of images showing the steps of suspending the hand from the pole, the clock of the operating room shows that the whole process, including picture taking and clearing of blood from the joint (large yellow arrow), has taken 5 minutes. (Copyright © 2011 by Dr. Piñal.)

scaphoid fossa until I considered the joint surface to be sufficiently stable (see the Video, available on the *Journal's* Web site, at www.jhandsurg.org). The rest of the radius fixation was done with the hand lying on the operative table. The hand was put in traction, the scope was inserted into the 3–4 portal, and the ulnar side of the joint was assessed. Because I found no distal radioulnar joint instability or damaged intracarpal ligament, I mobilized the wrist after 48 hours.

PEARLS AND PITFALLS

It is important to insert locking pegs or screws into critical spots under arthroscopic guidance because loss of reduction may occur while drilling. Smaller fragments can be held in position with the flat surface of a Freer elevator to avoid crumbling. Unfortunately, inserting the drill and locking screws with the hand in traction is cumbersome, because the flexor tendons are in tension, blocking access to the plate, and the position from which the surgeon has to operate is awkward. The task may be somewhat eased by releasing the traction slightly, which will allow easier retraction of the flexor tendons ulnarly. Nevertheless, as soon as the major articular fragments are stable to probe palpation, the hand is released from the traction and laid flat on the operating table, because in this position the rest of the pegs and screws can be inserted expeditiously.

I find no reason to contraindicate arthroscopy for swelling or risk of compartment syndrome if the dry technique is used. Even open joints will benefit from flushing the most inaccessible areas, with minimal additional damage.

The dry technique is contraindicated, however, when using heat-generating devices (vaporizers, laser, etc.) because the heat may not dissipate as readily as when water is used and may cause uncontrolled cartilage damage. This can be easily overcome by swapping to the wet technique during the specific time period this instrument is needed. In some arthroscopic settings (such as during a proximal row carpectomy), the use for a prolonged period of time of burrs or synoviotomes may cause contact burns at the entrance of the portal via the heat generated by the rotating engine. This is overcome by flushing the joint with saline and aspirating, but again this is never a problem in fracture management.

DISCUSSION

Scientific studies claim that lack of restoration of the anatomy and ongoing osteoarthritis may be associated with a good clinical result after distal radius fractures.[25] According to the current way of thinking, it may be difficult to rebut this well performed study; nevertheless, the essence of our role as surgeons dictates that we look to restore the anatomy and perfection. In this respect, the help of arthroscopy is invaluable because it allows us to see inside the joint with clear light and magnification. This seems clear to all of us. A different matter is whether the introduction of the scope (another tool) complicates the surgery. In fact, it does.

Logistics are fundamental in this complex operation. With slight modifications, the operation can be summarized as follows: (1) temporary fixation of the articular fragments with Kirschner wires to a volar locking plate under fluoroscopic control; (2) arthroscopic fine-tuning of the reduction; (3) rigid articular fragment fixation under arthroscopic guidance; and (4) triangular fibrocartilage complex and midcarpal exploration.

The operation requires substantial arthroscopic education in the most comminuted cases but is easily accomplished in simple cases. The paradox is that the cases that benefit most from arthroscopy are the most complex. I cannot underestimate the value of becoming proficient in the use of the arthroscope in simple cases, because this will ultimately benefit the surgeon who will treat more complex cases at a later date. On the other hand, the arthroscopic technique is no different from that currently being applied to other breakthrough fields of wrist surgery. Contrary to general belief, minimal time is involved in the procedure when all personnel are acquainted with the procedure (Fig. 17).

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