

Arthroscopic Radioscapholunate Fusion: Surgical Technique



Jean-Baptiste de Villeneuve Bargemon, M.D., Nael Ben Hadid, M.D.,
Hideo Hasegawa, M.D., and Michel Levadoux, M.D., Ph.D.

Abstract: The development of radioscapholunar osteoarthritis after a distal radius joint fracture is a challenge, especially when it is addressed to young patients who want to maintain some wrist mobility. Classically, radioscapholunar arthrodesis is performed by an open longitudinal approach of more than 10 cm on the dorsal surface, largely exposing the midcarpal level. Wrist arthroscopy has already shown its effectiveness in preserving joint mobility compared to open procedures. Performing this arthroscopic procedure minimizes the “aggression” of the joint and hypothetically provides better mobility. This article details the surgical technique for performing radioscapholunar arthrodesis arthroscopically.

Introduction

Radioscapholunar osteoarthritis remains a common problem in hand surgery. Its occurrence in a posttraumatic context corresponds to the most frequent etiology, although other systemic diseases, inflammatory or not, can cause its appearance.¹ The radiocarpal joint seems to play an important role in the mobility of the wrist, having an implication in midcarpal joint mobility, especially in the movements of flexion and extension.^{2,3} These observations help to understand the painful and functional impact of the occurrence of radioscapholunar osteoarthritis. One of the most common treatments is radioscapholunar fusion, which has good functional results.^{4,5} However, this intervention considerably reduces range of motion by direct and indirect effects.

This consequence has a significant impact on mobility, especially since the age of patients with posttraumatic radioscapholunar osteoarthritis is often young. Classically, radioscapholunar arthrodesis is

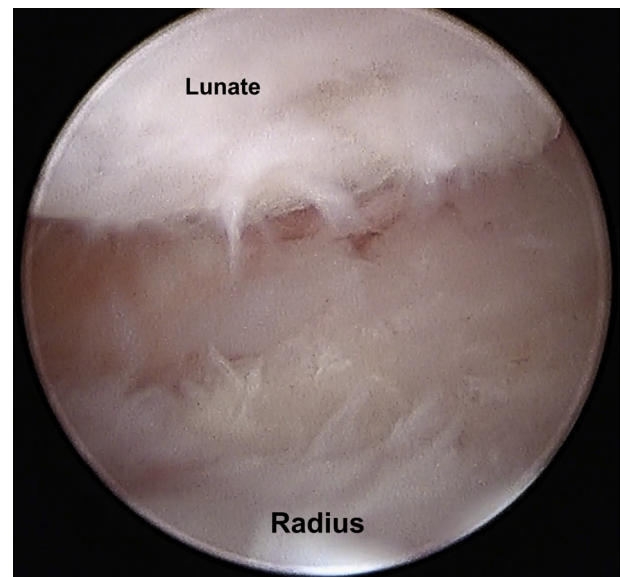


Fig 1. Radiocarpal arthroscopic view with the 3-4 portal. Arthroscopic radioscapholunate fusion was performed on a right wrist. Patient is placed in a supine position. The patient’s arm is secured to the arm board, and fingers traps are used to apply 5–7 kg (11–15.5 lbs) of traction along the arm’s axis vertically. We observe the articular surfaces of the radius and lunate, which shows that chondromalacia has already evolved. A large and complete radiocarpal synovectomy helps to assess osteocartilaginous status.

Hand, Wrist and Elbow Surgery, Saint Roch Private Hospital, Toulon, France (J.-B.deV.B., M.L.); Hand Surgery and Limb Reconstructive Surgery Department, Timone Adultes Hospital, Aix Marseille University, Marseille, France (N.B.H.); and Department of Orthopedic Surgery, Nara Medical University, Nara, Japan (H.H.).

Received January 10, 2022; accepted February 8, 2022.

Address correspondence to Jean-Baptiste de Villeneuve Bargemon, 191 Boulevard Baille 13005, Marseille, France. E-mail: jbdevilleneuvebargemon@gmail.com.

© 2022 THE AUTHORS. Published by Elsevier Inc. on behalf of the Arthroscopy Association of North America. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

2212-6287/2271

<https://doi.org/10.1016/j.eats.2022.02.015>

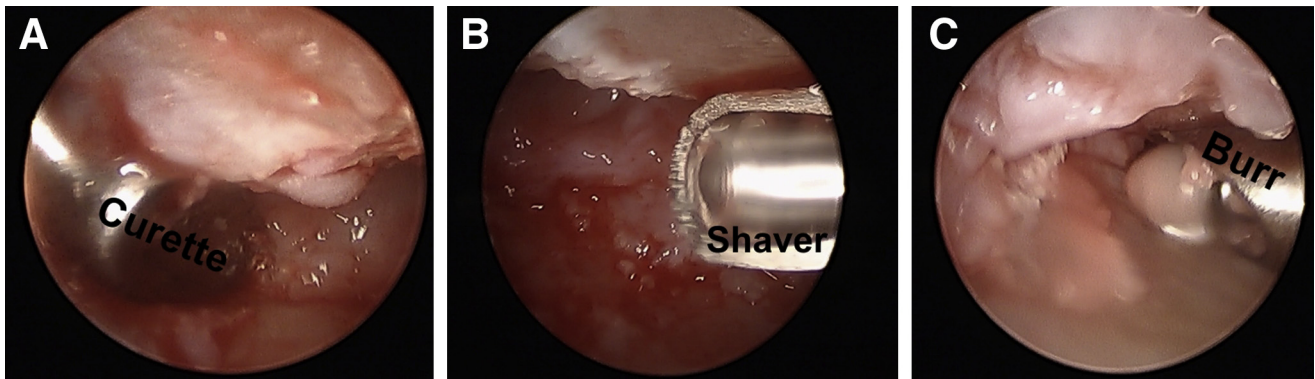


Fig 2. The radioscapholunate cartilage surfaces are removed and the subchondral bone is edged. Radiocarpal arthroscopic view with 3-4 portal and 6R instrumentation. Initially, the aviva is carried out with a curette (A) to resect as much cartilage as possible. Bone loose bodies will be removed using the shaver and suction under irrigation (B). To perfect the embedding, burring will be carried out using a 3.5-mm burr (C).

performed by an open longitudinal approach of more than 10 cm on the dorsal surface, largely exposing the midcarpal level. The stiffness induced by the fusion of the radiocarpal level is added to that caused by any open dorsal port on the wrist.

Wrist arthroscopy has already shown its effectiveness in preserving joint mobility compared to open procedures.^{6,7} We think that radioscapholunar arthrodesis performed by arthroscopy could reduce this inconvenience and not expose the patient to this stiffening “double penalty.”

The avoidance of a capsulotomy by the use of wrist arthroscopy, therefore, offers a strategy of choice in a stiffening surgery, such as radioscapholunar arthrodesis. This article details the surgical technique for performing radioscapholunar arthrodesis arthroscopically (Video 1).

Surgical Technique

Installation

The procedure is performed on an outpatient basis under regional anesthesia using a tourniquet. The

patient’s arm is secured to the arm board, and finger traps are used to apply 5–7 kg (11–15.5 lbs) of traction along the arm’s axis vertically. It is necessary to have an X-ray machine available in the room that is compatible with the use of arthroscopy.

Arthroscopic Exploration

The scope (30°, 2.4 diameter; Stryker, Bloomington, MN) is introduced in the 3-4 portal and the shaver (2.5 mm; Stryker) in the 6R portal. The first phase of the arthroscopic procedure consists of complete radiocarpal synovectomy with a shaver, reversing the shaver and scope positions.

Once the synovial flanges are excised with a shaver, the radiocarpal osteocartilaginous status is assessed, confirming the diagnosis and the indication for arthrodesis (Fig 1). A careful examination of the radiocarpal articular surfaces should be performed, noting osteochondral lesions. Sometimes, the radiocarpal stage appears to be very mobile due to associated lesions of the scapholunar capsuloligamentous complex. These will not be repaired. An exploration of the midcarpal level by radial and ulnar midcarpal portals should be

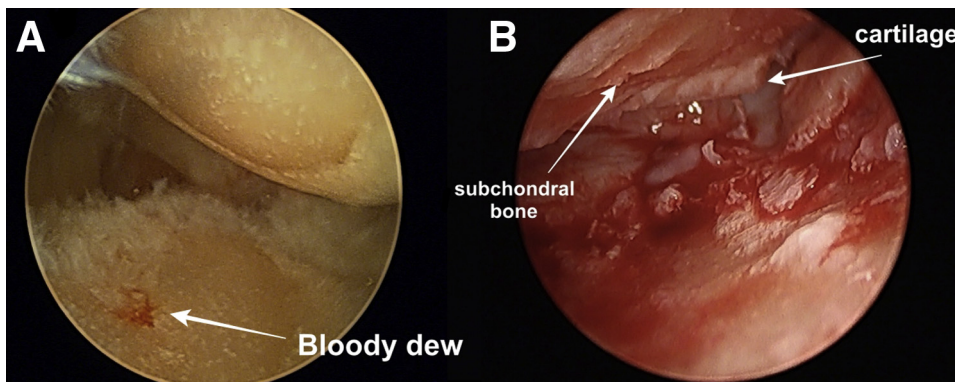


Fig 3. (A) Radiocarpal arthroscopic view with the 3-4 portal after performing an effective cartilage debridement. Burring is effective when a “bloody dew” appears under irrigation. (B) This bleeding can be observed even if the tourniquet is inflated. A dry-arthroscopic inspection can confirm the good quality of the cartilage resection.

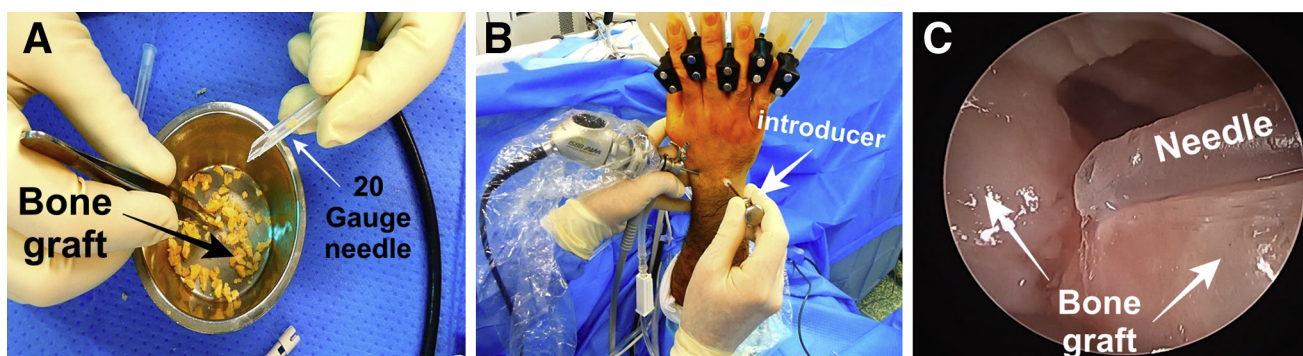


Fig 4. (A) Insertion of the bone graft into several 20 Gauge needle plugs (intramuscular). (B) The ends of the plugs are cut in a bevel shape for better insertion into arthroscopic passages. (C) Once introduced through the first radiocarpal tract, the bone graft is then pushed into the joint using the introducer. Arthroscopic control is performed to ensure the correct positioning of the bone graft during its introduction.

performed systematically to rule out osteoarthritis at this level, which would contraindicate isolated radioscapolunate fusion.

Active Joint Surfaces

We then perform an initial vigorous bone debridement with a curette at the level of the articular surfaces until the remains of cartilage are removed to expose the subchondral bone (Fig 2). This pruning can be carried out with or without irrigation. We recommend repeated use of washout using the shaver's cannula after removing the rotary burr (Stryker) to aid in debris removal. Once the joint is devoid of cartilage, burring using a 3.5-mm burr (Stryker) is performed on the entire surface of the joint, both on the radial and carpal sides, in order to obtain a "bloody dew" (Fig 3) by

superficial resection of the thin "shell" of subchondral bone to avoid a decrease in the carpal height as much as possible. To reduce, as much as possible, the discomfort caused by the suspension of osteocartilaginous debris in a humid environment due to a "snowstorm effect," we recommend that you perform this step in "dry-arthroscopy" interspersed with several washouts to avoid thermal burns to the bone. Once the joint has been cleaned and the joint has been emptied after prolonged irrigation, the tourniquet is deflated after placing a compression bandage.

Harvest and Preparation of the Bone Graft

A sufficient quantity of bone graft seems to us essential to achieve a quality arthrodesis and promote fusion of the three bones. The provision of a graft plays

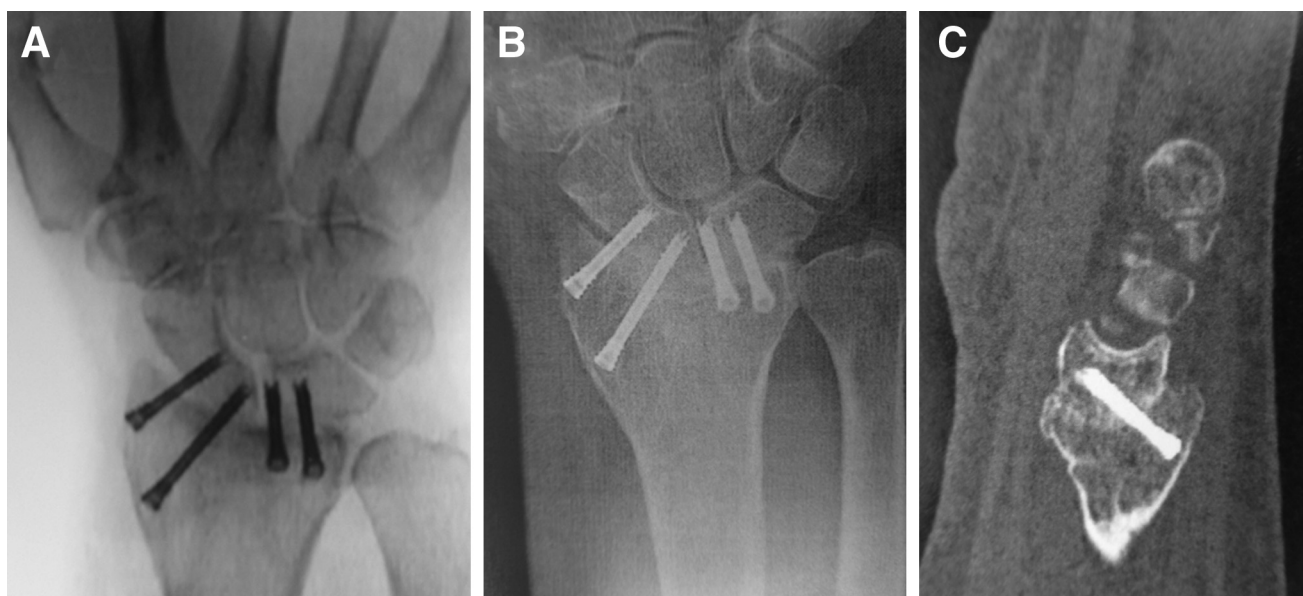


Fig 5. (A) Intraoperative radiological control of radioscapolunate arthrodesis. Use self-tapping, double-pitch cannulated screws 3 mm in diameter, Herbert type. Care must be taken not to cross the pins in the bone to avoid any conflict between the screws. To obtain maximum compression, do not forget to slightly move back all the pins when screwing. Only the guide pin for the first screw is left in place. (B) Control radiograph 3 months postoperatively. (C) 3-month control CT scan in sagittal view.

Table 1. Surgical Pearls and Pitfalls

Pearls	Pitfalls
<ul style="list-style-type: none"> - A trick to facilitate the introduction of the bone graft is to remove the cap of an intramuscular needle (20 gauge) and cut the end in the form of a bevel. The bone graft is then filled into the cap. The preparation of several caps makes it possible to speed up the introduction of the bone graft compared to the usual techniques using a cannula. The caps are then introduced through the mid-carpal portals, and the bone graft is pushed into the site of nonunion. - One should not hesitate to use 3.5-mm burs, rarely used in wrist arthroscopy. - Wash the joint with several washouts for better visualization of the joint 	<ul style="list-style-type: none"> - Too superficial debridement and the absence of a large amount of graft can lead to a failure of consolidation - Performing burring with irrigation, which causes a “snowstorm” effect and thus prolongs an already long surgery.

a significant role in this bone fusion. To avoid weakening the mechanical strength of the distal metaphysis of the radius necessary for the rigidity of the final assembly, the graft is taken from the iliac crest, according to conventional rules. The bone graft is fragmented to be then introduced into the radiocarpal level under arthroscopic control using 20-gauge needle trocar caps (Fig 4) that are beveled then filled manually and introduced by the 3-4 and 6R portals alternately. The bone graft is then positioned and compacted using the palpator.

Bone Fixation

Internal fixation must be rigid to ensure complete fusion and always takes place without traction (Fig 5). We use self-tapping, double-pitch cannulated screws 3 mm in diameter, Herbert type (New Clip Nantes France Laboratory). The introduction is percutaneous on 1-mm guide pins placed under fluoroscopic control from the dorsal radius to the scaphoid and from the dorsal radius to the lunate. A minimum number of three pins is required: two in the scaphoid and one in the lunate. However, one more can be placed in the lunate. Care must be taken not to cross the pins in the bone to avoid any conflict between the screws. To obtain the optimal “compression” after making sure that the pins are correctly positioned face and side to the radius, we choose the first screw to introduce after having determined its length with the “dedicated” device. Only the guide pin of this screw will be held in place. The other pins will be moved back and removed from the scaphoid and lunate but left in the radius to ensure maximum compression of the assembly after tightening the first screw. This is positioned until the maximum compression is obtained, affirmed by a reduction in the height of the interline at the radiograph, a complete passage of the distal thread of the screw in the first row, and the complete burial of the proximal part in the radius to avoid any conflict with the extensor tendons. Then, the other pins can all be pushed back to their original position in the scaphoid and lunate to act as guides for the other screws.

Postoperative Care

The wrist is immobilized immediately postoperatively. The postoperative care includes strict immobilization with a forearm splint for 90 days. Rehabilitation is initiated at approximately 2 weeks for lymphatic drainage, scar care, and analgesic physiotherapy, then active mobilization and opening of joint amplitudes are carried out at 3 months.

Discussion

The development of radioscapholunar osteoarthritis after a distal radius joint fracture is a challenge, especially when it is addressed to young patients who want to maintain some wrist mobility. Several methods have been proposed, such as wrist denervation⁸ or arthroscopic tendon interposition.⁹ However, these techniques remain variable and random in their results, while arthrodesis still represents the “golden standard” in the management of this type of pathology. In addition, denervation and interposition do not stop the progression of osteoarthritis, which always comes back later. Targeted at the radioscapholunar level, arthrodesis hypothetically allows to maintain “half” of the mobility of the wrist in flexion and extension. However, the classic technique uses a wide dorsal approach, the comorbidity of which is often synonymous with overall stiffness of the wrist. Performing this arthroscopic procedure minimizes the “aggression” of the joint and hypothetically provides better mobility. In addition, arthrodesis can be done after the achievement of tendon interposition or denervation. Some suggest other associated procedures with partial arthrodesis, such as resection of the triquetrum or the distal scaphoid. These methods are being evaluated in recent literature. Degeorge et al. believe that resection of the triquetrum would lead to a reduction in the possible risk of postoperative ulnocarpal syndrome due to a reduction in the radiocarpal level during arthrodesis (hence the interest of a resection “at least”).^{5,10} Other teams believe that resection of the distal pole of the scaphoid during radioscapholunar arthrodesis can prevent possible scaphotrapezotrapezoid osteoarthritis by

removing the impingement and improving the rate of bone union.^{2,3,5} The interest of arthroscopy remains an undeniable advantage in the conservation of articular amplitudes, in particular, during arthrodesis of the wrist. This article aims to show that it is possible to perform radioscapholunar arthrodesis arthroscopically and obtain a good fusion within the correct timeframe. We present to you our technique and our tips (Table 1) for performing this arthroscopic intervention, even if a good experience in wrist arthroscopy is necessary for its realization.

The authors declare no conflicts of interest.

References

1. Murray PM. Radioscapholunate arthrodesis. *Hand Clin* 2005;21:561-566. <https://doi.org/10.1016/j.hcl.2005.08.003>.
2. Saiz A, Delman CM, Haffner M, et al. The biomechanical effects of simulated radioscapholunate fusion with distal scaphoidectomy, 4-corner fusion with complete scaphoidectomy, and proximal row carpectomy compared to the native wrist. *J Hand Surg* 2021;46:1125.e1-1125.e8. <https://doi.org/10.1016/j.jhsa.2021.02.028>.
3. Suzuki D, Omokawa S, Iida A, et al. Biomechanical effects of radioscapholunate fusion with distal scaphoidectomy and triquetrum excision on dart-throwing and wrist circumduction motions. *J Hand Surg* 2021;46:71.e1-71.e7. <https://doi.org/10.1016/j.jhsa.2020.08.009>.
4. Degeorge B, Montoya-Faivre D, Dap F, Dautel G, Coulet B, Chammas M. Radioscapholunate fusion for radiocarpal osteoarthritis: Prognostic factors of clinical and radiographic outcomes. *J Wrist Surg* 2019;08:456-462. <https://doi.org/10.1055/s-0039-1688939>.
5. Degeorge B, Dagneaux L, Montoya-Faivre D, et al. Radioscapholunate fusion for posttraumatic osteoarthritis with consecutive excision of the distal scaphoid and the triquetrum: A comparative study. *Hand Surg Rehabil* 2020;39:375-382. <https://doi.org/10.1016/j.hansur.2020.05.002>.
6. Shim JW, Kim JW, Park MJ. Comparative study between open and arthroscopic techniques for scaphoid excision and four-corner arthrodesis. *J Hand Surg Eur Vol* 2020;45:952-958. <https://doi.org/10.1177/1753193420908820>.
7. Baur EM. Arthroscopic-assisted partial wrist arthrodesis. *Hand Clinics* 2017;33:735-753. <https://doi.org/10.1016/j.hcl.2017.07.013>.
8. Wu CH, Strauch RJ. Wrist denervation. *Orthop Clinics North Am* 2019;50:345-356. <https://doi.org/10.1016/j.ocl.2019.03.002>.
9. Arianni M, Mathoulin C. Arthroscopic interposition tendon arthroplasty for stage 2 scapholunate advanced collapse. *Arthroscopy* 2019;35:392-402. <https://doi.org/10.1016/j.arthro.2018.10.134>.
10. Liechti R, Beeres FJP, Hug U. Triquetrum excision in radioscapholunate arthrodesis for posttraumatic radiocarpal osteoarthritis with ulnar impaction syndrome. *Tech Hand Upper Extremity Surg* 2019;23:182-185. <https://doi.org/10.1097/BTH.0000000000000251>.