Technical Note

Arthroscopic Excision of Infraspinatus Calcific Tendinitis With Double-Row Margin Convergence Repair

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Abstract: Calcific rotator cuff tendinitis is a common cause of shoulder pain. It is thought to be an active cell-mediated process although the exact pathophysiology remains unclear. It commonly affects the supraspinatus tendon. The condition is generally self-limiting and can be managed with appropriate nonoperative treatment; however, some cases may need surgical excision. Complete removal of the calcific deposits may result in large significant defects. Infraspinatus calcific deposits were seldomly described. This report illustrates a double-row suture bridge technique with margin convergence of a large cuff defect after excision of calcific deposits within the infraspinatus tendon.

Calcific tendinitis of the rotator cuff is a common painful disorder of the shoulder characterized by the presence of calcifications in either the mid-substance or insertion of the rotator cuff tendons and in the subacromial bursa.[1] The prevalence of calcific tendonitis in adults has been reported to be between 2.7% and 10.3%. Approximately one half of these patients eventually become symptomatic. The condition is more common in women, who are 2-fold more affected than men. It commonly presents in patients aged 30 to 60 years and is bilateral in about 10% to 25% of the patients.[2]

Regarding the localization of calcifications, most reports concur that the supraspinatus tendon is most commonly involved, with an incidence in 51.5% to 90% of the cases and with negligible rates for the other tendons.[3] Only one study reported a much greater involvement of the infraspinatus (about 50%) and subscapularis (33%) compared with previous studies.[4] Most of the calcifications are insertional, situated in the so-called "critical zone," resulting from its poor vascularization.[2,4]

Controversy exists concerning the etiology and pathogenesis of this disabling ailment.[5] The main clinical feature of calcific tendinitis is shoulder pain; it may be associated with restriction of joint mobility. Calcific tendonitis can be diagnosed by routine shoulder radiographs, ultrasonography, and/or magnetic resonance imaging.[2,5]

Several treatments are currently in use, although the best choice remains controversial. There is, however, a fairly large consensus in starting with a conservative approach based on rest, nonsteroidal anti-inflammatory drugs, physical therapy, local corticosteroids subacromial injections, and/or extracorporeal shock wave therapy. Surgery is recommended only when conservative treatment is unsuccessful for 6 months.[6]

Most reports in the literature have described the arthroscopic management of the calcific tendinitis of the supraspinatus tendon and dealt with the cuff defect after arthroscopic excision. This report describes in detail the arthroscopic excision of a large calcific infraspinatus tendinitis and double-row margin convergence repair of the residual defect (Video 1).

Surgical Technique (With Video Illustration)

The indication, advantages, and disadvantages of the technique are presented in Table 1. The pearls, pitfalls, and limitations are shown in Table 2. The procedure steps are presented in Video 1.

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Table 1. Indication, Advantages, and Disadvantages of the Technique

Indication	Cases with sizable calcific deposits inside infraspinatus tendon
Advantages	Well-secured double-row margin convergence repair allows maximum cuff compression and earlier safe rehabilitation
	Standard arthroscopic setup and portals
	No special instrumentation
	Standard arthroscopic suture shuttling and tying techniques
	Technique allows for complete excision of calcific deposits
	Needle localization helps to accurately identify deposits.
Disadvantages	Wide bursectomy is necessary
	Complete excision of the deposits may be challenging
	Large residual defect may be unavoidable

Preoperative Assessment

The patient's preoperative range of motion is assessed both actively and passively. Routine shoulder radiographs and magnetic resonance imaging are performed to evaluate size and site of the calcific deposits (Figs 1-4).

Patient Positioning and Preparation

The procedure is performed with the patient under general anesthesia with an ultrasound-guided regional interscalene nerve block. The patient is then positioned in a modified beach chair position (semi-sitting). Care should be taken to maintain the head and neck of the patient in the neutral position (Fig 5). Examination under anesthesia of the operated shoulder is performed to confirm the free passive range of motion and the stability of the shoulder.

The patient's skin is disinfected with povidone—iodine, and sterile drapes are applied. An arthroscopic pump is used starting with the pressure around 40 mm Hg with hypotensive general anesthesia.

Table 2. Pearls, Pitfalls, and Limitations of the Technique

Pearls	Use a wide-bore spinal needle to identify site of calcification from the intra-articular compartment before switching to subacromial space.
	Use a metal probe or trocar to milk the calcific deposits to avoid unnecessary removal of healthy cuff tissue.
	Care should be taken to remove all calcium deposits, especially in the hidden sites at the gutters of the infraspinatus.
	Posterior capsule should be included in the repair because the remaining fleshy fibers of the infraspinatus may not hold the repair.
	The lateral row knotless anchor insertion ensures maximum cuff compression and secures repair for immediate rehabilitation.
	Repair any significant defects in the rotator cuff tendon.
Pitfalls	Overzealous debridement of the rotator cuff tendon adjacent to the calcific deposit can result in an unnecessarily large defect that may be challenging to the repair.
	Infraspinatus fleshy fibers remaining after excision of the calcium deposits may not hold the repair.
	Avoid excessive tension during margin convergence of the cuff.
	Inaccurate identification of the site of the calcification may result in iatrogenic cuff tears.
	Avoid making deep cuts into the rotator cuff while exploring for deposits. A small residual deposit may not impair the clinical outcome.

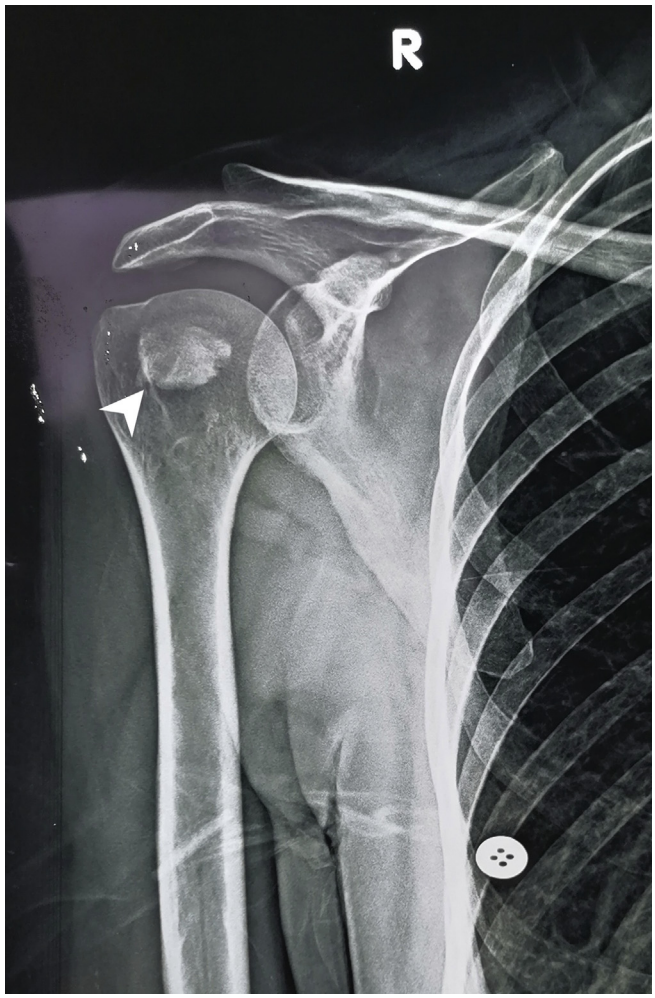

Fig 1. Plain radiograph of the right shoulder, anteroposterior view, showing a large calcific deposit in the infraspinatus tendon (white arrow).

Portal Placement and Diagnostic Arthroscopy

A posterior portal is established 2 cm distal and 1 cm medial to the posterolateral corner of the acromion, and a 30° arthroscope (Stryker Endoscopy, San Jose, CA) is introduced. Systematic diagnostic shoulder arthroscopy is performed, and any intra-articular pathology is addressed.

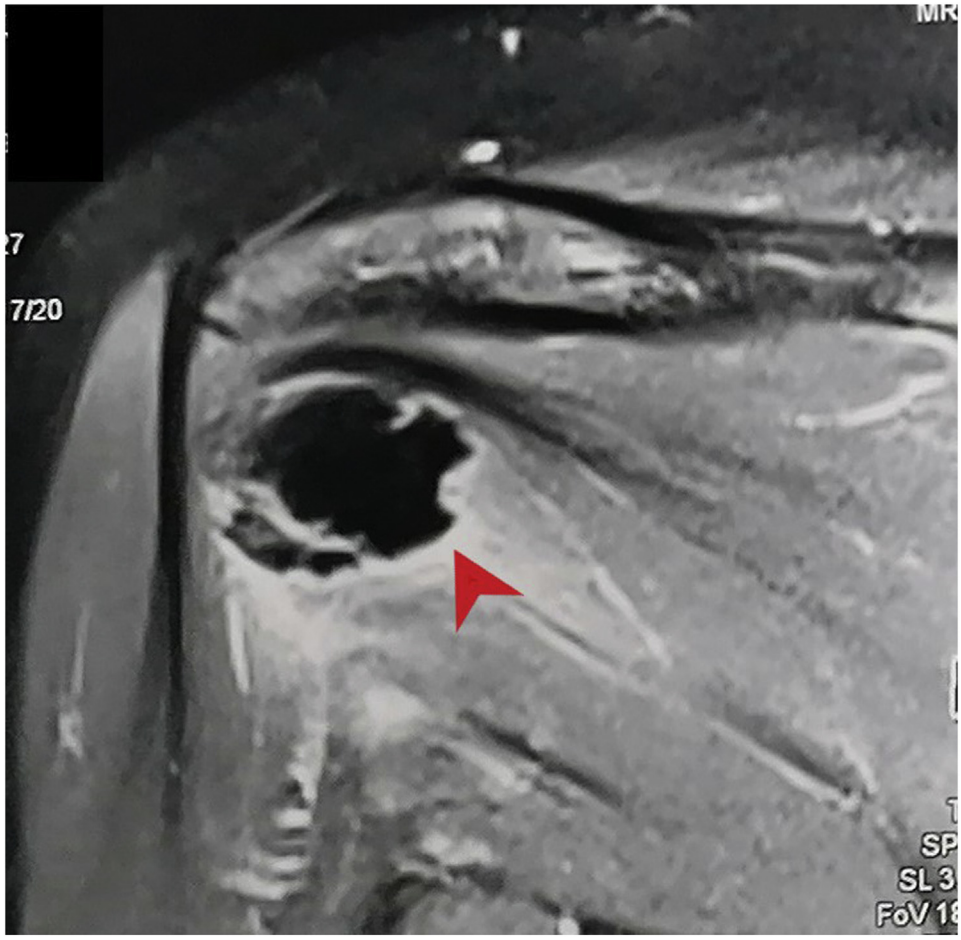

Fig 2. Coronal magnetic resonance imaging view of the right shoulder showing a large calcific deposit in the infraspinatus tendon (red arrow).

First Step: Localization of the Calcific Deposits Inside the Tendon

With the scope in the glenohumeral compartment, a 20-gauge spinal needle is used to localize the area of calcific deposits inside the infraspinatus tendon. This spinal needle can be used to repeatedly pierce the rotator cuff tendon in proximity to the location at which the calcific deposits are determined preoperatively. Once a

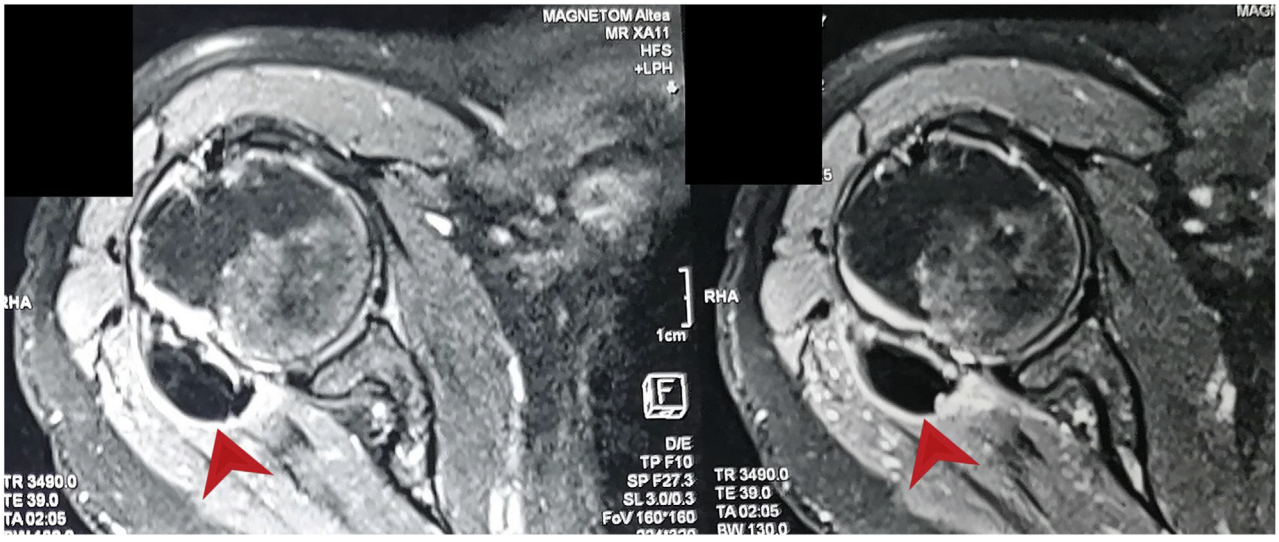

Fig 3. Axial magnetic resonance imaging views of the right shoulder showing a large calcific deposit in the infraspinatus tendon indenting the posterosuperior aspect of the humeral head (red arrows).

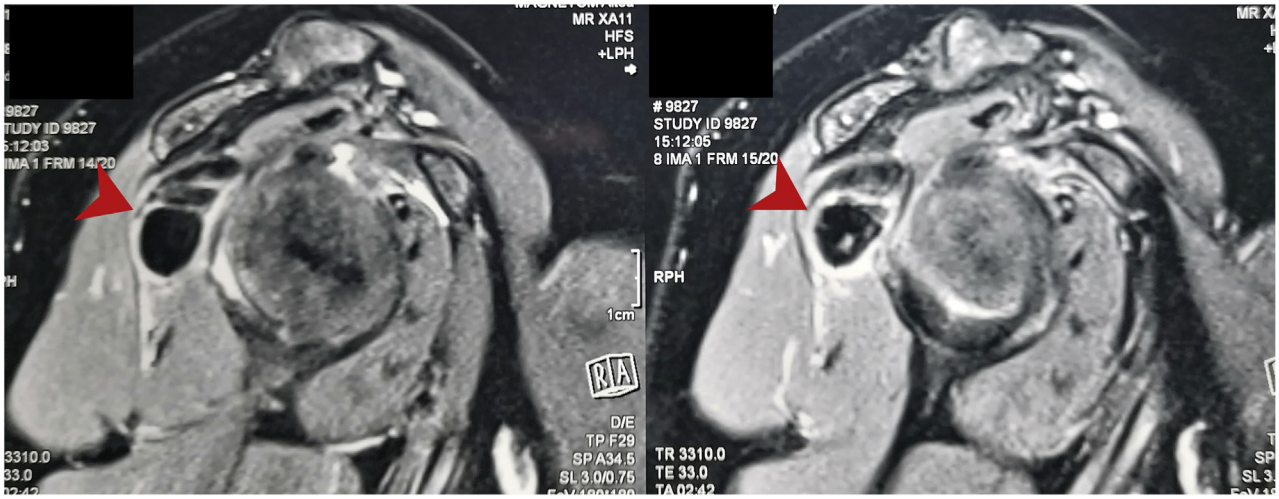

Fig 4. Sagittal magnetic resonance imaging views of the right shoulder showing a large calcific deposit in the infraspinatus tendon posterior to the humeral head (red arrows).

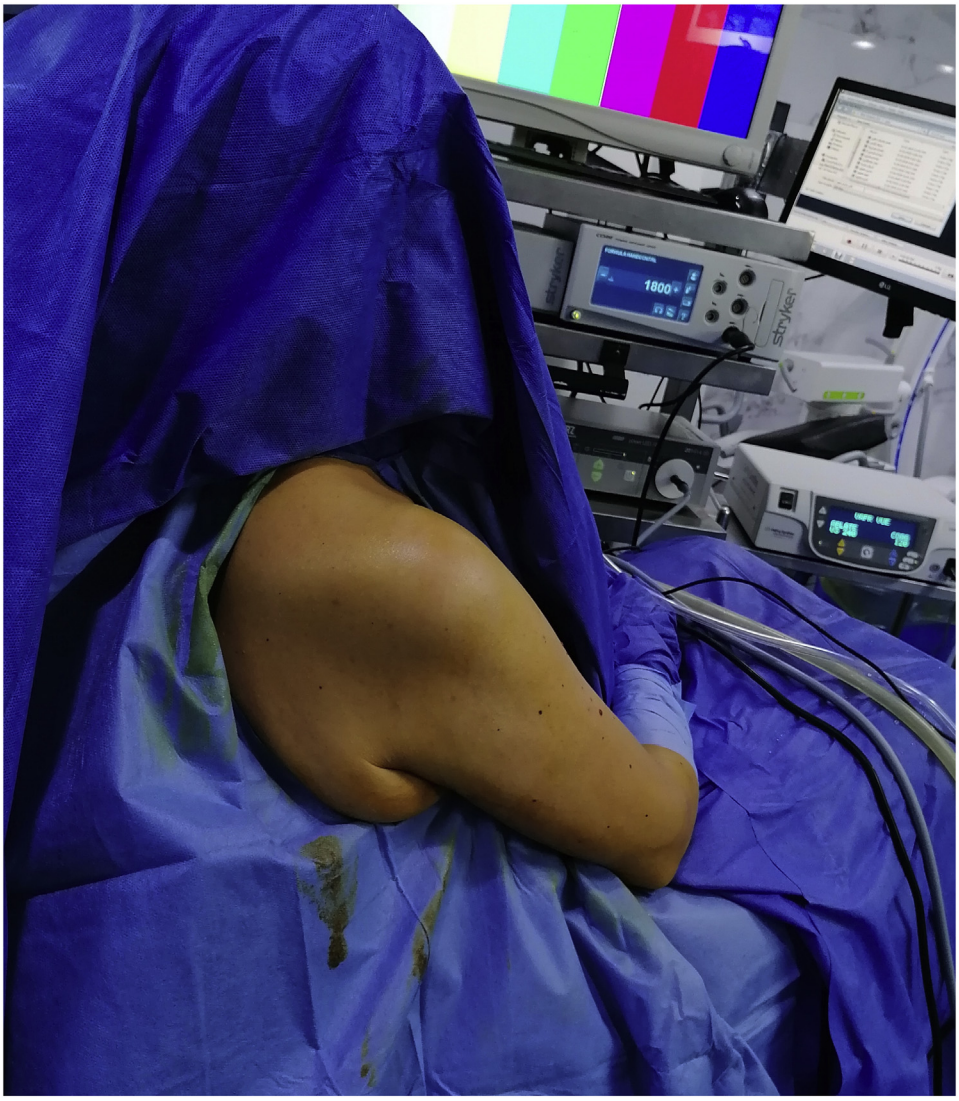

Fig 5. The patient positioned in the modified beach chair position with draping of the right shoulder. The positioning should ensure complete full unrestricted access to the shoulder.

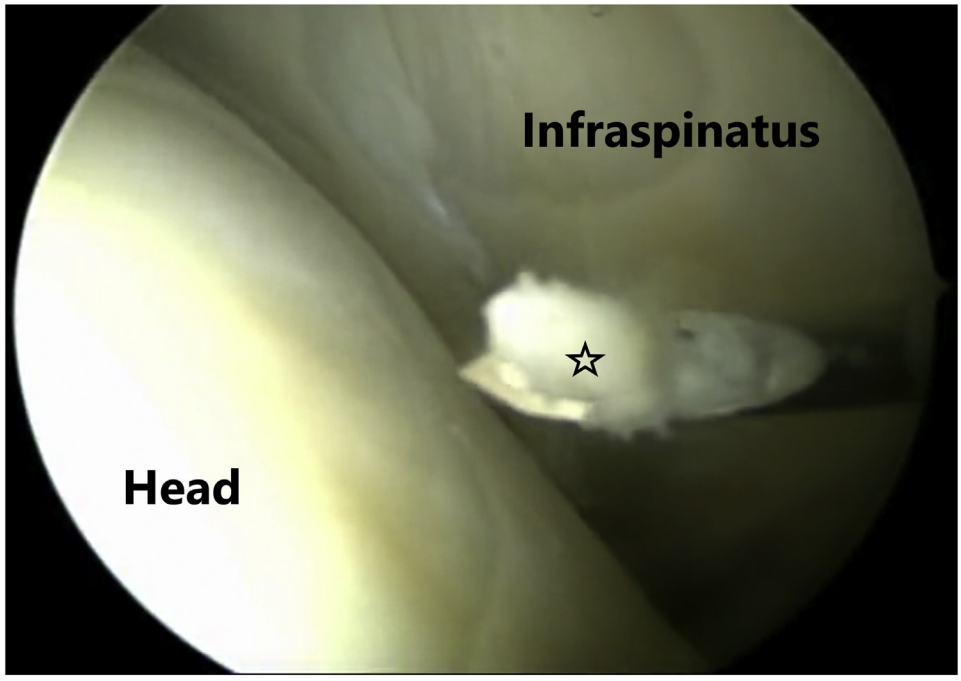

Fig 6. Arthroscopic view of the right shoulder through the posterior portal in the modified beach chair position. Calcium deposits are shown at the tip of the spinal needle (star) identifying the site of the calcification.

chalky white material is seen at the tip of the needle, the scope is shifted to subacromial space (Figs 6 and 7).

Second Step: Excision of the Calcified Area of the Infraspinatus Tendon

A subacromial bursectomy is performed to ensure complete visualization of the rotator cuff tendon. This includes removal of the inflamed posterior bursa. The area of the calcification is located by the site of the spinal needle.

The released calcification can resemble either “toothpaste,” "milky fluid," or “chalk dust.” The lesion is then milked to express the rest of the calcium deposit from the area.

Fig 7. The arthroscope is inserted through the posterior portal of the right shoulder in the modified beach chair position. The spinal needle is inserted through the calcified area of the infraspinatus tendon. The scope is then shifted to the subacromial space with the needle in place identifying the site of the calcification.

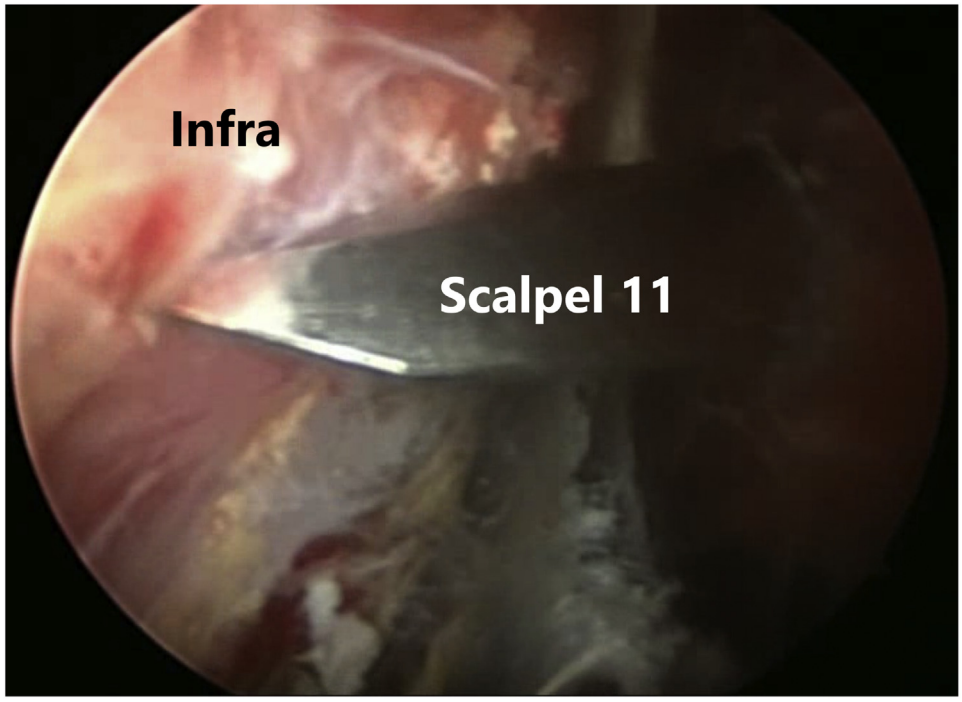

Fig 8. Arthroscopic view of the right shoulder subacromial space through the posterior portal in the modified beach chair position. A No.11 Scalpel blade is inserted through the lateral portal to open the calcified deposits from subacromial space.

A No. 11 scalpel blade on a standard knife handle may be used to create a partial-thickness transverse incision (along the line of tendon fibers) on the bursal surface of the rotator cuff in the determined location of the calcific deposits (Fig 8).

A 4.5-mm shaver blade (Stryker Endoscopy) is then used through the lateral portal to debride the cuff from calcium deposits (Fig 9). Care should be taken to remove all the deposits without making a large defect; sometimes the deposits are hidden in the gutters

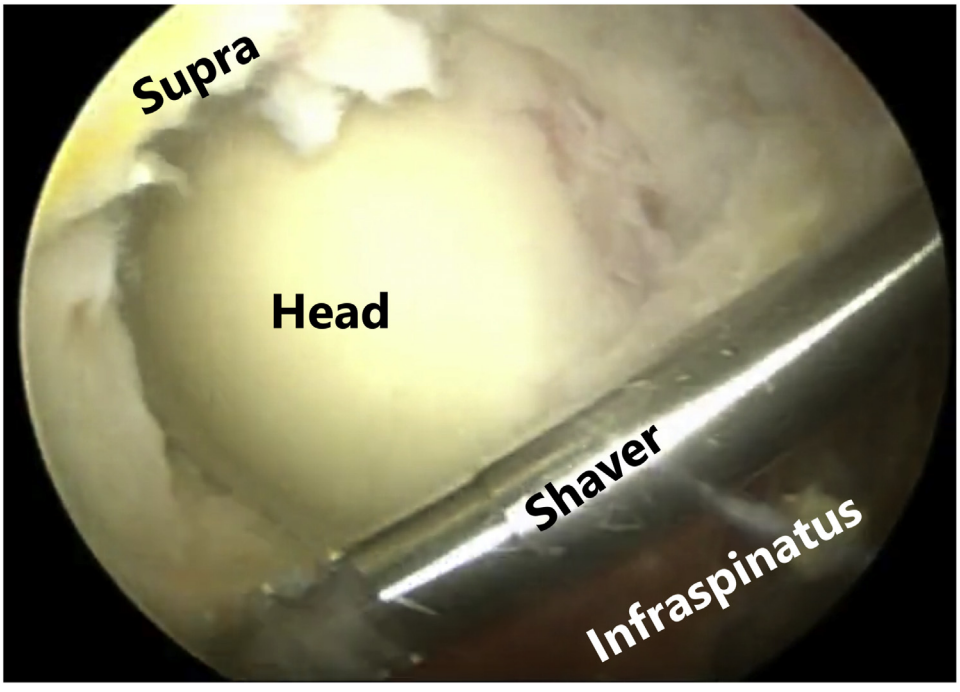

Fig 9. Arthroscopic view of the right shoulder subacromial space through the posterior portal in the modified beach chair position. Calcium deposits are removed using a motorized shaver through the lateral portal.

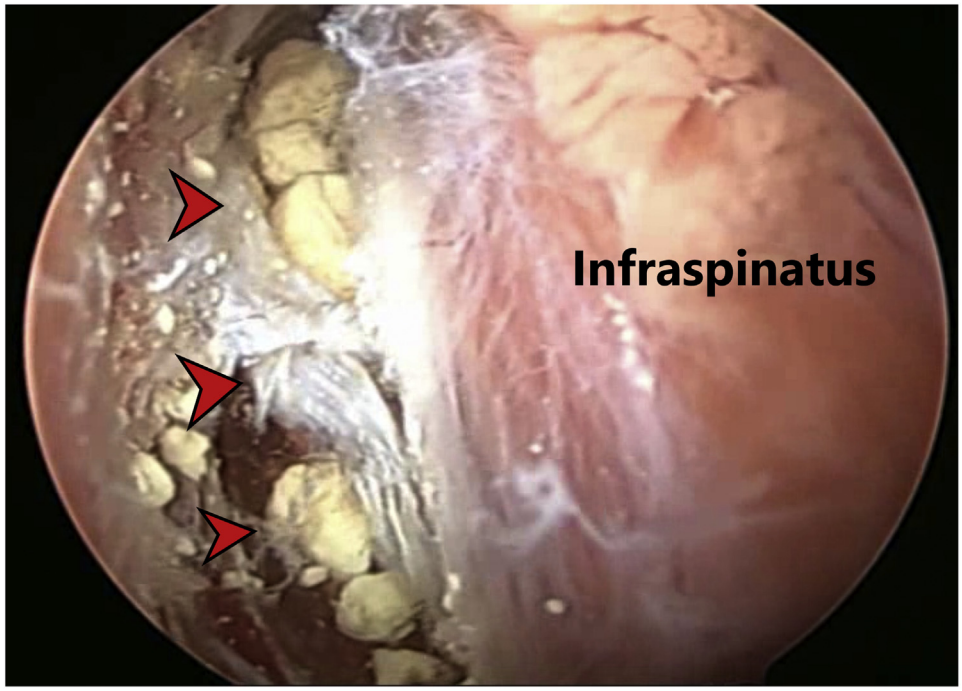

Fig 10. Arthroscopic view of the right shoulder subacromial space through the lateral portal in the modified beach chair position. Calcium deposits (red arrowheads) are hidden posterior to the infraspinatus below the deltoid muscle.

anterior and posterior to the infraspinatus tendon (Fig 10).

Care should be taken to minimize the excision of the adjacent rotator cuff tissue during the calcific deposit debridement, but such removal of the rotator cuff tissue is often unavoidable.

Third Step: Defect Management

The residual defect is then inspected from the posterior and lateral portals to obtain a 3-dimensional configuration of the defect (Figs 11 and 12).

With the scope in the lateral portal, a 5-mm knotted ALLthread titanium double-loaded suture (Zimmer

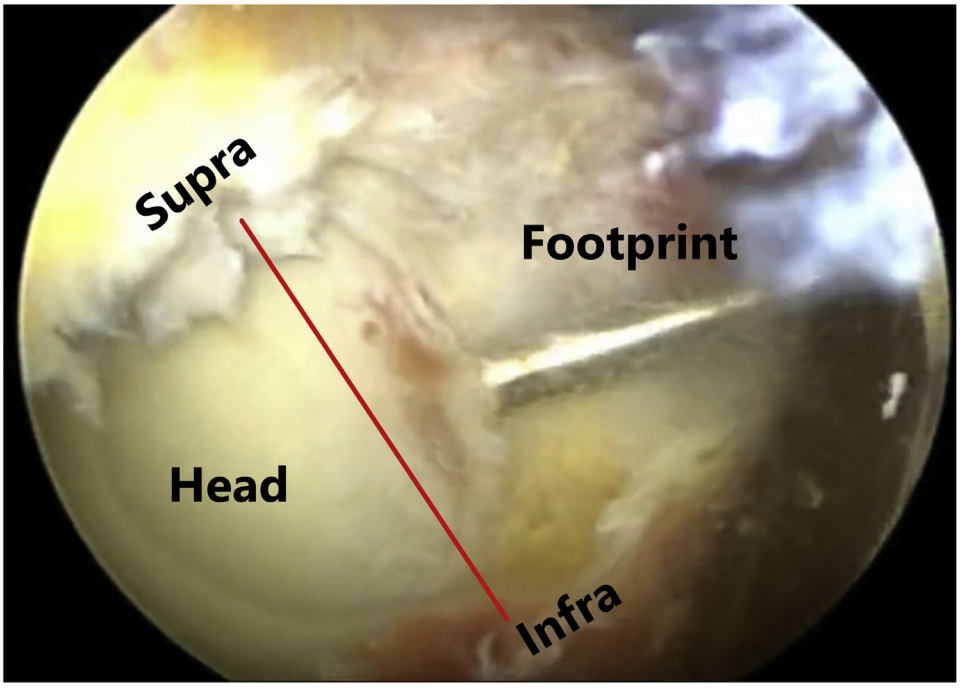

Fig 11. Arthroscopic view of the right shoulder subacromial space through the posterior portal in the modified beach chair position. A large defect is seen (red line) between supraspinatus and infraspinatus tendons.

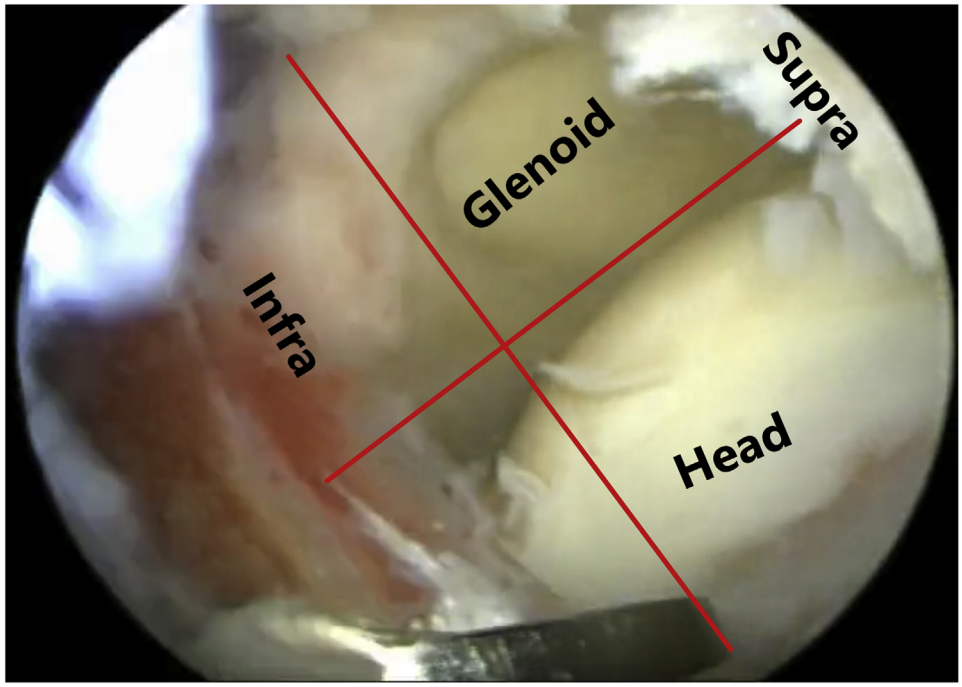

Fig 12. Arthroscopic view of the right shoulder subacromial space through the lateral portal in the modified beach chair position. A large defect is seen (red lines) between supraspinatus and infraspinatus tendons up to the glenoid.

Biomet, Warsaw, IN) is then inserted at the footprint of the infraspinatus tendon (Fig 13).

With visualization of the defect from the lateral portal, a single strand of each suture is then passed through the remaining infraspinatus tendon using the suture passer. Care should be taken to involve the posterior capsule with the infraspinatus during repair because the remaining fibers of the infraspinatus may be fleshy and friable to hold the repair (Figs 14-16). The other 2 strands are passed through the posterior

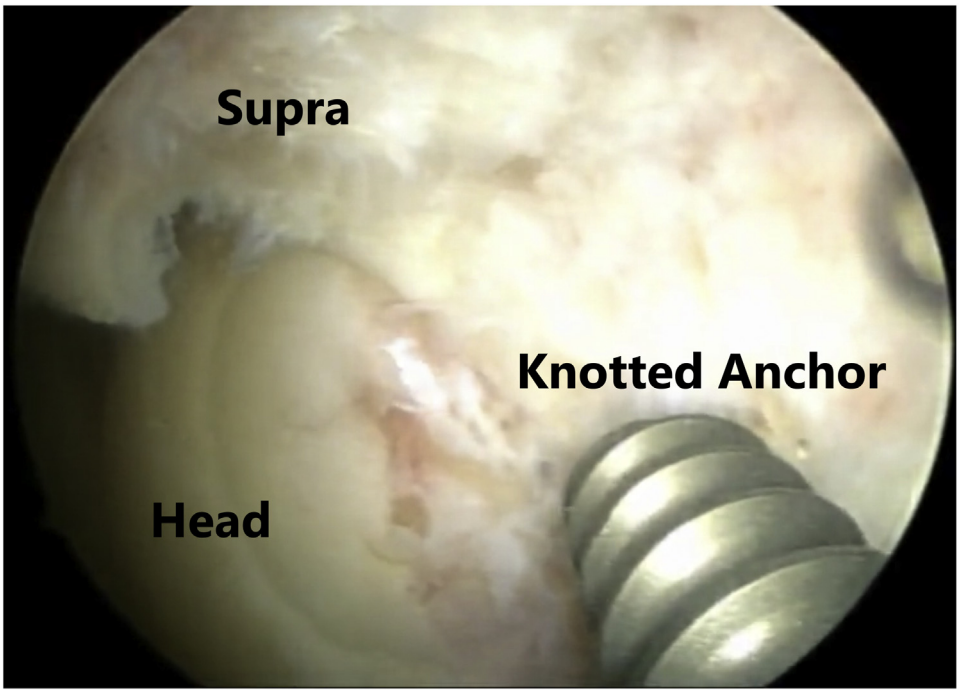

Fig 13. Arthroscopic view of the right shoulder subacromial space through the lateral portal in the modified beach chair position. A 5-mm knotted ALLthread double-loaded suture is inserted at the footprint of the infraspinatus tendon.

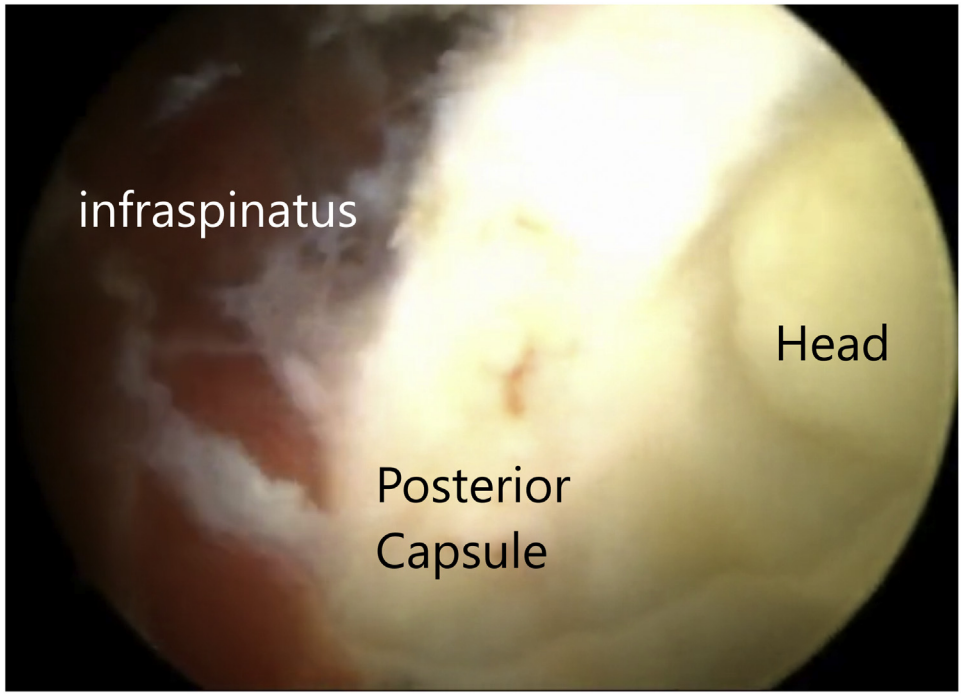

Fig 14. Arthroscopic view of the right shoulder subacromial space through the lateral portal in the modified beach chair position. The remaining infraspinatus muscle fibers may be insufficient to hold the repair. The posterior capsule anterior to the infraspinatus fibers should be involved in the repair.

edge of the supraspinatus tendon (Fig 17). The 2 strands of the same suture color are tied in a simple fashion creating margin convergence repair of the defect (Fig 18).

Afterwards, one PEEK (polyether ether ketone) 5.5-mm knotless anchor (Quattro 5.5 mm; Zimmer Biomet) is placed laterally to provide a transosseous equivalent double-row repair of the defect (Figs 19-21).

Postoperative Care

The patient is discharged with a sling to be worn for 6 weeks. Range-of-motion exercises of the elbow and

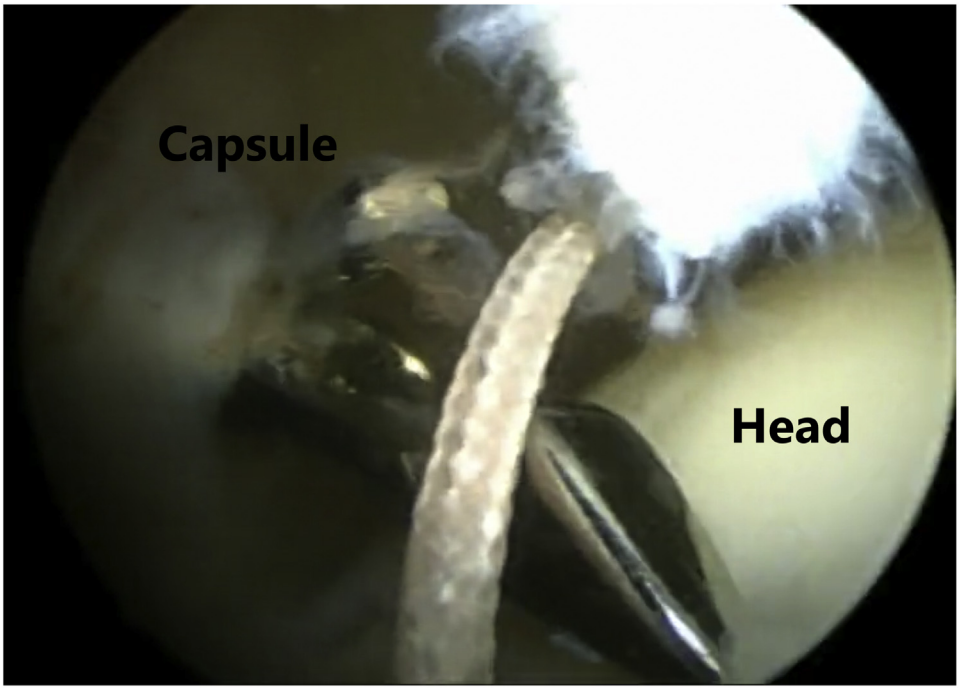

Fig 15. Arthroscopic view of the right shoulder subacromial space through the lateral portal in the modified beach chair position. The suture passer pierces both the infraspinatus and the posterior capsule.

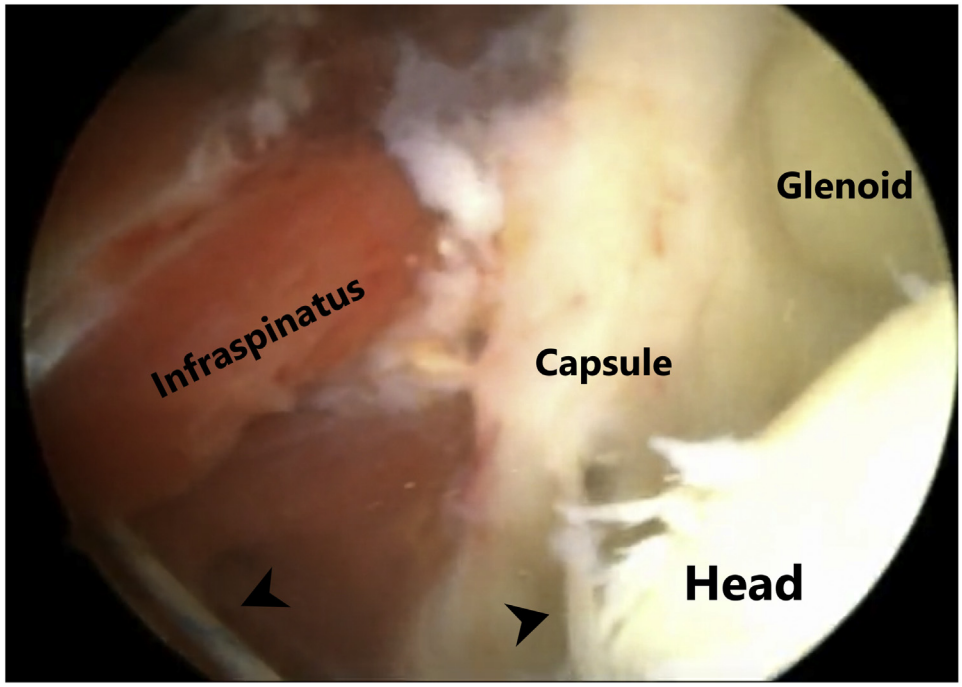

Fig 16. Arthroscopic view of the right shoulder subacromial space through the lateral portal in the modified beach chair position. One suture (anterior arrowhead) passes through the capsule and the other (posterior arrowhead) passes through the infraspinatus fleshy fibers.

pendulum exercises for the shoulder may begin on postoperative day 1. Full range of motion is permitted as tolerated. Physical therapy, focusing on range of motion and periscapular stabilization, begins approximately 10 days postoperatively.

Discussion

Arthroscopic treatment of calcific tendonitis of the rotator cuff has proved to be an effective treatment option in chronic cases that fail to improve with conservative measures.[6] Arthroscopy has become the

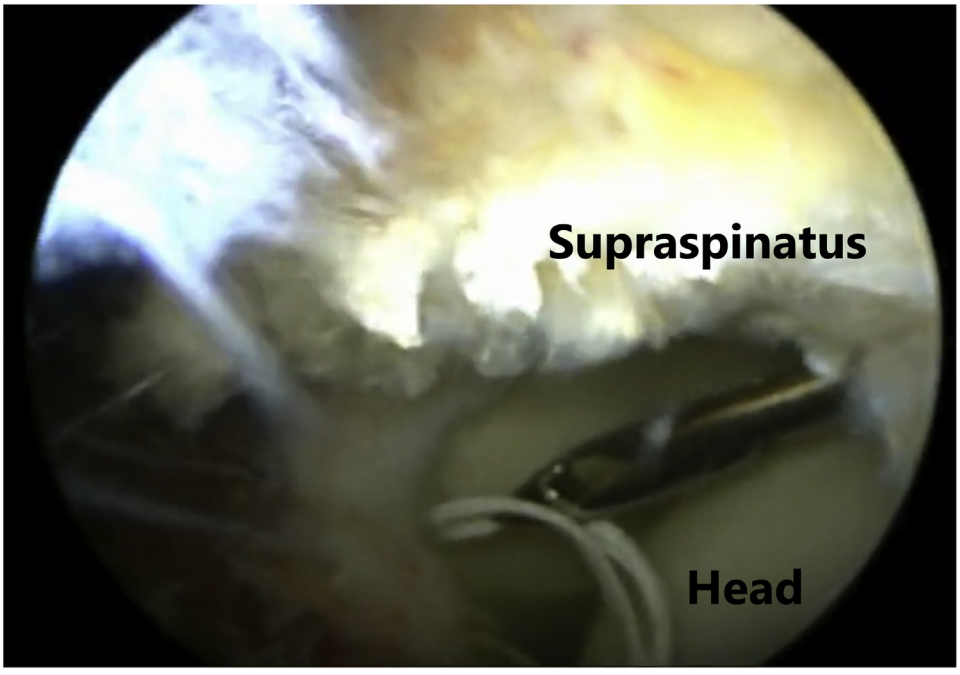

Fig 17. Arthroscopic view of the right shoulder subacromial space through the lateral portal in the modified beach chair position. Sutures are passed through the posterior edge of the supraspinatus tendon.

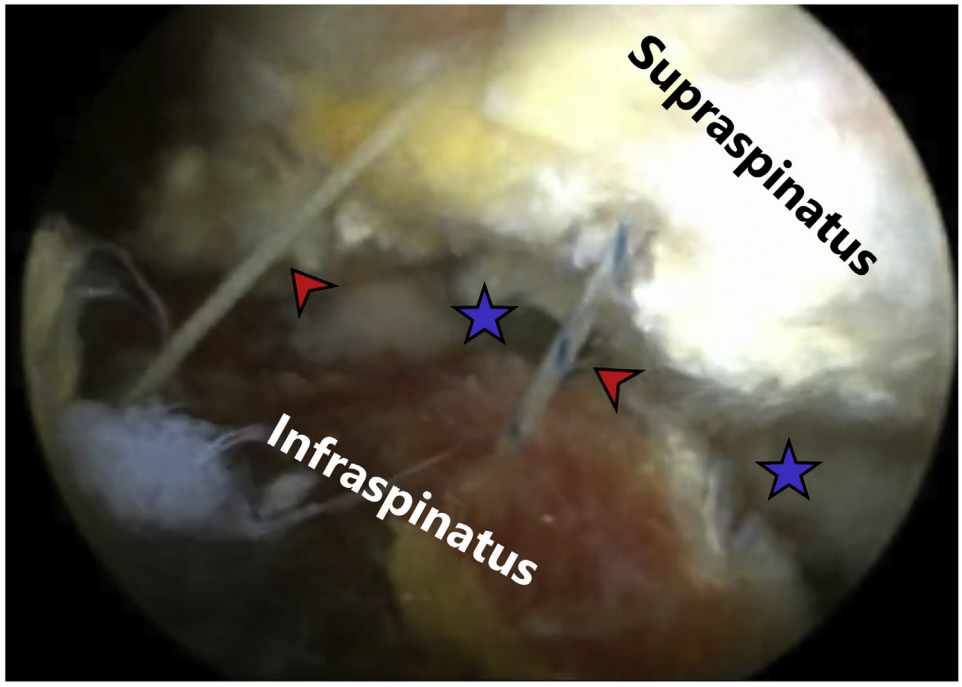

Fig 18. Arthroscopic view of the right shoulder subacromial space through the posterior portal in the modified beach chair position. Sutures (red arrowheads) are tied in a simple fashion resulting in a margin convergence of the 2 tendons. The defect (blue stars) is closed.

preferred technique to treat the chronic formative phase of calcific tendonitis, offering results similar to open surgery but with less morbidity of the deltoid and early rehabilitation. However, the optimum management remains in debate, such as repairing versus leaving the defect and complete versus partial removal of the deposits.[7,8]

Although the vast majority of the available literature entails the management of the calcific tendinitis within the supraspinatus tendon, there is paucity of data regarding management of the infraspinatus calcific deposits. Henning et al.[9] in 2015 published a case report of 55-year-old female patient with an intraosseous calcifying tendinitis of the infraspinatus tendon with erosion

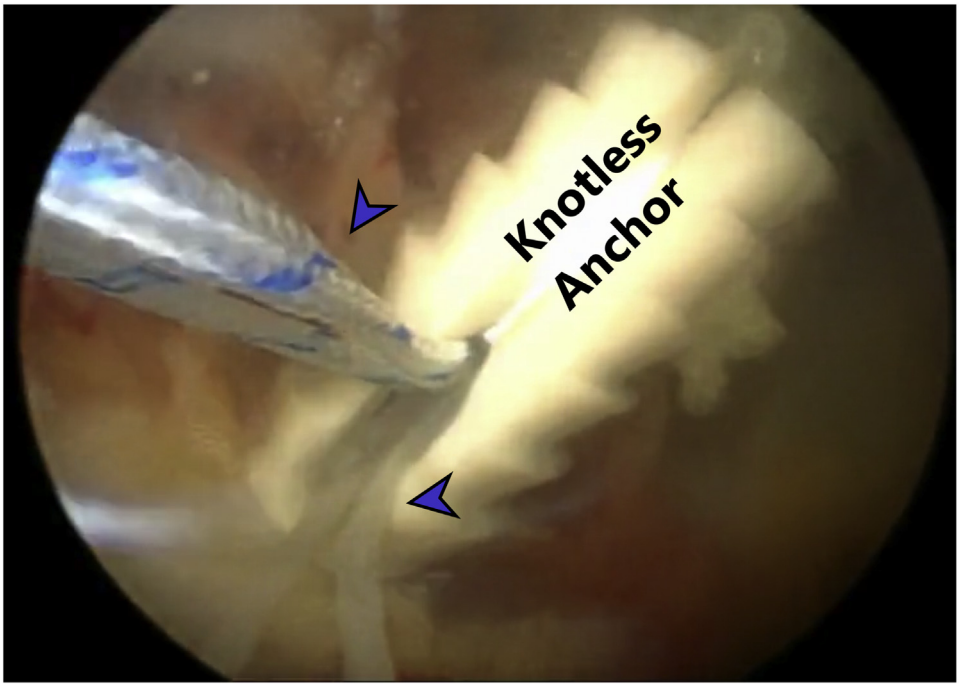

Fig 19. Arthroscopic view of the right shoulder subacromial space through the posterior portal in the modified beach chair position. Sutures (blue arrowheads) are loaded over knotless lateral row anchor.

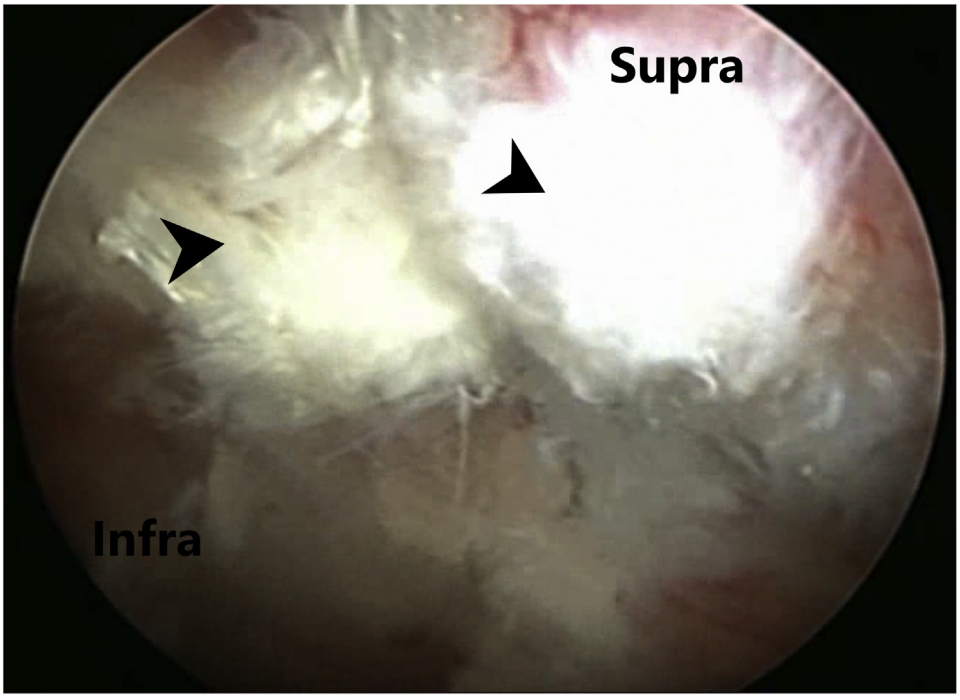

Fig 20. Arthroscopic view of the right shoulder subacromial space through the lateral portal in the modified beach chair position. The defect is closed with 2 side-to-side sutures (black arrowheads).

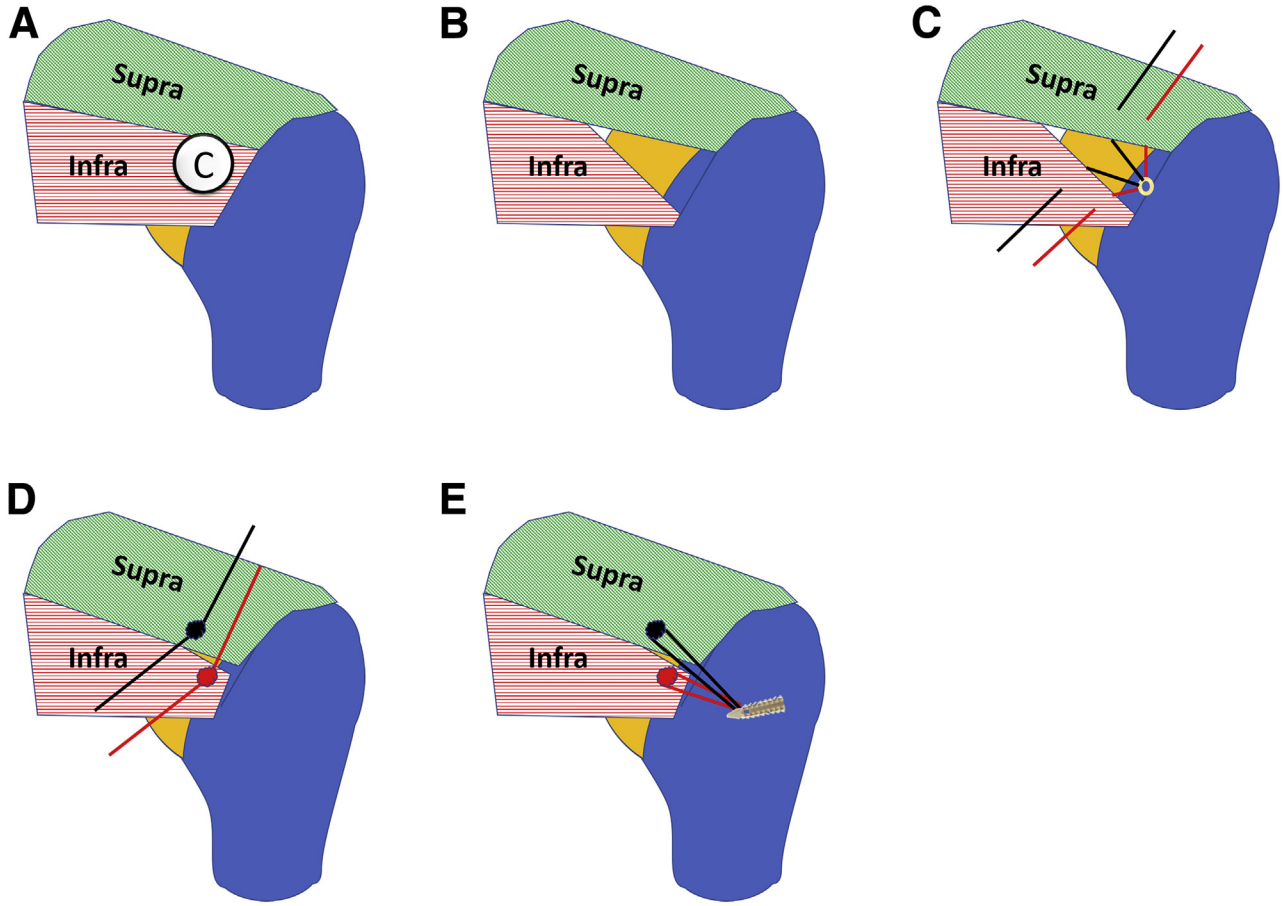

Fig 21. Summary of the technique. (A) Calcific tendinitis at the insertion of the infraspinatus muscle. (B) Excision of the calcific deposits with residual large defect in infraspinatus. (C) Medial anchor insertion with sutures passing through the cuff edges. (D) Side-to-side anchor repair of the defect. (E) Double-row suture bridge repair to compress cuff over the footprint.

into the greater tuberosity. They reported that arthroscopic treatment is preferable when intraosseous extension is demonstrated and has been found to improve both the degree and the time of the functional recovery.

Mitsui et al.[10] reported a case with calcific tendinitis within the subscapularis and infraspinatus tendons. The patient was treated with arthroscopic excision of the calcific deposits and subsequent repair using a suture-anchor technique, to ensure excellent clinical outcome.[10]

To avoid a large massive defect, partial removal of the deposits was recommended in some studies.[6,7,11] They assume that complete eradication is unnecessary because the cell-mediated resorption could have already been triggered by the surgical incision of the affected area. Moreover, a partial removal provides better preservation of the tendon. They also found that minor remnant calcifications did not impair the clinical outcome and was spontaneously resolved at the follow-up.[7,12-15]

In contrast, Porcellini et al.[16] recommended complete removal of the deposits followed by repair of the defect, using simple side-to-side sutures or suture anchors depending on the size of the residual defect. They argued that the repair gives similar results without the fear of propagation of the tear and also helps in early patient rehabilitation.[16]

To date, repair options include side-to-side in situ repairs of the tendon, or full-thickness takedown and repair. Yoo et al.[17] recommended closure of the defect with either side-to-side repair in case of small defect or suture anchor repair if large defect occurs. Wilson and Field[18] provided a management strategy for cuff defects after calcific tendinitis debridement. If the defect is superficial (<3-5 mm in depth), the defect is generally left unrepaired. For deep defects (>5 mm), rotator cuff repair is accomplished.

Whether rotator cuff repair after the removal of calcific deposits affects clinical outcomes remains controversial. However, rotator cuff repair using side-to-side repair and suture anchors can facilitate rehabilitation with satisfactory clinical outcomes.[19]

References

1. Sansone V, Maiorano E, Galluzzo A, Pascale V. Calcific tendinopathy of the shoulder: Clinical perspectives into the mechanisms, pathogenesis, and treatment. *Orthop Res Rev* 2018;10:63.
2. Brinkman JC, Zaw TM, Fox MG, et al. Calcific Tendonitis of the shoulder: Protector or predictor of cuff pathology? A magnetic resonance imaging—based study. *Arthroscopy* 2020;36:983-990.
3. Le Goff B, Berthelot J-M, Guillot P, Glémarec J, Maugars Y. Assessment of calcific tendonitis of rotator cuff by ultrasonography: Comparison between symptomatic and asymptomatic shoulders. *Joint Bone Spine* 2010;77:258-263.
4. Sansone V, Consonni O, Maiorano E, Meroni R, Goddi A. Calcific tendinopathy of the rotator cuff: The correlation between pain and imaging features in symptomatic and asymptomatic female shoulders. *Skeletal Radiol* 2016;45:49-55.
5. Fields LK, Muxlow CJ, Caldwell PE III. Arthroscopic treatment of subscapularis calcific tendonitis. *Arthrosc Tech* 2014;3:e571-e573.
6. Barber FA, Cowden CH III. Arthroscopic treatment of calcific tendonitis. *Arthrosc Tech* 2014;3:e237-e240.
7. Merolla G, Singh S, Paladini P, Porcellini G. Calcific tendinitis of the rotator cuff: State of the art in diagnosis and treatment. *J Orthop Traumatol* 2016;17:7-14.
8. Louwerens JK, Veltman ES, van Noort A, van den Bekerom MP. The effectiveness of high-energy extracorporeal shockwave therapy versus ultrasound-guided needling versus arthroscopic surgery in the management of chronic calcific rotator cuff tendinopathy: A systematic review. *Arthroscopy* 2016;32:165-175.
9. Henning P, Truter R, Boeyens M, Andronikou S, Suleman FE. Intra-osseous calcifying tendinitis of the infraspinatus tendon with erosion into the greater tuberosity. *S Afr Orthop J* 2015;14:43-46.
10. Mitsui Y, Gotoh M, Tanesue R, et al. Calcific tendonitis of the rotator cuff: An unusual case. *Case Rep Orthop* 2012;2012.
11. Jerosch J, Strauss J, Schmiel S. Arthroscopic treatment of calcific tendinitis of the shoulder. *J Shoulder Elbow Surg* 1998;7:30-37.
12. Seil R, Litzenburger H, Kohn D, Rupp S. Arthroscopic treatment of chronically painful calcifying tendinitis of the supraspinatus tendon. *Arthroscopy* 2006;22:521-527.
13. Ark JW, Flock TJ, Flatow EL, Bigliani LU. Arthroscopic treatment of calcific tendinitis of the shoulder. *Arthroscopy* 1992;8:183-188.
14. Balke M, Bielefeld R, Schmidt C, Dedy N, Liem D. Calcifying tendinitis of the shoulder: Midterm results after arthroscopic treatment. *Am J Sports Med* 2012;40:657-661.
15. Maier D, Jaeger M, Izadpanah K, Bornebusch L, Suedkamp NP, Ogon P. Rotator cuff preservation in arthroscopic treatment of calcific tendinitis. *Arthroscopy* 2013;29:824-831.
16. Porcellini G, Paladini P, Campi F, Paganelli M. Arthroscopic treatment of calcifying tendinitis of the shoulder: Clinical and ultrasonographic follow-up findings at two to five years. *J Shoulder Elbow Surg* 2004;13:503-508.
17. Yoo JC, Park WH, Koh KH, Kim SM. Arthroscopic treatment of chronic calcific tendinitis with complete removal and rotator cuff tendon repair. *Knee Surg Sports Traumatol Arthrosc* 2010;18:1694-1699.
18. Wilson WK, Field LD. Management strategies for rotator cuff defects after calcific tendinitis debridement. *Arthrosc Tech* 2019;8:e1051-e1055.
19. Kim MS, Kim IW, Lee S, Shin SJ. Diagnosis and treatment of calcific tendinitis of the shoulder. *Clin Shoulder Elbow* 2020;23:210-216.