SURGICAL TREATMENT OF CHRONIC DISLOCATION 
OF THE STERNO-CLAVICULAR JOINT

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The costo-clavicular ligament is always ruptured in dislocation at the sterno-clavicular joint. Anterior, superior or posterior displacement of the medial end of the clavicle may occur. Acute dislocation usually responds to conservative treatment and operation is seldom required. Chronic, or recurrent, dislocation may cause pain and disability on strenuous activity and necessitate surgical treatment. The operation of tenodesis of the subclavious tendon with capsulorrhaphy described by Burrows (1951) has been adopted. The intra-articular meniscus is often damaged and displaced, and may block reduction; its removal is then necessary. In addition, a threaded Steinmann pin transfixing the joint has been found useful to maintain the stability of reduction. The operation has been performed on five patients, four of whom had excellent results. The fifth patient disrupted the repair in a drinking bout shortly after the operation.

The sterno-clavicular joint represents the only synovial articulation between the upper extremity and the trunk. Dislocations of the sterno-clavicular joint are more frequent than often assumed (Brown 1927), and were found to represent 1 per cent of all dislocations in a review of records at Cook County Hospital.

The injury may escape recognition. Pain may be localised to the anterior chest wall and local swelling can mask detection. Radiographs may be inadequate to disclose the displacement.

The proximal part of the clavicle is triangular shaped and is directed downward and slightly forward. Less than one-fourth of the total surface area rests in a shallow depression formed by the fibrocartilage of the sternum and the cartilage of the first rib. This makes a very insecure articulation. The anchoring anterior and posterior sterno-clavicular ligaments and the capsule diverge from the clavicle to the sternum. The costo-clavicular or rhomboid ligament is the major ligament securing the proximal clavicle to the chest cage. It arises on the proximal fourth of the inferior margin of the clavicle and passes obliquely to the first rib. Elevation and depression occur around the horizontal axis through the costo-clavicular ligament while forward and backward motion occurs through a vertical axis of the ligament. (A small bursa is always present between the two layers of the costo-clavicular ligament.) A small round inter-clavicular ligament, concave from above, stretches between the clavicles. These fibres are also inserted into the meniscus and are situated somewhat posterior to the sternum.

The muscles attached superiorly are the sternocleido-mastoid, sternohyoid and sternothyroid and tend to be a deforming force leading to dislocation, while the pectoralis major and the subclavius muscles act as antagonists.

The articular meniscus is located between the clavicle and the sternum. It is attached to the anterior and posterior sterno-clavicular ligaments and to the inter-clavicular ligament. The meniscus divides the joint into two cavities, each of which is lined by synovial membrane. Types of dislocation—Because of the anatomical configuration, dislocation is possible in three directions. For dislocation to occur, the costo-clavicular ligament must rupture. This was noted by Kennedy (1949), Bearn (1967) and Moseley (1969), and confirmed by our studies on cadaver specimens. Anterior, posterior and anterior-superior dislocations occur with rupture of the anterior sterno-clavicular and the interclavicular ligaments. The meniscus is usually detached or ruptured, but may remain attached to the clavicle or stay within the joint. With posterior dislocation, the posterior clavicular ligament is ruptured only after the costo-clavicular ligament is severed. Bearn (1967) has written an excellent summary and analysis of the movements and strength of the sterno-clavicular ligament and DePalma (1959) studied the normal degenerative process of the sterno-clavicular joint. Cave and Brown (1952) described the anatomy of the tendon of the subclavius muscle.

TREATMENT

If the dislocation is not treated, or if it recurs, abnormal motion develops. The meniscus may become detached and displaced, often posteriorly, in a dislocation, and prevents reduction.

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Most authors believe that operation is seldom indicated for an anterior dislocation. Watson-Jones (1955), Waskowitz (1961), Allman (1967) and O’Donoghue (1970) stated that surgical reconstruction of the ligaments or resection of the medial end of the clavicle may be employed if operation is thought necessary. However, symptoms are usually mild. Brown (1961) and Omer (1967) reviewed the literature and found surgical results to be varied. Most authors agree that when conservative measures fail, posterior dislocation may warrant open reduction and fixation, because of the potential hazard to the mediastinal structures.

SELECTION OF PATIENTS

Many patients with dislocation of the sterno-clavicular joint have no disability. Persistent discomfort, swelling and fatigue after vigorous heavy labour or athletic pursuits have been moderately impressive symptoms in our patients subjected to operation. Chronic sterno-clavicular dislocation produces an asymmetrical deformity on the chest which is not very disfiguring and, by itself, has not been an indication for operation. In all of our patients, however, this deformity was reduced significantly.

METHOD OF OPERATION

We have used a slightly modified technique of the surgical procedure described by Burrows (1951). The skin incision is made parallel to and two centimetres below the clavicle from a point over the sternum to just lateral to the middle of the clavicle. The platysma is divided and allowed to retract upward. The clavicular head of the pectoralis major and the sternal head of the sternoclavicular mastoid are sharply dissected from the sternum (Fig. 1). As the periosteal flap is turned downward and laterally, it is incised to expose the plane between the pectoralis major and the subclavius muscle. The subclavius tendon may be identified easily at its attachment to the first costochondral junction, and its fibres traced cephalad and dissected from the muscle fibres. The subclavian vessels pass under the muscle at its lateral edge and care is necessary during dissection in the area.

The sterno-clavicular joint is adequately exposed by this dissection and must now be examined. The meniscus may be found to be attached to the clavicular head, to be lying free within the joint, or, as has been our experience, to be lying posteriorly, frayed and degenerate, and blocking reduction. The synovial joint on the medial side of the meniscus may contain a few millilitres of fluid, indicating synovial inflammation. The joint is debrided of osteophytes and the meniscus, and reduction of the joint is performed.

Two four-millimetre (\(\frac{3}{8}\)-inch) drill holes are created on the antero-inferior and antero-superior aspects of the clavicle and the edges smoothed with a small curette (Fig. 2). The freed subclavius tendon is then placed in the inferior hole and brought out of the superior hole. The tendon is sutured snugly upon itself with heavy synthetic suture material. In our last three patients, reduction has been ensured by placing a threaded Steinmann pin through the sterno-clavicular joint before the tenodesis was performed. The pin is left subcutaneously. A few millimetres gap between the medial clavicle and the sternum is left to prevent contact during the post-operative period.

FIG. 1

Cross-sectional sketch showing dissection through skin and platysma. The clavicular portion of the pectoralis major is elevated subperiosteally. The periosteum is divided inferiorly to identify the subclavius muscle. The tendinous part of the subclavius is along its inferior margin. (After Burrows 1951.)

FIG. 2

The anterior capsule of the sterno-clavicular joint is retracted superiorly. Drill holes are placed in the medial end of the clavicle. Joint debridement and meniscectomy have been performed and the joint reduced and maintained with a threaded Steinmann pin. The subclavius tendon has been identified and detached from the clavicle.
Care is taken to obtain a snug capsular repair of the anterior sternoclavicular ligament. The periosteal attachments of the pectoralis major muscle are carefully reattached to the sternum and clavicle. Fine plain catgut suture is used to close the subcutaneous tissue and fine synthetic suture is used for the skin. A firm compressive dressing is applied. Wound drainage was not used post-operatively. Antibiotics have not been administered.

Post-operative care—The patient wears a stockinet Velpue bandage for at least two weeks after the operation, and then a sling for four weeks. The Steinmann pin is removed between four and six weeks after operation. All patients are allowed to return to light activity at six weeks and unlimited activity at eight weeks after operation. A post-operative radiograph and a discharge radiograph (usually the third post-operative day) are taken to ensure correct pin placement, and again at the first post-operative visit. No haematoma has occurred. The incisions have healed primarily without keloid formation. The skin sutures are removed at fourteen days after operation. We have had no problems with pin migration, breakage, or infection. The pin is left subcutaneously. No difficulty has been encountered in the removal of the pin as an out-patient procedure under local anaesthesia.

CASE REPORTS

Case 1—A twelve-year-old boy presented with a three-year history of frequent recurrent anterior dislocations of the left sternoclavicular joint. These were usually reduced by the brother pulling on the outstretched arm and applying lateral traction with a foot in the axilla. Mild symptoms were always present after vigorous activity and with dislocation; a few days of rest were necessary after reduction was accomplished. After two months of painful, persistent and irreducible anterior dislocation, he was referred to University Hospitals. He had pain and swelling over the sternoclavicular joint after moderate physical activity. The epiphysis was intact and no fracture was identified. The meniscus was found to be detached and displaced posteriorly, preventing reduction. A joint debridement and a tenodesis were performed. Post-operatively, he has maintained alignment and is symptom-free, despite the full activity of a teenage boy.

Case 2—A twenty-year-old pre-medical student experienced pain and swelling in the right sternoclavicular joint while doing hyperabduction exercises a year before he sought medical care. The clavicle was noted to be displaced anteriorly. At operation, the meniscus was degenerate but attached normally to the sternum. The epiphysial plate was not closed or displaced and no fracture was identified. Joint debridement and tenodesis were performed. After operation a Steinmann pin was used for four weeks. At eight weeks he was allowed to return to track and swimming. He has remained symptom-free in these activities. A full, painless range of motion is present on re-examination two years after operation.

Case 3—A twenty-three-year-old male was involved in a motor-cycle accident and dislocated the right sternoclavicular joint four months before referral. He was a horse trainer and breaker and was unable to return to his occupation after the accident. He continued to complain of pain and persistent swelling, even after light activity. At operation, the clavicle was found to be displaced superiorly and anteriorly; the meniscus was fragmented and degenerate, and lay posteriorly within the joint. Joint debridement and tenodesis were performed. A Steinmann pin was used to maintain reduction in this patient who had a known history of a convulsive disorder. The pin was removed easily at four weeks. He returned to his normal work and is without symptoms in all modes of activity. A full range of motion is present and the medial clavicle remains reduced.

Case 4—A fifty-nine-year-old man fell on his shoulder while carrying a heavy bag of corn. He was seen two years later

![Fig. 3](image1)

**Fig. 3**—Anterior and superior dislocation of the clavicle in a man of 59. The medial part of the clavicle had large palpable osteophytes and there was crepitus on movement of the clavicle.

![Fig. 4](image2)

**Fig. 4**—Two years after operation the reduction has been maintained and there were no symptoms.

with complaints of painful snapping at the sternoclavicular joint. Examination showed a large prominence in this muscular man (Fig. 3). This was most prominent with the shoulder abducted fully. Pain and crepitus were present at the sternoclavicular joint. At operation, the meniscus was seen to be fragmented and detached, lying posteriorly within the joint. Large osteophytes were present blocking reduction of the clavicle. The meniscus was removed. The medial end of the clavicle was debrided, tailored and reduced, and anchored to the sternum with a Steinmann pin. A subclavius tenodesis
was performed. The follow-up at two years reveals no deformity and a full, painless range of motion at the shoulder (Fig. 4). The patient has returned to heavy labouring.

DISCUSSION

Most anterior and posterior acute dislocations treated by the authors have been successfully reduced by manipulation and immobilisation with a Velpeau dressing. In two patients the acute superior dislocation could not be so reduced. Open reduction was undertaken with excision of the detached meniscus, transfixion of the sternoclavicular joint with a Steinmann pin and repair of the torn ligaments. A tenodesis has not been performed for acute dislocation as good capsular and ligamentous tissue is available for surgical repair.

In chronic dislocation, the costo-clavicular ligament is damaged and can be absent. In four out of five cases reduction was prevented by a posteriorly displaced meniscus. Both meniscus and joint showed degenerative change in three cases.

Different surgical repairs were performed on cadaver specimens. The operations of Bankart (1938), Burrows (1951), Speed and Smith (1956), Cave (1958), Omer (1967) and Moseley (1969) were compared for technical difficulty and stability of reduction. The tenodesis of Burrows (1951) was technically similar to and easier than the other procedures and proved equally secure. The procedure also has the advantages of requiring a single incision, and of utilising a living dynamic suture with the subclavius tendon. In three patients the procedure was modified to include the Steinmann pin fixation to gain additional stability. This procedure was selected for use and has been performed on seven patients.

Many patients with dislocation of the sternoclavicular joint have had no symptoms. In a similar way chronic dislocation of the acromio-clavicular joint seldom causes symptoms. Men performing heavy labour or vigorous athletic activity seem to have troublesome symptoms at the sternoclavicular joint after dislocation. In our experience, this group of patients complains of weakness and instability when resection of the medial portion of the clavicle has been performed and they have been unable to return to their work. On the other hand, following joint debridement and reduction, and subclavious tenodesis, patients with chronic sternoclavicular dislocation have been able to return to heavy labour.

The use of pins placed across joints must be used with caution. The pin must be drilled slowly and accurately through the centre of the joint to minimise damage to the joint surfaces. The patient must be adequately immobilised post-operatively to prevent breakage and a threaded pin has been used to prevent migration.

REFERENCES