Arthroscopic Excision of the Sternoclavicular Joint

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Abstract: Osteoarthritis changes at the sternoclavicular joint (SCJ) have been shown to be present on computed tomography in more than 90% of people over the age of 60 years. Although usually asymptomatic, when symptoms do occur, they can be very debilitating. Most patients respond favorably to conservative treatment, but there is a small cohort of patients who continue to be symptomatic despite adequate conservative treatment. Surgical management with an open SCJ excision has been shown to give satisfactory results. However, probably due to concerns with regard to damage to the mediastinal structures, instability, and scarring, there is a high threshold for surgery. Arthroscopic SCJ excision has been shown to achieve similar results to an open procedure while avoiding some of the risks. In this Technical Note, we describe the indications, imaging, and the technique of an arthroscopic excision of the SCJ.

Evidence of osteoarthritic changes at the sternoclavicular joint (SCJ) has been shown to be present on computed tomography (CT) scans in more than 90% of patients over the age of 60 years.[1] Although most people remain asymptomatic, when symptoms do occur, they can be very debilitating. The vast majority of symptomatic patients can be treated successfully with conservative measures. However, a small subgroup of patients continue to have persistent problems despite adequate nonoperative treatment.

Open resection arthroplasty of the medial end of the clavicle for persistent SCJ osteoarthritis has previously been reported with good results.[2-6] The procedure was found to be safe and effective with a high degree of patient satisfaction. However, most of these series have been retrospective with low numbers of patients collected over a large time period. This maybe partly due to previous concerns about the associated risks of an open SCJ procedure, including potential damage to mediastinal structures, instability, and a protracted recovery period. As a result, there remains a high threshold to undertake an open resection arthroplasty for SCJ osteoarthritis refractory to conservative treatment.

More recently, arthroscopy of the SCJ has been described for various intra-articular pathologies with encouraging results.[7-10] A prospective series of 10 patients with symptomatic SCJ osteoarthritis refractory to conservative treatment who subsequently underwent an arthroscopic SCJ excision reported good results, similar to an open procedure, at a mean follow-up of 28 months (17-41 months).[9] The advantages of the arthroscopic procedure were that it was undertaken as a day-case procedure, no postoperative immobilization was required, and that there was minimal scarring with no concerns with regard to instability.

This Technical Note describes the indications for surgery, the pertinent arthroscopic anatomy, and the surgical technique for an arthroscopic excision of the SCJ.

Indications for Surgery

The indications for an arthroscopic SCJ excision for osteoarthritis are exactly the same as those for an open procedure. Most patients with symptomatic SCJ osteoarthritis respond to conservative measures. These initially include rest, nonsteroidal anti-inflammatories, and physiotherapy. For those that do not settle an ultrasound-guided cortisone and local anesthetic injection, directly into the SCJ, usually resolve their symptoms.

Our indication for an arthroscopic SCJ excision is a failure to respond to an adequate course of

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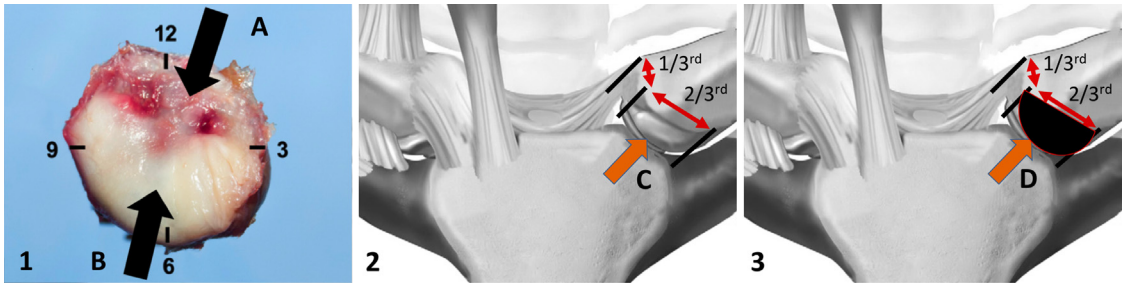

Fig 1. (1) Cadaveric photograph of the medial end of the clavicle, with "A" the insertion point of the superior end of the intra-articular disk and "B" the articular cartilage. (2) "C": Diagram of the surgical anatomy of the sternoclavicular joint (SCJ) showing the superior insertion of the intra-articular disk into the superior one-third of the medial end of the clavicle and the articular surface occupying the inferior two-thirds. (3) "D": Black shaded box representing the area articular and subchondral bone that is resected during an arthroscopic excision of the SCJ.

nonoperative treatment for at least 6 months. This should include at least 1 ultrasound-guided SCJ cortisone and local anesthetic injection, undertaken primarily, as a therapeutic treatment but acting as a diagnostic tool when only a transient response occurs. A contraindication to surgery is a significant abnormal anatomy including any evidence of fusion across the joint. A relative contraindication is a previous stabilization procedure and previous infection.

Imaging

Standard plain radiographs, including a serendipity view, are not sufficient to assess an osteoarthritic SCJ before surgery. A standard CT scan or magnetic resonance imaging (MRI) scan is required to adequately visualize the joint and its position. Of particular interest are the size, position, and extent of any associated osteophytes.

In our unit we routinely use digital tomograms as the initial screening modality for SCJ pathology. The advantages of a digital tomogram over a CT scan or MRI scan are as follows: it can be undertaken immediately in the outpatient radiology department, it is cheaper than either a CT or MRI scan, and, in the case of a CT scan, it only exposes the patient to a radiation dose that is slightly more than a plain chest x-ray. A further benefit of using digital tomograms is that it is possible to obtain immediate postoperative images of the SCJ at the patients' follow-up appointment (Fig 1).

We have found that a digital tomogram gives us sufficient diagnostic and anatomic information to proceed to surgery in most cases. As a result, we now routinely use a digital tomogram as our only diagnostic investigation before and after undertaking an arthroscopic excision of the SCJ.

Surgical Anatomy

The classic anatomic texts of the SCJ depict the medial end of the clavicle to be completely covered with the articular cartilage with the capsule to be circumferentially attached around it. This is akin to the acromioclavicular joint and so an adequate excision of the clavicular articular component of the SCJ has been considered to involve an excision of the whole of the medial end of the clavicle. However, a recent study of the surgical anatomy of the SCJ has described the intra-articular anatomy of the joint in detail and found it to be slightly different to the classic anatomic texts.[11]

A more detailed dissection of the medial end of the clavicle shows that only the inferior two-thirds of the bone is covered by the articular cartilage. The thick superior end of the intra-articular disk, as it blends with the capsule and interclavicular ligament, inserts into the superior third of the bone. The anterior, posterior, and inferior part of the capsule insert around the medial end of the clavicle at the junction of the articular cartilage and metaphyseal bone.

The consequence of this is that an adequate excision of the articular portion of the medial end of the clavicle, and its subchondral bone, can be undertaken as an intra-articular procedure with minimal loss of clavicular length. Excision can be achieved by removing an undercutting triangular wedge of the inferior two-thirds of the medial clavicle within the confines of the capsule. In the osteoarthritic joint, an overhanging inferior osteophyte is usually present that, having stretched out the capsule, leads to a clearer surgical delineation of the capsular margin (Fig 2).

There are a number of anatomic advantages of being able to undertake an intra-articular excision of the articular part of the medial end of the clavicle. The joint capsule and the surrounding insertions of the stabilizing sternoclavicular ligaments are not breeched, and so stability is not compromised. Only a small amount of bone is resected having a minimal effect on clavicular length avoiding potential issues with SCJ stability and ACJ and shoulder girdle function.

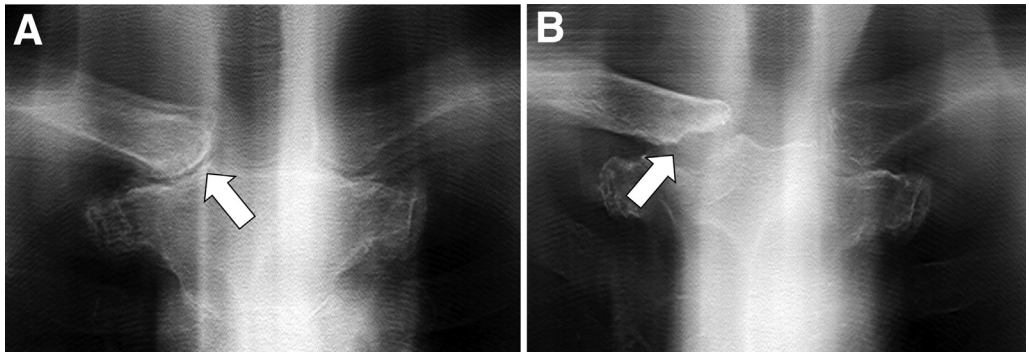

Fig 2. (A) Preop tomogram of a right osteoarthritic sternoclavicular joint with joint space narrowing, subchondral sclerosis, and an inferior osteophyte. (B) Postop tomogram of the same patient taken 6 weeks after surgery with the undercut excision of the subchondral bone.

Surgical Technique

Equipment and Positioning

A standard arthroscopy stack with a pump, powered shavers, and radiofrequency unit is used. Standard 30° and 70° 2.9-mm-diameter arthroscopes (Smith & Nephew, Andover, MA) are used to allow for complete visualization of the SCJ. A minishaver, micro punches and scissors, and a radiofrequency probe are required to resect any residual disk and other soft tissue. A miniburr, progressing to a 4-mm acromionizer burr, is used to resect the medial end of the clavicle. The arthroscopic monitor and stack are positioned at the head end of the bed (Fig 3). The operating surgeon stands at the side on the patient's affected side facing the monitor. The assistant stands on the opposite side.

The patient is positioned supine with a sandbag positioned between the scapulae. This allows for increased retraction of the scapulae, opening up the SCJ anteriorly. The patient is intubated with his head on a head ring in slight extension. The anesthetic tubes pass superiorly over the patient's head.

Portal Placement

The SCJ and bony contours are palpated, and a surgical marker is used to outline the medial end of the clavicle, the sternum, and sternal notch. The anterior sternoclavicular ligament, the small area of bony congruence, and the inclination of the sternal side of the SCJ are taken into consideration.[8,12]

The bony contours of the joint are palpated and an initial inferior portal is positioned approximately 1 cm directly inferior to the joint line. An 18-gauge spinal needle is inserted and angled at 30° cephalad to the horizontal plane and 30° lateral to the midline to take into account the inclination of the sternal side of the joint. An 8-mm longitudinal stab incision is made in the skin and a blunt trocar inserted. A distinct "pop" is felt as the trocar penetrates the capsule and the joint is entered. As a general rule, the trocar usually enters the sternal side of the joint on insertion. Having established an inferior viewing portal and assessed the joint, a superior working portal is created. The spinal needle is then inserted with a 10-mm skin bridge superiorly, to protect the anterior SCJ ligament, and visualized as it

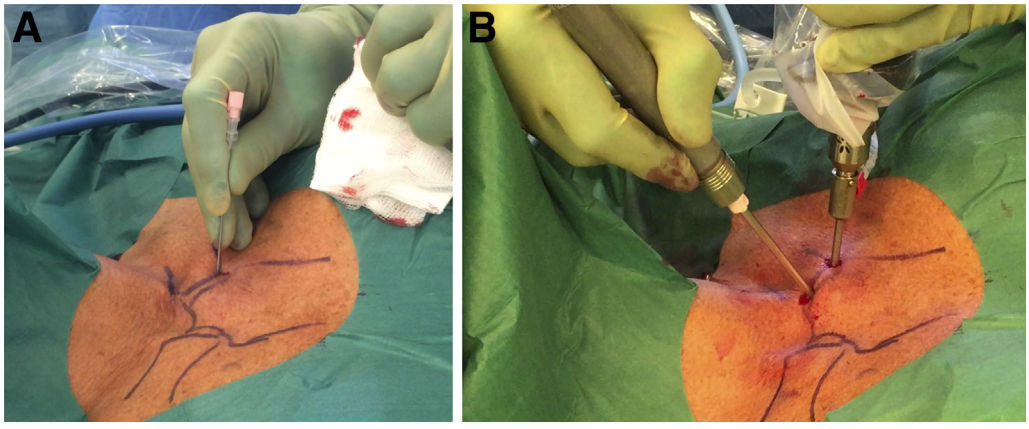

Fig 3. (A) Intraoperative external view photograph of a patient, positioned supine, undergoing a left arthroscopic sternoclavicular joint (SCJ) excision. The SCJ boney landmarks have been drawn out and the 18-gauge spinal needle is being inserted into the inferior joint space of the left SCJ. (B) Resection of the medial end of the clavicle is being undertaken with the arthroscope in the inferior portal and the power shaver in the superior portal.

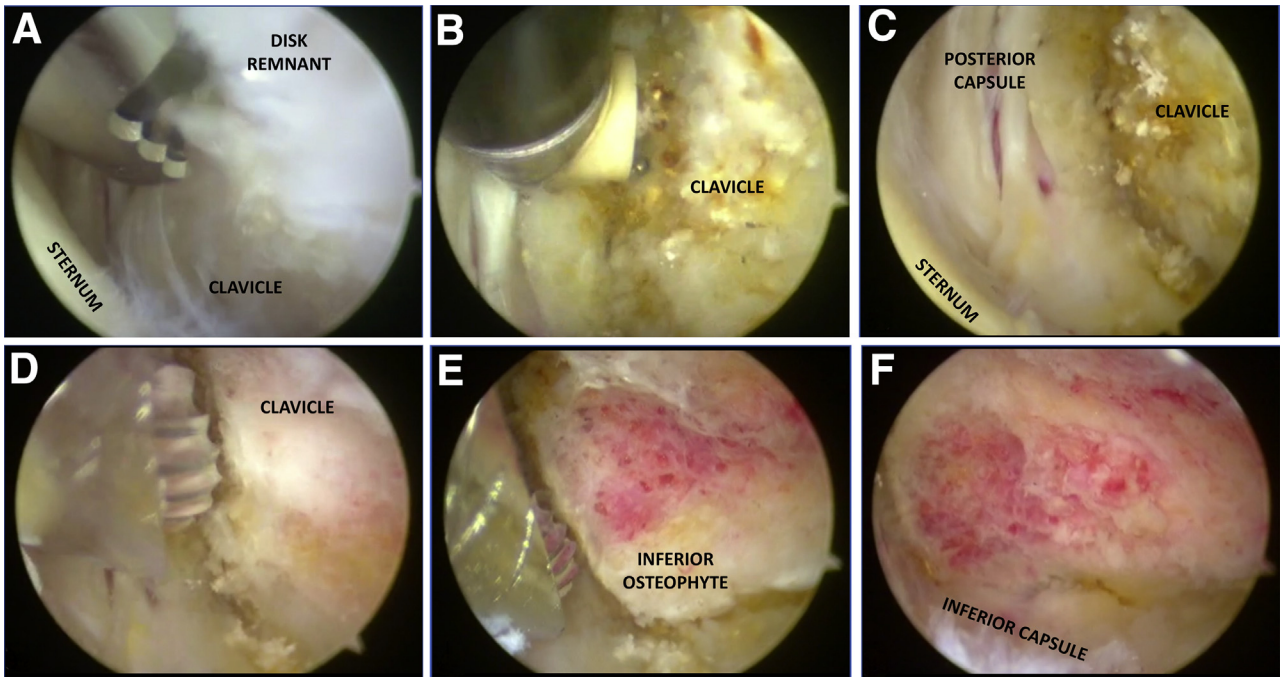

Fig 4. Intraoperative arthroscopic pictures of a left sternoclavicular joint arthroscopic excision. The arthroscope is in the inferior portal in all of the images with the shaver, radiofrequency probe, and burr in the superior portal. (A) A 3.5-mm shaver is initially used to resect the remnants of the degenerate disk and clear away any loose intra-articular soft tissue. (B) The radiofrequency probe is next used to clear any remaining soft tissue and articular cartilage from the medial end of the clavicle and to clearly expose the bone of the medial end of the clavicle, circumferentially. (C) The medial end of the clavicle has been prepared and denuded of any residual articular cartilage, the joint space has been completely cleared, and the posterior capsule and the well-preserved sternal articular surface can also be seen. (D) A 4-mm acromionizer burr has begun to resect the superior part of the medial end of the clavicle working from posterior to anterior. (E) The superior part of the medial clavicle has been resected with the inferior osteophyte at the most lateral part of the joint about to be resected by the burr. (F) At the end of the case, the articular part of the medial end of the clavicle has been completely resected circumferentially back to the edge of the capsule with the inferior part of the capsule fully exposed.

enters the joint. The superior working portal is then created by an outside-to-inside technique.

Diagnostic Arthroscopy

Having created both portals, a diagnostic arthroscopy is undertaken using a probe. In every case that we have undertaken, there has been a degenerate tear of the intra-articular disk that has become detached from its inferior and posterior capsular insertion.

Initially, the posterior capsule is identified and then the arthroscope rotated inferiorly to visualize the inferior capsule and joint. Rotating the arthroscope medially allows for the sternal articular surface to be assessed; this is usually well preserved. Rotating the arthroscope laterally reveals the degenerate end of the medial clavicle. An attempt is made to visualize the inferior recess and surface of the joint, but this is often obscured by residual degenerate disk material.

Procedure

Viewing from the inferior portal, a combination of the minishaver, minipunches, and the radiofrequency probe is used to resect any residual soft tissue and the remnants of the intra-articular disk back to a stable circumferential rim. Any residual cartilage or soft tissue is also debrided off of the medial end of the clavicle. At this point, the inferior recess of the joint and the medial end of the clavicle, including any osteophytes, should be able to be visualized.

Once the joint has been cleared, a mini-burr, again inserted from the superior portal, is used to begin the resection of the superior part of the medial end of the clavicle from immediately below the insertion of the residual intra-articular disk. The resection is made from posterior to anterior, gradually "undercutting" the bone as it is taken inferiorly. After resection of the first couple of millimeters of the medial clavicle, there is usually sufficient space to introduce a 4-mm acromionizer burr into the joint. This is able to resect more quickly a larger volume of the bone while directing the "undercut" toward the inferior lateral part of the bone. As progress is made, the radiofrequency probe is used to further ablate any soft tissue to help more clearly visualize the inferior part of the joint. Boney resection is

Table 1. Relative Advantages and Disadvantages of Open Versus Arthroscopic Sternoclavicular Joint Excision

	Arthroscopic Excision		Open Excision	
	Advantage	Disadvantage	Advantage	Disadvantage
Equipment	Miniscope, instruments, shaver, and radiofrequency probe able to precisely excise the disk	Initial capital outlay and ongoing consumable costs	Standard orthopaedic and surgical instruments	Instruments insufficiently precise to excise the inferior triangular two-thirds of the medial end of the clavicle without collateral damage to the superior disk and capsular insertion
Visualization and access	Visualization and easy access to the whole joint	No extra-articular visualization or ability to assess and address any preoperative joint instability	Extra-articular visualization and ability to assess and address any pre-existing joint instability	Poor visualization of the posterior joint and difficult surgical access
Postoperative period	Day-case procedure, no sling, immediate mobilization, minimal incision scar	Potential difficulty in managing unexpected pain issues in the immediate days after surgery	Patient remains in hospital, allowing easier adjustment of medication to address any unexpected anesthetic or pain issues	Inpatient procedure, sling required, 4-6 wk of immobilization. Prominent incision scar
Risks and complications	Minimal risk to joint stability, minimal risk to posterior vascular structures, minimal risk of infection			Potential risk of joint instability, potential risk of infection
Surgeon requirements		Advanced arthroscopic experience, high-volume sternoclavicular joint practice	Procedure can be undertaken by a competent and experienced upper limb surgeon	

then continued until the most inferior and central part of the subchondral bone has been resected, including any osteophytes. Sometimes, swapping the arthroscope to the superior portal and using the burr through the inferior portal can allow better access to the inferior part of the joint (Fig 3).

At the end of the procedure, there should be a smooth, triangular undercut of the medial end of the clavicle from the superior disk insertion to the lateral inferior joint capsule (Fig 4). The rest of the joint is then inspected and hemostasis obtained. The wounds are closed with subcuticular sutures and adhesive strips.

Arthroscopic Excision of the SCJ

Postoperative Rehabilitation. The patient does not need a sling and is encouraged to use his shoulder and arm as much as comfort permits immediately after surgery. The patient can begin active mobilization exercises under the supervision of the physiotherapists as soon as pain allows. Most patients should expect to be able to return to their normal activities of daily living, including driving, within 2 to 4 weeks of surgery (Video 1).

The patients are reviewed in the outpatient clinic at 4 weeks, where a digital tomogram is undertaken to confirm adequate boney resection.

Pearls and Pitfalls. Table 1 lists some of the pearls and pitfalls in undertaking an arthroscopic excision of the SCJ compared with an open procedure.

Discussion

Previous descriptions of open SCJ excisions have described resection of varying amounts of the medial end of the clavicle, with one author recommending an excision of 4 cm.[2-5,13-15] These procedures are probably based on the assumption that an SCJ excision is analogous to an excision of the lateral end of the clavicle for ACJ osteoarthritis.

However, the ACJ is a very different joint to the SCJ in that the coracoclavicular ligaments "strut" out the lateral end of the clavicle from the medial side of the acromion. After resection of the lateral end of the clavicle, lateral to the coracoclavicular ligaments, the gap between the clavicle and acromion is maintained, and there is a minimal effect on joint stability. This is not the case for the SCJ where the medial end of the clavicle collapses down toward the sternal articular surface with a variable effect on joint stability. However, a recent cadaveric biomechanical study showed that a parallel excision of the medial end of the clavicle of less than 10 mm with repair of the soft-tissue

structures provided adequate decompression with a minimal effect on stability.[16]

An arthroscopic excision of the SCJ is in fact a very different operation to an open procedure. An arthroscopic excision involves an intra-articular excision of the articular and subchondral end of the medial clavicle. Less than 8 mm of clavicular length is lost at its maximum with no compromise to the static soft-tissue stability of the joint.

An arthroscopic excision of the SCJ for symptomatic osteoarthritis is a safe and reproducible procedure. It has the advantages over an open procedure of not having to undertake a formal capsulotomy with subsequent capsular repair, excising extra-articular bone, the risk of potential instability, and not requiring a postoperative period of immobilization. Arthroscopic SCJ excision is well within the capabilities of the experienced shoulder and elbow surgeon. However, because the likely number of patients with SCJ osteoarthritis is small, SCJ arthroscopic surgery should only be performed in centers with a high volume of SCJ referrals and by surgeons with a familiarity and experience of all types of SCJ surgery.

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