Early Experience With (Dry) Arthroscopic 4-Corner Arthrodesis: From a 4-Hour Operation to a Tourniquet Time

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Purpose Scaphoidectomy and 4-corner arthrodesis (4CA) is an effective procedure for treating several degenerative conditions of the wrist. Recently, the arthroscopic approach to this operation was described. Although it is conceptually appealing, certain aspects make its application difficult. We present our technique for dry arthroscopic scaphoidectomy and 4CA, which reduces the operative time to less than 2 hours.

Methods Four consecutive patients underwent scaphoidectomy and 4CA. In each case, we performed the operation with a dry arthroscopic technique using cannulated screws for rigid fixation. We performed bone grafting from the distal radius in 2 patients and from the scaphoid itself in the other two. The relevant operative details are the use of a scapholunate portal, the resection of the scaphoid with a pituitary rongeur, and the placement of bone graft in a dry arthroscopic environment. Range of motion exercises are started 2 to 3 weeks after the operation.

Results The first operation took 4 hours. The last 2 were completed in 1 hour 45 minutes and 1 hour 55 minutes, respectively. No complications occurred. No operations were converted to an open procedure.

Conclusions Although the operation has a steep learning curve, it is conceptually appealing. It is too early to prove that the arthroscopic procedure has better results than the open 4CA; nevertheless, in our opinion it represents the future of wrist surgery. *(J Hand Surg 2012;37A:2389–2399. Copyright © 2012 by the American Society for Surgery of the Hand. All rights reserved.)*

Key words Wrist arthroscopy, wrist osteoarthritis, scaphoid nonunion, SNAC, SLAC.

In 1984, WATSON and Ballet[1] described the so-called "4-corner arthrodesis" (4CA). Its prime indication is to treat wrists with degeneration of the head of the capitate (scapholunate advanced collapse [SLAC]/scaphoid nonunion advanced collapse [SNAC] stage III). This is a contraindication for proximal row carpectomy (PRC).[2] A recent study[3] showed stable results of the scaphoidectomy and 4CA between 1 and 10 years postoperatively, which demonstrate its long-term reliability. Although this technique is widely used, considerable discussion exists in the literature as to the best method of fixation (circular plate vs Kirschner wires vs headless screws).[4–10]

In a pioneering paper, Ho[11] described a method of arthroscopic partial wrist arthrodesis, including arthroscopic 4-corner arthrodesis (A-4CA). Although the idea of minimizing the surgical insult to the wrist is appealing, the technical difficulties of the operation, including more than 3 hours' operative time, make implementation challenging. Some of the procedural struggles come from the infusion of saline. Specifically, it is difficult to place bone graft in the continuously irrigated joint accurately without resorting to compli-

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Received for publication February 1, 2012; accepted in revised form August 21, 2012.

No benefits in any form have been received or will be received related directly or indirectly to the subject of this article.

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0363-5023/12/37A11-0032$36.00/0
http://dx.doi.org/10.1016/j.jhsa.2012.08.026

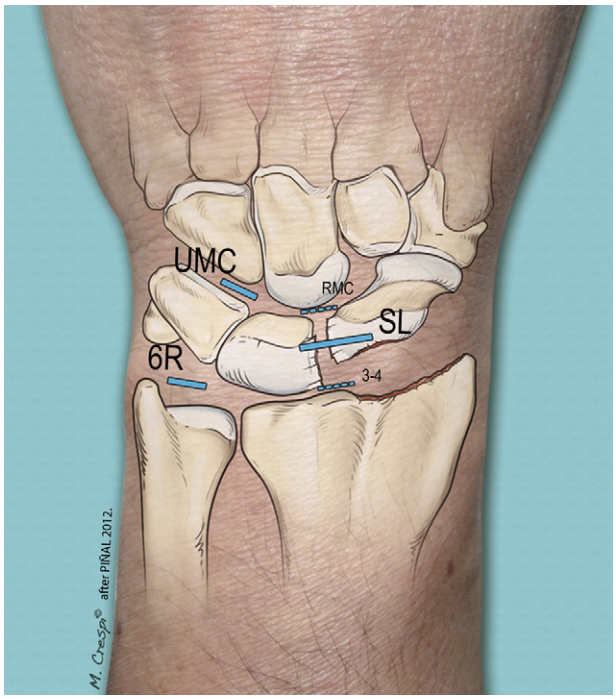

FIGURE 1: The SL portal is located midway between the 3–4 and radial midcarpal portals. RMC, radial midcarpal.

FIGURE 2: Straight articulated rongeur and angulated rongeur used during the procedure.

cated maneuvers (use of a Foley balloon, etc).[11] Furthermore, as the length of the procedure increases, the infusion fluid continues to extravasate and the swelling becomes more pronounced. This masks bony landmarks, making accurate insertion of guidewires for bony fixation difficult. Finally, the scaphoid has to be removed by a burr, which is time consuming and precludes saving this bone as a source of bone graft. In all, these difficulties have made the procedure unappealing.

We have endorsed the dry arthroscopy technique (arthroscopy without infusing saline) as ideal to carry out wrist arthroscopy in general.[12] It is particularly useful in complex operations such as distal radius fixations and in any semi-open operation.[13–15] With this technique, most difficulties mentioned for the wet A-4CA as described by Ho[11] are circumvented. Specifically, bone graft can be accurately placed, and the swelling does not mask the bony landmarks. Although those were major advances, initially the procedure still took long in our hands (nearly 4 hours in our first complete attempt). Through our experience carrying out arthroscopic PRC and other "ectomy" procedures, we have been increasingly employing rongeurs to remove the carpals and minimizing the use of burrs. With all of these modifications, we have been able to refine the operation and diminish the operative time to one that is competitive with the open procedure. The purpose of this article was to describe the technique of A-4CA using the dry arthroscopic technique, underscoring the steps taken and improvements made to reduce the operative time to less than 2 hours (ie, 1 tourniquet time).

SURGICAL TECHNIQUE

The procedure is performed with the dry arthroscopy technique as described previously.[12,15] A custom-made device is used for traction. This makes it easier to place the hand on traction for arthroscopy and release the traction for use of fluoroscopy without losing sterility.[16] In the dry arthroscopic technique, the optic cavity within the wrist is maintained by distraction of the hand; fluid is used only to clear the joint of debris by flushing the joint intermittently with saline. Details of the technique itself can be found elsewhere. Only the specific steps that apply to the A-4CA technique will be highlighted below.

Scapholunate portal

In SNAC and SLAC wrists, the radial-sided carpal anatomy is distorted. Therefore, the ulnar portals are established first, specifically the 6R and ulnar midcarpal (UMC) portal. The radiocarpal joint is assessed as to the feasibility of the operation by specifically investigating the quality of the cartilage of the lunate fossa and lunate. The alternative A-PRC is considered if the capitate's cartilage is preserved while viewing it from the UMC portal. Then, a third 1.5-cm transverse scapholunate (SL) portal is created at a location between the 3–4 and radial midcarpal portal sites. This SL portal overlies the scaphoid pathology (SL gap or scaphoid nonunion)