

Unusual complications of shoulder arthroscopy

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As shoulder arthroscopy becomes increasingly common, complications of the procedure are becoming more apparent. We have previously reported cutaneous nerve lesions of the shoulder and arm after shoulder arthroscopy⁴; these are common complications of the procedure. This study presents 9 cases of unusual complications of shoulder arthroscopy: 8 from the senior authors (M.G.H. and A.D.S.), whose experience includes more than 4000 shoulder arthroscopies, and 1 referral from another institution. Some of these complications are difficult to attribute to the surgical procedure. They are, however, undesirable sequelae, and we believe that they should be reported.

Our standard practice in all cases of shoulder arthroscopy, unless there are specific contraindications, is to administer a general anesthetic and, frequently, an interscalene block. We perform shoulder arthroscopy with the patient in the lateral decubitus position, supported by a deflated bean bag. The arm is suspended by means of a 4-kg weight through use of single overhead traction applied through non-adhesive forearm skin traction. Our irrigation fluid is water in 1000-mL bags, 0.5 mL of 1:1000 adrenalin being added to each bag. We use a hand pump to assist in distension when it is required. Our 3 standard portals are the posterior, anterior, and lateral portals. We routinely perform electro-surgery with a diathermy unit (Valleylab Inc, Boulder, Colo). There was no deviation from our standard practice in any of the cases described in this article, except as specifically noted in the individual case histories.

CASE REPORTS

Case 1. A 32-year-old, right-hand-dominant farmer underwent an arthroscopic acromioplasty and debridement of a partial-thickness tear of the supraspinatus. The patient presented to his rural medical practitioner 2 weeks after surgery and at our clinic 4 weeks after surgery. He complained of aching in his shoulder at night and weakness of shoulder flexion. Clinical examination revealed moderate wasting of the sternal head of the right pectoralis major and grade 3 strength of this muscle. Shoulder abduction strength was grade 4. There was no deltoid wasting. The patient was seen by a neurologist, and electrophysiologic studies were performed on the deltoid and sternal head of the pectoralis major. Neither muscle had fibrillation to suggest denervation,

but the recruitment patterns were markedly reduced in the sternal head of the pectoralis major and reduced in the deltoid, which suggested a neurapraxia of the right medial pectoral and right axillary nerves.

The patient regained full strength of the right deltoid within 5 months of surgery. Although the bulk and strength of the sternal head of the pectoralis major continued to improve, the patient still complained of some weakness of shoulder flexion at his most recent review 1 year after surgery. He noted some aching and lack of endurance in the shoulder while he was shearing sheep, and he complained that because of weakness he could not serve at tennis or throw.

Case 2. A 53-year-old general practitioner and surgical assistant underwent an arthroscopic acromioplasty and debridement of a type III SLAP (superior labrum, both anterior and posterior) lesion and partial-thickness tear of the supraspinatus. Surgery was performed with the patient under general anesthesia; no regional block was used. Two weeks postoperatively the patient was noted to have slight wasting and weakness of the sternal head of the pectoralis major. This improved significantly by 2 months postoperatively, and the patient was asymptomatic within 3 months of surgery. He returned to tennis at 2 months after surgery but noted lack of control and weakness in the forearm stroke. The clinical diagnosis was a neurapraxia of the right medial pectoral nerve.

Case 3. A 42-year-old swimmer and swimming instructor underwent an arthroscopic acromioplasty. Postoperatively he had clinical symptoms and signs of a left anterior interosseous nerve palsy, with weakness of his left flexor pollicis longus and flexor digitorum longus to the index finger. The index finger weakness resolved within 4 months of surgery; the flexor pollicis longus weakness, however, resolved more gradually, over 18 months.

DISCUSSION

Although cutaneous nerve lesions⁴ and musculocutaneous, ulnar, radial, axillary, and median nerve lesions³ have been reported, we are unaware of previous reports of injuries to the medial pectoral or anterior interosseous nerve complicating shoulder arthroscopy. These injuries are difficult to explain on an anatomic basis. Although nerve lesions may result from interscalene nerve blocks, one of these 3 patients (case 2) did not have such a block.

The medial pectoral nerve arises from the medial cord, and the medial cord is posterior to the axillary artery. The nerve curves forward between the axillary artery and vein and communicates with the lateral pectoral nerve. It enters the deep surface of the pectoralis minor and supplies this muscle. Two or 3 branches pierce the pectoralis minor; others may pass around its inferior (medial) border to end in the pectoralis major,⁶ supplying the sternal head of that muscle. Mechanical injury to the medial pectoral

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nerve before the nerve enters the pectoralis major is difficult to envisage.

Two other possible explanations for direct nerve injuries are anatomic anomalies of the medial pectoral nerve and local compression from fluid extravasation. However, we have found no reports of anatomic variations of the medial pectoral nerve, and fluid extravasation may be expected to result in less specific nerve injury.

Isolated anterior interosseous nerve palsy is also not explainable on the basis of direct portal injury. Injury to the musculocutaneous nerve has previously been documented.³ After giving off the musculocutaneous nerve, the lateral cord continues and joins the medial cord to form the median nerve. Although it is conceivable that the lateral cord could be injured in this region, such injury would not result in an isolated anterior interosseous nerve lesion, as the medial cord (C8, T1) is the major contributor to the anterior interosseous nerve.

We can speculate that forearm compression by the arm traction sleeve may have resulted, in this isolated instance, in a compression neuropathy of the anterior interosseous nerve, but there is no evidence to support this. Another possibility is neurologic injury from the interscalene nerve block.

It is possible that our patient with isolated anterior interosseous nerve palsy had brachial neuritis without other neurologic signs. Brachial neuritis may be idiopathic, being related to a viral illness or trauma. Anterior interosseous nerve syndrome has been reported in the literature.⁷ Wong and Dellon⁷ reported a case of brachial plexus neuritis presenting as anterior interosseous nerve compression. Their case demonstrated clinical findings of isolated anterior interosseous nerve compression 2 months after a viral infection. Electrodiagnostic testing demonstrated more diffuse and subtle changes consistent with brachial neuritis. Their patient recovered function by 7 months.

Although we cannot define the definitive mechanism of nerve injury in these 3 cases, we recommend continued vigilance with respect to the well-known safety measures used in shoulder arthroscopy. We continue to give patients the option of a regional block, but there is a small incidence of nerve injury with these techniques. Urban and Urquhart,⁵ reviewing 266 patients with interscalene blocks for upper limb surgery, found that 9% had mild paresthesias on the first postoperative day and 3% still had neurapraxias at 2 weeks.

Case 4. A 60-year-old man underwent an arthroscopic acromioplasty. During the surgical procedure, the patient was noted to have marked redness of the skin just adjacent to the lateral portal, with 2 anterior extensions of redness. The appearance was consistent with a superficial burn, although the cause of the burn was not appreciated until we noted a similar experience (documented in case 5). The wound healed uneventfully.

Case 5. A 69-year-old man underwent a right shoulder arthroscopy proceeding to an open rotator cuff repair. Six years earlier he had undergone a right shoulder arthroscopic acromioplasty. At the most recent procedure, the patient sustained a superficial burn adjacent to the lateral portal; this was similar in location, size, and appearance to the burn sustained by the patient in case 4. At the time of surgery it was noted that the location of the burn correlated with the path taken by arthroscopic fluid extravasating from the lateral portal. The extravasating fluid was pal-

pated and noted to be hot. The electrosurgery diathermy had been used immediately before this. The fluid volume and flow in the subacromial space had temporarily decreased between the time one arthroscopic fluid bag was emptied and the time the next was opened. The wound healed uneventfully.

Case 6. A 46-year-old company director underwent an arthroscopic acromioplasty. The subacromial space was noted to be "tight," and although the surgeon was satisfied with the placement of the lateral portal, it was moderately difficult to instrument the entire width of the acromion. The diathermy unit was used through the lateral portal to release the coracoacromial ligament from the undersurface of the acromion—a standard technique. The insulated sheath of the diathermy contacted the skin adjacent and directly inferior to the lateral portal and caused a full-thickness 2 × 0.5-cm burn. The burn had developed over a period of up to 2 minutes while the surgeon was watching the arthroscopic monitor. The burn was excised and the skin margins were sutured. The wound healed uneventfully.

DISCUSSION

Use of electrosurgery in arthroscopic procedures implies a risk of iatrogenic thermal injury. This risk can be minimized with good technique. In cases 4 and 5 there was overheating of the irrigation fluid as use of the diathermy unit was continued while the fluid volume and flow were low, at a time when the arthroscopy fluid bags were being changed. We are currently developing a method of measuring the temperature in the subacromial space to further clarify the issue of overheating during surgery.

In case 6 the insulated diathermy sleeve contacted the skin over a 2- to 3-cm length. Although a burn should not result from skin contact with an adequately insulated electrode, this complication can be completely avoided if the skin is not touched by the electrode, especially for prolonged periods. If the lateral portal is too proximal, there is a tendency to place downward pressure on the handle of the diathermy unit to bring the working tip of the instrument into contact with the undersurface of the acromion. Other compounding factors may be patient obesity and an acromion that inclines downward in the coronal plane. Disposable cannulae would also prevent this complication, but we have not found them to be necessary in routine instrumentation of the subacromial space through the lateral portal. We recommend that before the lateral portal is established, the anterolateral corner of the acromion be marked with a needle and the needle be visualized in the subacromial space to assist orientation.

Case 7. A 29-year-old, right-hand-dominant clerical worker underwent an arthroscopic labral debridement, bursectomy, and coracoacromial ligament division. The shoulder was noted to be swollen and cool at the end of the procedure and in the recovery room; however, these features are common after shoulder arthroscopic procedures. Cold packs were not used in recovery. Three days postoperatively the patient was noted to have blistering over the proximal aspect of the arm and adjacent chest wall. Her general practitioner made a provisional diagnosis of cellulitis and treated her with antibiotics. Two areas of full-thickness necrosis developed, one on the inner aspect of the upper arm and the other on the anterior



Figure 1 Severe HO in subacromial space in case 9, complicating arthroscopic acromioplasty, mini-open rotator cuff repair, and subsequent infection.

aspect of the chest; each was approximately 2 cm in diameter. These were treated 3 weeks postoperatively by debridement and split skin grafting. The grafted areas healed uneventfully.

Case 8. A 36-year-old woman underwent an arthroscopic acromioplasty and labral debridement. Toward the end of the procedure, marked diffuse swelling and blanching of the skin around the shoulder were noted; the appearance was similar to that in case 7. The patient was observed and the shoulder kept warm. No areas of necrosis developed, but at 2 weeks postoperatively there was still some firmness to palpation around the anterior portal. This subsequently settled.

DISCUSSION

Swelling around the shoulder is very common during and immediately after shoulder arthroscopy; nevertheless, we can find no other reports of skin necrosis complicating this procedure. There were no obvious precipitating factors in these 2 cases to explain the marked skin ischemia, although in each case marked swelling and extravasation were noted toward the end of the procedure.

Swelling is likely to be more severe with a longer procedure, higher peaks in pressure when a hand pump is used, problems with extravasation of fluid around the inflow portal and, theoretically, a hypotonic irrigation fluid (eg, water). Impaired skin perfusion may result from mechanical compression of skin vessels from high tissue pressures and vasoconstriction caused by adrenalin added to the arthroscopy fluid.

We are cognizant of these potential contributing factors to skin ischemia and advocate abandoning any arthroscopic procedure if swelling becomes severe during the operation. We are careful to minimize use of the hand pump. We no longer routinely use the anterior portal as an inflow portal in arthroscopic acromioplasty, as swelling often occurs around this portal with extravasation of fluid. If increased flow is required for adequate visualization, however, we still use the anterior portal.

Case 9. A 47-year-old, right-hand-dominant construction

worker presented at our clinic for a second opinion; he had a long history of right-shoulder problems and multiple shoulder procedures. He had undergone an arthroscopic acromioplasty and open (deltoid splitting approach) rotator cuff repair. This procedure was complicated by infection. Eight days postoperatively the patient had an open washout of the infected subacromial space and was given intravenous antibiotics. This was repeated twice during the next 2 weeks. A gallium nuclear medicine scan at this time was consistent with osteomyelitis of the acromion. He continued to experience severe pain, especially with movement, and returned to our clinic more than 1 year later for another opinion.

Assessment of the patient was difficult, partly because of his marked expression of pain. Of note, he had had a minor work injury to the elbow 2 years before the shoulder injury, and this had been complicated by a reflex sympathetic dystrophy. Radiographs of the right shoulder demonstrated severe heterotopic ossification (HO) in the subacromial space (Figure 1). An ultrasound scan of the shoulder did not show a rotator cuff tear, and a bone scan and gallium scan did not suggest active infection. Results of blood testing, including white cell count, erythrocyte sedimentation rate, and C-reactive protein, were normal. It was our opinion that the marked ossification in the subacromial space was a major contributor to the patient's symptoms and that no active infection was present.

Approximately 18 months after his index procedure, the patient underwent the operative procedures of right shoulder arthroscopy, open acromioplasty, and removal of extensive subacromial bone at our clinic. The operative findings were an intact rotator cuff, good articular surfaces in the glenohumeral joint, and large ossific spurs in the subacromial space. These spurs were continuous with the acromion anteriorly, laterally, and posteriorly.

At the most recent follow-up, 6 months after surgery, some improvement was noted in the patient's symptoms. There was no recurrence of HO. However, the patient still had significant pain and limitation of movement. No further investigations or surgical treatments were considered appropriate because of psychosocial considerations.

DISCUSSION

HO after acromioplasty has been reported.^{1,2} We have not seen other cases with such marked HO as was noted in case 9. Berg and Cuillo¹ reported the incidence of symptomatic HO after acromioplasty or distal clavicular excision to be 3.2%. In their series of 40 patients with this complication, the incidence was significantly higher in patients with chronic pulmonary disease ($P < .05$).

The patient in case 9 did not have chronic pulmonary disease or any other known risk factors. Risk factors for HO include head injury, burns, ankylosing spondylitis, and (with reference to HO after total hip arthroplasty) bilateral osteoarthritis. It is more common in men over 60 years of age. Apart from being male, the patient in case 9 had none of these features.

Infection, multiple operative procedures, and history of reflex sympathetic dystrophy have not been reported as risk factors for heterotopic bone formation. Apart from the complication of HO, these were the only unusual features of this case.

REFERENCES

1. Berg EE, Ciullo JV. Heterotopic ossification after acromioplasty and distal clavicle resection. *J Shoulder Elbow Surg* 1995;4:188-93.
2. Berg EE, Ciullo JV, Oglsby JW. Failure of arthroscopic decompression by subacromial heterotopic ossification causing recurrent impingement. *Arthroscopy* 1994;10:158-61.
3. Rodeo SA, Forster RA, Weiland AJ. Current concepts review: neurological complications due to arthroscopy. *J Bone Joint Surg* 1993;75A:917-26.
4. Segmuller HE, Alfred SP, Zilo G, Sales AD, Hayes MG. Cutaneous nerve lesions of the shoulder and arm after arthroscopic shoulder surgery. *J Shoulder Elbow Surg* 1995;4:254-8.
5. Urban MK, Urquhart B. Evaluation of brachial plexus anesthesia for upper limb surgery. *Reg Anesth* 1994;19:175-82.
6. Williams PL, editor. *Gray's anatomy*. 38th ed. New York: Churchill Livingstone; 1995. p 1269.
7. Wong L, Dellon AL. Brachial neuritis presenting as anterior interosseous nerve compression—implications for diagnosis and treatment: a case report. *J Hand Surg* 1997;22A:536-9.

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