RETROSTERNAL DISLOCATION OF THE CLAVICLE

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Dislocation of the sternoclavicular joint is an uncommon injury. It has occurred in this clinic only one-fifth as often as dislocation of the acromioclavicular joint, a proportion similar to those given by Berkhina (1935) and Cave (1958). The displacement of the clavicle is nearly always anterior; only rarely is it displaced retrosternally.

Neither Bohler (1956) nor Berkhina (1935) had seen a case of retrosternal dislocation. It was seen only once in sixteen hundred shoulder injuries treated at the Massachusetts General Hospital (Cave 1958), and Schlegel (1922) traced only two reports in the records of the German Armed Forces. In all, about fifty cases have been recorded.

The condition is important despite its apparent rarity. The sudden intrusion of the medial end of the clavicle among the structures of the thoracic inlet may produce serious effects from pressure upon the trachea, the oesophagus or the great vessels; sometimes rapid death has resulted.

HISTORICAL REVIEW

Retrosternal dislocation of the clavicle was recorded by Sir Astley Cooper in 1824. The patient had become emaciated from the resulting dysphagia and was relieved by a heroic procedure by Davie of Suffolk. He excised the medial end of the clavicle, protecting the underlying vessels while sawing the bone by inserting "a piece of well-beaten shoe leather." Malgaigne (1855) collected a further eleven cases from the European literature between 1830 and 1848; these included a second report from Sir Astley Cooper. Pressure effects were noted upon the trachea (Rodrigues 1843), the oesophagus (Pellieux 1834) and great vessels (Sir Astley Cooper 1830; Petit, quoted by Malgaigne 1855). In all these cases treatment was by manipulation and immobilisation in braces or binders. Many patients failed to regain full shoulder movement, a fact which Malgaigne attributed to the short period of immobilisation.

Slow spontaneous retrosternal displacement of the clavicle from the repetitive manipulation of a heavy lever was reported by Katzenstein (1903). While under observation the patient developed weakness of his arm and the sternoclavicular joint was then arthredosed with a satisfactory result. Preiser (1911) demonstrated a young girl who could produce this type of dislocation at will by manipulating her shoulder. A loud click accompanied the manoeuvre but in the absence of symptoms no treatment was advised.

Gobell (1914) performed an open reduction of a three-month-old dislocation and maintained the position by fascial slings to both the sternum and first rib. Schlegel (1922) reported a case with compression of the innominate artery; relief was obtained by excising the inner three centimetres of the clavicle. He also reviewed the European literature and noted a case in which the trachea had been lacerated by the clavicle with a fatal outcome (Von Schreiber).

Between 1925 and 1955 sporadic reports of single cases were reported from Europe by Tavernier (1927), Wehner (1931), Niessen (1931), Holmdahl (1954) and Wruhs (1954); from Canada by Kennedy (1949); from the United States by Brown (1927), Greenlee (1944) and Gunther (1949); and from South America by Goni Moreno (1938).

Two of these cases followed direct injury to the anterior aspect of the clavicle (Brown 1927, Wehner 1931), whereas the rest resulted from an indirect blow on the outer aspect of the shoulder. Successful closed manipulation was achieved on only three occasions and in each of these it was necessary to apply percutaneous traction upon the clavicle with bone forceps.
(Wehner 1931), towel clips (Gunther 1949) or a hook (Wruhs 1954) while traction was applied simultaneously to the abducted arm. Compression of the trachea or oesophagus was noted in several of these patients (Niessen 1931, Wehner 1931, Greenlee 1944, Kennedy 1949) and

FIG. 1
Case 1—An antero-posterior view of the right shoulder. The medial end of the right clavicle has been displaced almost to the midline of the manubrium where it is partly obscured by mediastinal shadows.

FIG. 2
Case 1—The dislocation has been reduced and the position maintained by an intramedullary wire, which was removed six weeks later.

was associated in Niessen's patient with pressure upon major vessels and the brachial plexus. Dewar (quoted by Kennedy 1949) recorded a death from haemothorax.

Over the past five years there have been three reports of multiple cases. Ferry, Rook and
Masterson (1957) successfully treated five cases by manipulation and immobilisation in a Velpeau binder. Stein (1957) achieved reduction in two cases by prolonged skin traction to the forearm with the shoulder abducted 100 degrees. A third patient required open reduction; the clavicle in this case was wired to the first rib but the dislocation subsequently recurved and became habitual. More recently Paterson (1961) reported three patients all of whom required open reduction: two of the patients had dyspnoea or dysphagia.

On rare occasions retrosternal displacement of the medial end of the clavicle has occurred with simultaneous dislocation of its lateral end, or of the opposite sternoclavicular joint. Beckman (1923) reviewed sixteen cases of total or bipolar clavicular dislocations, and in only one did the medial end pass retrosternally. A similar case has since been reported in which both the sternoclavicular and acromioclavicular joints were stapled successfully (Prat 1936). Bilateral sternoclavicular dislocation has been reported with both clavicles passing retrosternally or with an asymmetrical presternal and retrosternal displacement (Hotchkiss 1896, Stapelmothr 1932).

**Fig. 3**
Case 1—After five years the patient has a full range of painless movement.

**Fig. 4**

**CASE REPORTS**

**Case 1**—In 1955 a twenty-one-year-old dental student sustained a blow on the lateral aspect of his right shoulder during a football match. He experienced great discomfort in the neck and shoulder, and on resuming play became intensely dyspnoeic. A medical bystander manipulated the shoulder with considerable improvement in respiratory function. On subsequent examination the patient stood with his neck flexed to the injured side and the right shoulder braced forward. Abduction of the arm increased his respiratory discomfort. The normal outline of the clavicle was absent and the inner half could not be felt. Radiological examination revealed that the clavicle overlapped the manubrium almost to the mid-line (Fig. 1). Attempted reduction by traction on the arm with the shoulder widely abducted failed because the clavicle could not be manipulated into the joint, which was then explored and the medial end of the clavicle was found firmly wedged behind the manubrium. The posterior part of the capsule was torn but the meniscus had been avulsed from the clavicle and remained attached to the manubrium. The dislocation was reduced with considerable difficulty and reduction was maintained by an intramedullary wire passed from the medial third of the clavicle, across the joint and into the manubrium (Fig. 2).

The patient's arm was bound to his side for six weeks after operation, when the wire was removed under local anaesthesia. He regained a full painless range of shoulder movement and over the past five years has played football without further trouble (Figs. 3 and 4).
Case 2—In 1959 a twenty-year-old welder and boilermaker sustained a superior subluxation of the medial end of his right clavicle. Displacement was minimal and he wore a sling until the pain subsided. In July 1960 during a football match the patient fell on his back and an opponent fell in a kneeling position on his clavicle. He suffered great discomfort in his neck and shoulder but was able to finish the game. He then sought medical advice, but only antero-posterior radiographs were taken and the dislocation was overlooked because the sternoclavicular joint was obscured by mediastinal shadows.

Three days later he returned suffering from extreme dysphagia. There was obvious asymmetry of the shoulders. His neck was flexed to the right and the injured shoulder was held forward. The right shoulder appeared flat due to depression of the clavicle with consequent loss of the supraclavicular and infraclavicular fossae. The absence of the normally prominent medial extremity of the clavicle was striking. There was considerable soft-tissue swelling and bruising over the sternoclavicular joint. No evidence of pressure upon vessels or nerves was detected and there was no surgical emphysema in the neck. Radiographic examination in oblique and lateral planes confirmed the diagnosis (Fig. 5) and also revealed a wedge fracture of the anterior lip of the articular surface of the clavicle.

Reduction was attempted by prolonged traction with wide abduction of the shoulder while an effort was made to push the clavicle forward. The patient immediately noticed that his breathing was improved although he had not previously complained of dyspnoea. Further radiographs revealed that the clavicle had returned to its previous subluxated position but with rather greater displacement than before.

The position was maintained by a figure-of-eight binder and his dysphagia improved rapidly. He returned to his trade after three months but was still troubled by pain on wide abduction of the shoulder. After six months he had a full range of painless movement of the shoulder but still complained of pain over the sternoclavicular joint after prolonged overhead welding.

DISCUSSION

Retrosternal dislocation of the clavicle was recorded in 1841 by Guérin (Stapelmohr 1932) in a foetal monster with multiple skeletal abnormalities. A few cases appear to arise spontaneously (Cooper 1824, Katzenstein 1903, Preiser 1911) but most follow violence to the shoulder.

A blow on the postero-lateral aspect of the shoulder will brace the shoulder forward and also apply an impacting force down the shaft of the clavicle. This usually occurs in wrestling
or football—when the patient is thrown on to his shoulder under the weight of an opponent—or when a squash player crashes into the wall with his shoulder braced forward at the completion of a forehand stroke. The costoclavicular ligament acts as a fulcrum to the forward movement of the outer end of the clavicle (Niessen 1931) to produce a small but powerful backward movement of the very short part of the clavicle medial to the ligament. This movement is at first between the meniscus and the manubrium (Cooper 1824) but if continued beyond the physiological range the meniscus tears, usually remaining attached to the sternum. The impacting force down the shaft of the clavicle then drives the medial end of the bone over the edge of the manubrial articular notch, the capsule is disrupted and the articular surfaces may be fractured (Niessen 1931, Greenlee 1944). The pressure symptoms produced depend on the obliquity of the clavicle at the time of its impaction into the thoracic inlet. Paterson (1961) has drawn attention to an abnormal orientation of the articular plane as a predisposing factor in this injury.

The diagnosis can usually be made on clinical grounds. The injured shoulder is held forward with the neck flexed to that side. The shoulder appears flat anteriorly because of the depression of the clavicle with loss of the supraclavicular and infraclavicular fossae. The sternomastoid muscle on the injured side may be less prominent (Tavernier 1927) and the empty articular notch on the manubrium may be palpable (Wehner 1931, Goni Moreno 1938). Radiographic confirmation may require special views (Goni Moreno 1938) and tomography may prove very useful (Paterson 1961).

The dislocation is difficult to reduce. Ferry, Rook and Masterson's (1957) experience in successfully manipulating five cases appears unique. Others have found great difficulty in reducing the dislocation even with the parts displayed at operation. Much depends on the duration of the dislocation and the extent of displacement. Ferry points out that none of his patients suffered obstructive symptoms within the thoracic inlet and that displacement may not have been great.

A neglected or incompletely reduced retrosternal dislocation of the clavicle constitutes a constant danger to the patient. Further displacement, either spontaneous or with another injury, is common (Katzenstein 1903, Niessen 1931, Holmdahl 1954) and open reduction is therefore advisable.

If open reduction is stable, simple capsular repair may be sufficient (Greenlee 1944); additional internal fixation may be necessary and intramedullary wire across the joint, successfully used by Kennedy (1949), was also used in one patient reported here. The articular surfaces have been wired together (Brown 1927, Goni Moreno 1938, Holmdahl 1954) or the clavicle wired to the first rib (Stein 1957). Niessen (1931) devised a variation of Marxer's fascial sling operation.

Resection of the medial end of the clavicle effectively relieves soft-tissue pressure (Cooper 1824) without greatly reducing shoulder function (Schlegel 1922). In the second of the two patients described here it is planned to perform this procedure if dislocation recurs. It was considered that open reduction would be both difficult and unstable in the presence of both long-standing subluxation and a fracture of the articular surface. Arthrodesis of the sternoclavicular joint (Katzenstein 1903) or conversion of a retrosternal to a pre sternal dislocation (Stapelmohr 1932) appears unnecessary.

SUMMARY

Retrosternal dislocation of the clavicle is an uncommon yet easily induced injury which may cause grave disability. Manipulation is rarely successful and usually open reduction with stabilisation of the joint is required. The literature on this subject is reviewed and an additional two cases are reported.
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