

Summary

Operative treatment of the carpal tunnel syndrome has proved, in our hands at least, to give less certain and less complete relief than is commonly believed and certainly less good results than have been suggested in recent annotations (*British Medical Journal* 1961, *Lancet* 1965) or in the majority of recent reports on the subject (e.g. Kremer *et al.* 1953, Kendall 1960, Garland *et al.* 1963, Crow 1960).

Improved diagnosis using nerve conduction time measurements in doubtful cases and, perhaps, the wider use of neurolysis and excision of underlying synovial sheaths may improve the results, but there appear to be a significant number of correctly diagnosed and adequately treated cases of carpal tunnel syndrome which are unrelieved or only partially relieved by operation. It therefore seems wise to give a more cautious prognosis, particularly when numbness and wasting are present pre-operatively. Operative treatment does, however, have the great advantage over conservative treatment in that it appears to produce a permanent result with little or no danger of relapse, particularly as regards the disturbing night pain.

Acknowledgments: I am grateful to Mr Austin Brown, Mr Walter Laurence and Mr J C F Lloyd Williamson for allowing me to carry out this survey on their patients.

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Arthrographic Changes in Frozen and Post-traumatic Stiff Shoulders

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The arthrographic changes seen in the established frozen shoulder were first described by Neviaser in 1962 and the pathological findings were reported by the same author in 1948. The changes found in this series of patients with frozen shoulders were essentially the same as he describes but those in post-traumatic stiff shoulders differed markedly from this.

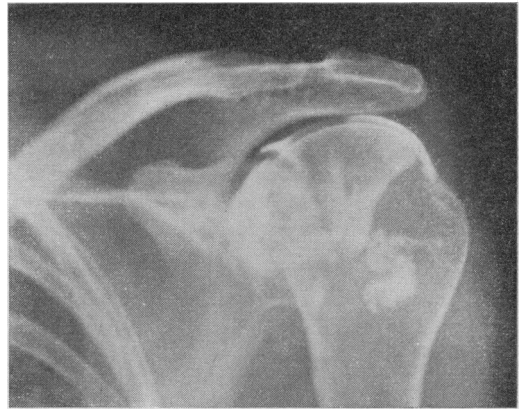


Fig 1 Antero-posterior view of frozen shoulder showing absence of subscapular bursa and no filling of biceps tendon sheath

Arthrographic Appearances

Frozen shoulders: Seventeen patients, with at least a three months' history of pain and increasing stiffness. Only one of this group, a man of 47, developed a frozen shoulder after injury, and it began ten days after a dislocation of the shoulder; there was no known precipitating factor in the other patients. Pain was subsiding or had subsided at the time of arthrography.

In each patient there was a gross reduction in joint volume, 0.5–3 ml of Hypaque and lignocaine mixture only being injected at pressures up to 1,000 mmHg. The injected radio-opaque medium outlined a small meniscus between the head of the humerus and the glenoid (Fig 1), with a greater or lesser amount of medium over the head posteriorly (Fig 2) depending upon the amount of injectable fluid. There was failure to fill the subscapular bursa, the bicipital tendon sheath and the axillary pouch in all instances.

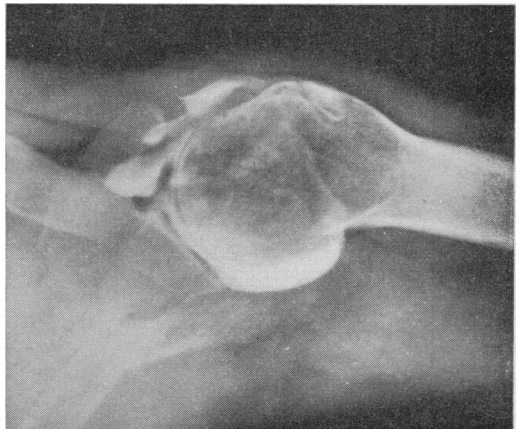


Fig 2 Axial view of frozen shoulder showing less restriction of posterior distribution of dye than anterior



Fig 3 Antero-posterior view of post-traumatic stiff shoulder showing partial loss of subscapular bursa, some restriction in joint volume and obliteration of the inferior pouch but good filling of the biceps tendon sheath

Post-traumatic stiff shoulders: Twenty-two patients. There is again reduction in joint volume with loss of the inferior pouch but the subscapular bursa is still present though reduced in size; some dye enters the bicipital sheath (Fig 3). These joints accepted 5–9 ml of medium and it was possible to distend the joint and introduce a further 2–5 ml of fluid by raising the injection pressure to 1,200–1,800 mmHg (Figs 4 & 5).



Fig 4 Antero-posterior view of post-traumatic stiff shoulder before distension

Effect of Manipulation

Frozen shoulders: Two patients had their shoulders manipulated under direct vision through a deltopectoral incision. An increase in abduction was obtained only by rupture of the inferior capsule close to the glenoid margin and external rotation by rupture of the subscapularis tendon at its insertion, commencing at its inferior border and progressively rupturing higher up with increasing rotation. The underlying capsule was ruptured at the same time.

The surface of the subscapularis tendon was seen to be injected at operation but the underlying capsule showed no evidence of hyperæmia. Though not adherent to the head, the synovial membrane was closely applied to it and contracted; the inferior pouch and subscapular bursa were adherent on their adjacent surfaces and could only be partially separated by blunt dissection. It was not possible to pass a probe into the bicipital tendon sheath, which was densely obliterated, and it appeared that antero-posterior stability of the shoulder was maintained after manipulation by the biceps tendon being immovable in its sheath, so forming a natural Nicola procedure. No acute inflammatory reaction was seen in the synovial membrane as reported by McLaughlin (1961), though in other respects the findings of the synovial membrane were similar. Manipulation of the shoulder was not accompanied by bleeding from synovial membrane, capsule or subscapularis tendon.

Arthrographic findings on manipulation: The tearing sensation associated with manipulation of the frozen shoulder was followed by loss of dye shadow; further injection of radio-opaque medium into the shoulder was immediately associated with an efflux of medium out through the hole in the capsule (Fig 6) which tracked down-

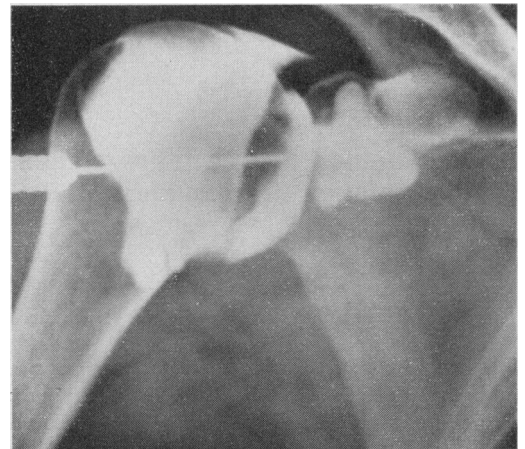


Fig 5 Same shoulder as Fig 4 after distension at 1,750 mmHg



Fig 6 Post-manipulative arthrogram in a frozen shoulder

wards to the region of the shaft of the humerus. This effect is distinct from that seen in capsular rupture following dislocation when the medium leaves the antero-inferior defect and tracks first downwards into the axilla and then upwards across the anterior surface of subscapularis in the region of the neck of the scapula following the path taken by the head of the humerus when dislocating.

Post-traumatic stiff shoulders: None of these was exposed at operation. During manipulation the medium was forced out of the subscapular bursa by external rotation and over the head. Abduction forced the head on to the inferior capsule and more dye into both the subscapular bursa and the bicipital tendon sheath. After manipulation it was possible to instil another 3 or 4 ml of radio-opaque medium with ease, the subscapular bursa and head shadows being larger and the inferior pouch partially distensible (Figs 7 & 8).

Effects of Joint Distension under Pressure

Normal shoulders were found in cadavers to rupture at pressures between 1,400 and 2,000 mmHg when examined within twenty-four hours of death, rupture occurring either at the antero-inferior portion of the capsule anterior to the triceps origin or in the bicipital tendon sheath.

Frozen shoulders: No patients with severe pain and early loss of movement were treated by this means. It was not found possible to distend the joints of these patients immediately after pain had ceased; the radio-opaque medium leaked back along the needle track with intra-articular pressures in the region of 850–1,500 mmHg. However, when the earliest signs of return of function had occurred it was possible to distend the joint progressively by serial intra-articular injections between 1,000 and 1,500 mmHg, the minimum pressure being

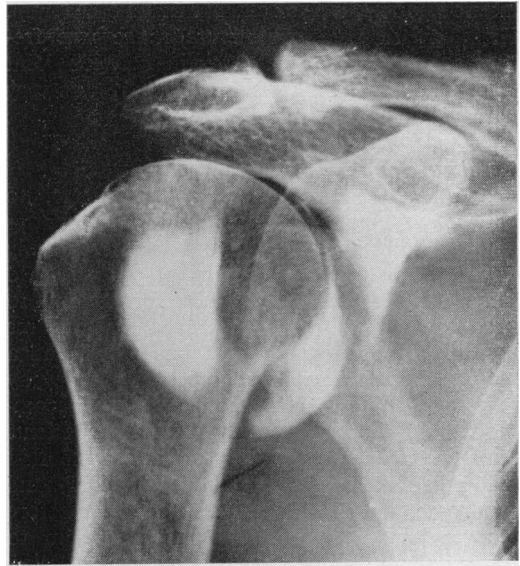


Fig 7 Post-traumatic stiff shoulder before manipulation

used which will just cause joint distension. A rapid rise in pressure without increase in joint capacity, as observed by means of the image intensifier, immediately precedes capsular rupture and this should therefore be done using a pressure recorder and continuous radiological screening.

Post-traumatic stiff shoulders: An increase in joint capacity was produced in these patients using intra-articular pressures between 1,200 and 1,800 mmHg and when it was successful both the

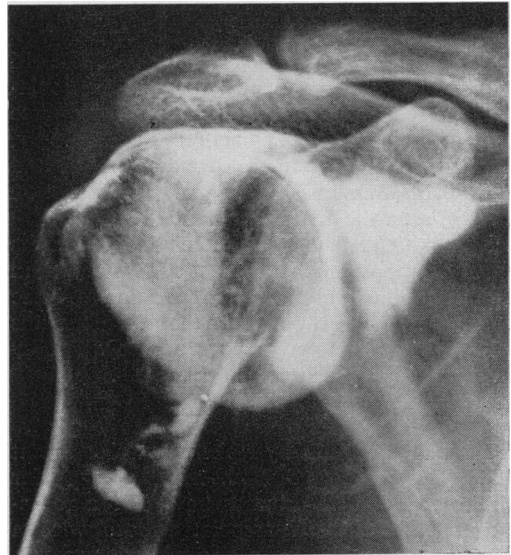


Fig 8 Post-manipulation arthrogram of the shoulder seen in Fig 7

inferior pouch and subscapular bursa opened up. However, the higher pressure range was frequently needed and the margin between joint distension and bicipital sheath rupture was very narrow.

Results of Treatment

Frozen shoulder: In a series of 15 patients, no patient was improved seventy-two hours after manipulation; one month post-operatively only 4 were showing clinical signs of an increased range of movement and these progressed to practically a full range of movement by three months. Of the remaining 11 patients, 4 had a recrudescence of pain and repeat arthrography revealed a minimal gleno-humeral space accommodating 1–2.5 ml of medium; 2 of these patients remained frozen for two years after the first manipulation, one with a full shoulder-hand syndrome, and the other 2 took one year before recovery was complete. Six patients began to recover three to four months after manipulation and recovery was completed by six months. One of these patients was arthrographed five weeks after manipulation and before recovery started; at this stage there was still a large anterior capsular defect (Fig 9). One further patient did not begin to recover until six months after manipulation, recovery being completed by one year.

In 2 patients the effects of serial distension were observed. In neither patient was the post-operative pain observed and the increased range of movement obtained at distension was maintained; one patient recovered in eleven weeks and the other in fifteen weeks.

Post-traumatic stiff shoulder: None of the 16 manipulated cases was made worse by manipulation. Thirteen of these had recovered by three months and a further 2 by six months. One only, a man who had sustained a fractured head and neck of his humerus, had significant restriction one year after the first manipulation.

Eight patients had serial distension. The results were not apparently as good as manipulation in either the range of movement regained or the recovery time which was more than three months in each case; all were recovered, however, by seven months after distension treatment.

Discussion

The distinction made by Robert Jones & Lovett (1923) between two different types of shoulder stiffness on clinical grounds have also a radiological differentiation associated both with a different prognosis and a different response to manipulation. The tearing sensation in frozen shoulders on manipulation is associated with

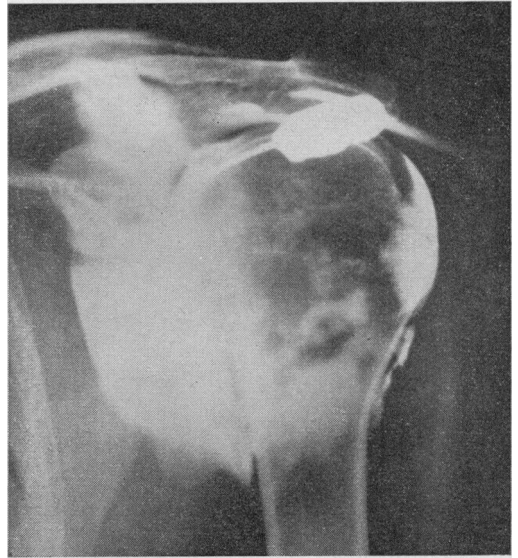


Fig 9 Arthrogram showing leakage of dye from an anterior capsular defect five weeks after manipulation of a frozen shoulder and before recovery had commenced

a rupture of the subscapularis tendon at its insertion, a procedure performed surgically by DePalma when he transplanted the tendon to the coracoid process in patients with persistent frozen shoulders (1953). The effects of manipulation in this series compare unfavourably with the results of Lloyd-Roberts & French (1959) who had a 58% recovery at three months in their manipulated group and a 29% in their control group – in this series 4 patients (27%) had recovered at three months. Six-month recovery figures were, however, comparable, 67% in this series, 68% in Lloyd Roberts & French's manipulated series and 44% in their control series.

The 2 patients who had serial distension both recovered in about three months. This method deserves a further trial in both late and early cases as it appears to cause little disturbance to the patient; any gain in range of movement is not temporary as it always is for a short while after manipulation due to the post-manipulation pain.

The post-traumatic stiff shoulders did not sustain a capsular rupture at manipulation and all showed a good response to manipulation; serial distension here was not as effective as manipulation and has nothing apparently to offer these patients in contrast to its effect in frozen shoulders.

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