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ARTHROGRAPHY AND MANIPULATION IN RIGIDITY OF THE SHOULDER JOINT

By

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Rigidity of the shoulder joint may be the predominant symptom in humeroscapular periarthritis. Within this heterogeneous group, the nomenclature distinguishes the true "frozen shoulder".

In cases of existing rigidity the limitation of the mobility may be forced by manipulation. Ever since this form of treatment was introduced by *Duplay* (1872) its value has been doubted. For various reasons it is difficult to asses its therapeutic effect.

The arthrographic findings in rigidity of the shoulder joint have been described by *Bateman* (1955) and in more detail by *de Sèze* (1961). The changes appear to consist in obliteration of the articular recesses. *Neviaser* (1962) has published arthrograms of two manipulated frozen shoulders in which the contrast medium escaped through tears at the site of the obliterated medial axillary fold. At arthrography two months later, when mobility had been re-established, the joint was of a normal appearance. That healing of capsular damage due to traumatic dislocation of the shoulder joint may occur in 1–4 weeks has been demonstrated arthrographically by *Pettersson* (1942).

Mainly on *Neviaser*'s (1945) investigations of exposed rigid shoulders, the anatomical basis of the rigidity has been considered a thickened synovial capsule. *Neviaser* suggested the term "adhesive capsulitis". According to *Bosworth* (1940) and *Wahren* (1942) the limitation of movements was supposed to be due to adhesions within the subacromial and the subdeltoid bursa respectively. *Lippman* (1941) stated that the same would result from adhesions to the biceps tendon, especially in its intraarticular course. *Lidström* (1963) found that firm

adhesions beneath the coracoid process and in the subacromial space were in most cases the main cause of the rigidity. Although preoperative arthrograms showed pronounced tightness of the capsule with partial obliteration of the medial axillary fold, he considered the adhesions within the articular recesses to be of subordinate importance. On the other hand, *de Sèze,* on the basis of the above-mentioned arthrographic studies (1961) and also of autopsied cases of shoulder rigidity (1960), feels that the anatomical basis of rigid shoulders is merely retraction of the joint capsule, not tendinitis, biceps peritendinitis, obliterative bursitis, or "adhesive capsulitis".

DePalma (1954) has reported damage to the subcapsular tendon during manipulation under anaesthesia. Although several workers, including *Payr* (1931), *McLaughlin* (1961), and *Meulengracht & Schwartz* (1952), have their misgivings owing to the risk of damage, the method has been preferred by others, *e.g. Klapp* (1916), *Reschke* (1919). *Withers* (1949), *Bloch & Nauta* (1951), and *Charnley* (1959). *Lidström* (1963) believed that the increased mobility during manipulation was due rather to rupture of the tissues on the anterior aspect of the joint than to a loosening of the adhesions between the tissue layers. This was, in his opinion, an explanation of the varying results of the manipulative procedure.

Thus, opinions are divided concerning the anatomical cause of the rigidity. What happens in manipulation has not been clearly substantiated, and warnings have been sounded that it may damage vital articular structures.

These aspects have been elucidated by arthrographic studies on a series of patients with shoulder rigidity of various causes treated by manipulation and reported below. However, the therapeutic result will not be discussed here.

MATERIAL AND METHODS

Manipulation under general anaesthesia has been part of the routine treatment of shoulder rigidity in the Orthopaedic Clinic, Jönköping, since 1956. In order to check the effect of the manipulation, arthrography was done in a number of cases immediately before the procedure. After the manipulative procedure the shoulder was X-rayed again, utilizing the remaining contrast medium. In all cases the manipulation was performed to the full extent. The elevation was detached with the arm in external rotation. Internal rotation and extension were

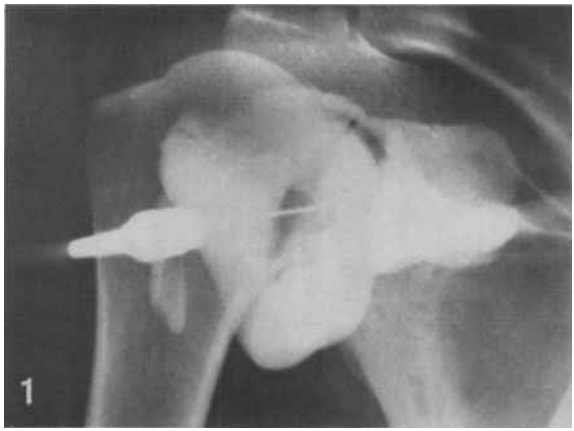


Fig. 1.
Arthrographically normal axillary fold.

forced with some caution, considering the possibility of damage to the rotator cuff.

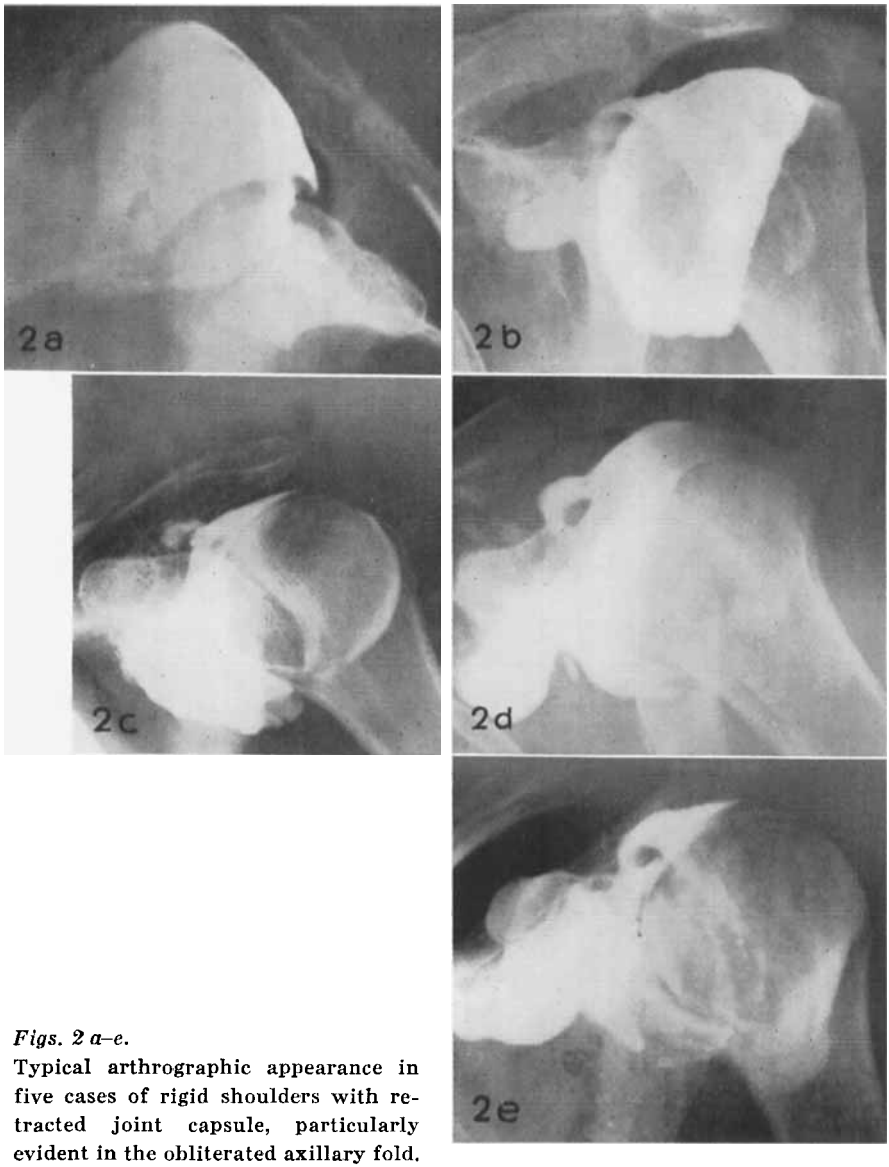
By this technique, the appearance of the joint could be studied in connection with 63 manipulative procedures.

Prior to the manipulation 45 shoulders showing varying rigidity of different aetiology were visualized by arthrography. In 33 cases the underlying cause was humeroscapular periarthritis in 6 cases rupture of the rotator cuff, while 6 shoulders were rigid following healing of fractures close to the shoulder joint or surgical procedures on the joint. The majority showed a limitation of movement which only permitted an elevation to less than 120°, others a somewhat greater elevation, but never beyond 150°.

After the manipulative procedure, 59 arthrographic check-up films could be assessed. In 45 the diagnosis was humeroscapular periarthritis, in 7 rupture of the rotator cuff, while in 7 there were other anatomical changes.

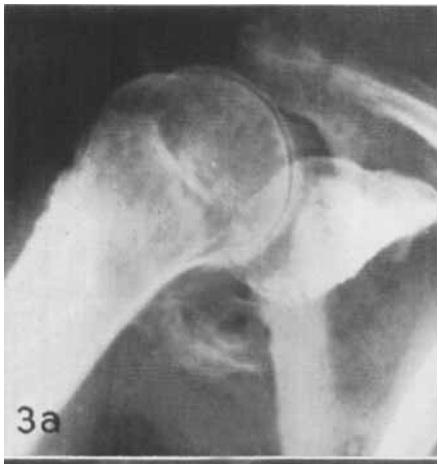
RESULTS AND DISCUSSION

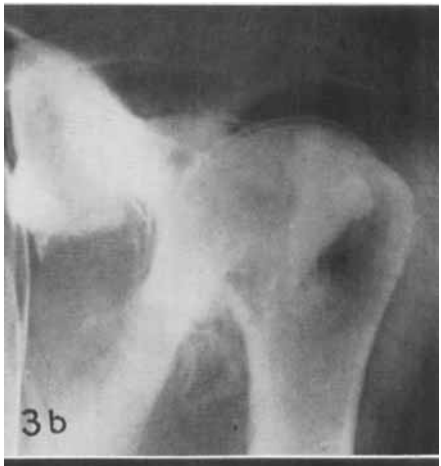
Regardless of the pathogenesis, the pre-manipulation arthrographies were characterized by obliteration of the articular recesses, most marked in the medial axillary fold (Figs. 2 a–e). Corresponding to the degree of capsular retraction, the joint took o smaller amount of contrast medium (cf. *de Sèze* (1961). In only 4 cases, all due to humeroscapular periarthritis, was there an inclination to classify the joint capsule as

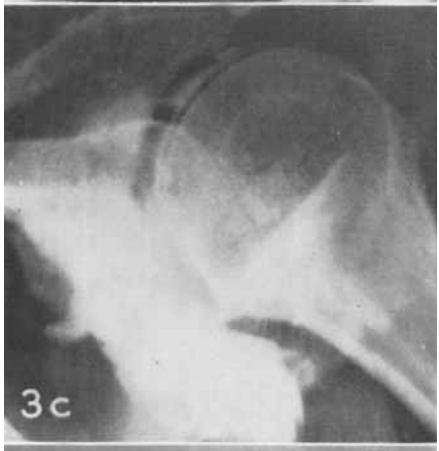


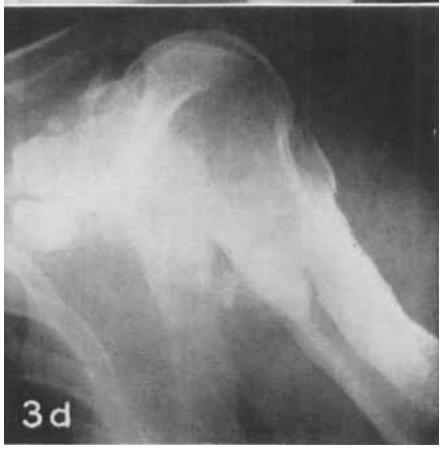
Figs. 2 a–e.
Typical arthrographic appearance in five cases of rigid shoulders with retracted joint capsule, particularly evident in the obliterated axillary fold.

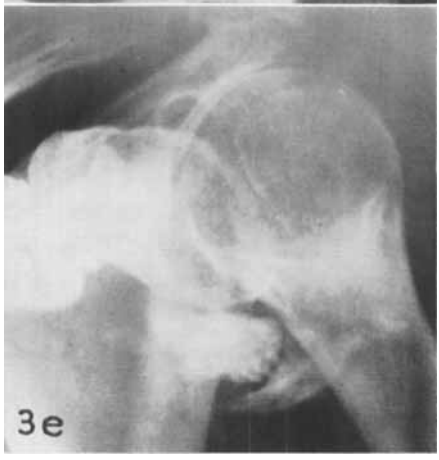
normal; nevertheless, rupture of the capsule, as described below, occurred during the manipulation in 3 of these 4 cases. In the remaining case the limitation of movement was due to pronounced pain inhibition. All 6 cases with rupture of the rotator cuff showed capsular obliteration, in keeping with *Lidström*'s (1963) observations, thus representing one



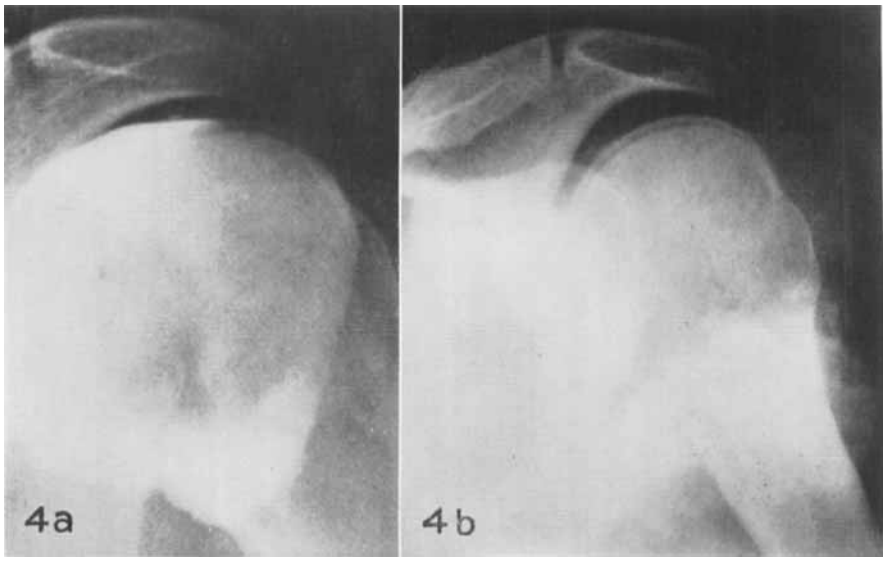


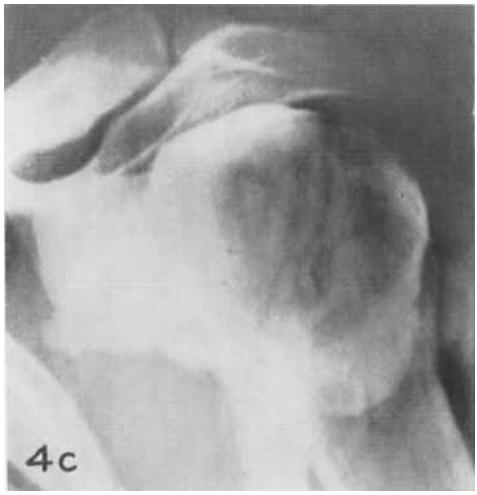






Figs. 3 a–e.
The same cases as in Fig. 2, after manipulation. The contrast medium has penetrated through tears in the retracted capsule and may be seen in irregular deposits around the joint, mostly in the vicinity of its medial border.

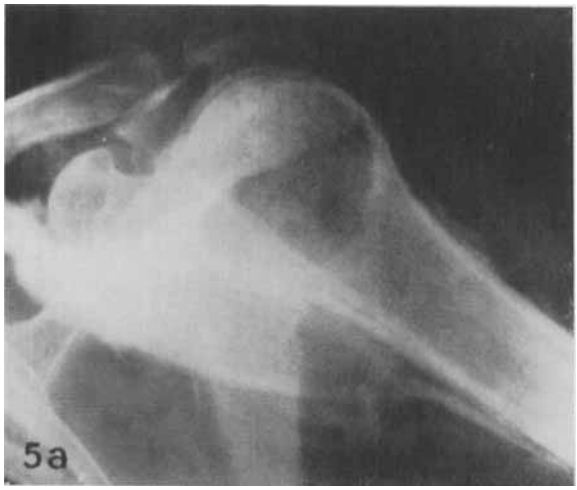




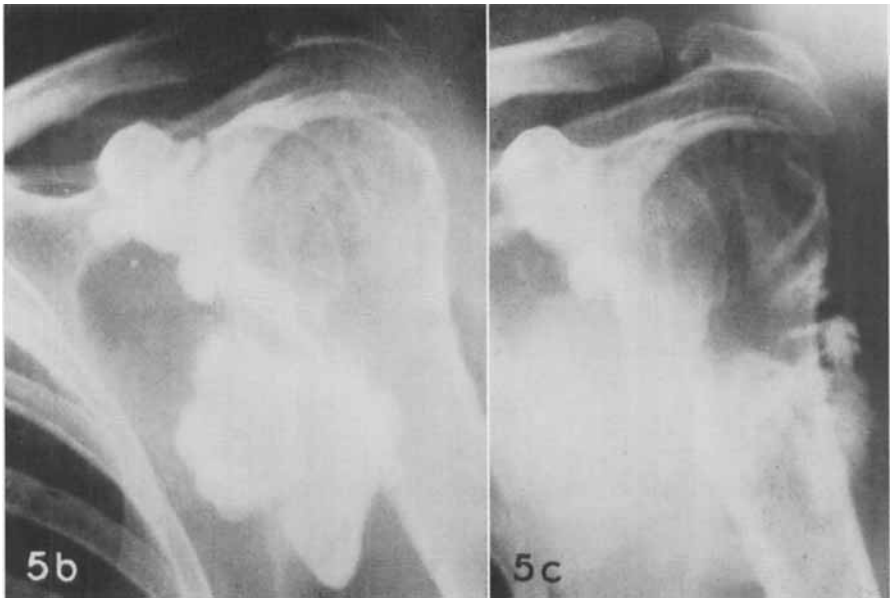
Figs. 4 a–e.
The typically retracted joint capsule of a rigid shoulder re-formed 3 weeks after manipulation procedure (4 a). Re-manipulated, with typical rupture of the capsule (Fig. 4 b) and again retracted 6 months later (Fig. 4 c).

cause of frozen shoulder. In all the pre-manipulative arthrograms the joint spaces presented themselves as uninterrupted contrast shadows, militating against the occurrence of adhesions between the joint surfaces.

The arthrographic check-up after the manipulative procedure also showed typical appearances. Now, the greater part of the contrast medium was outside the joint, mainly on its medial side, on a level with the neck of the humerus, but also beneath the coracoid process



Figs. 5 a–c.
The contrast medium has accumulated around the joint in a typical fashion after manipulation of rigid shoulder (Fig. 5 a). Six weeks later the mobility is still limited, apparently by a constriction in a re-organized pouch resembling the axillary fold (Fig. 5 b). Full function was restored by re-manipulation (Fig. 5 c).



and laterally. The films showed, more or less distinctly, the leakage of contrast medium which had occurred through ruptures in the changed joint capsule, and which could be correlated to the typical sounds heard during the manipulation (Figs. 3 a–e). It was only in one of the 4 above-menitoned cases that no leakage could be traced.

In 2 instances, the manipulation was performed after operative exposure of the shoulder from the anterior aspect. Thereby, the inter-

pretation of the arthrographic films could be confirmed. In both instances a capsular tear was palpable at the site of the medial axillary fold. Through this slit the naked joint surface and the shaft of the humerus could be palpated. This is in exact confirmity with the description given by *Neviaser* (1945) after the dissection of 10 frozen shoulders exposed to forced abduction: "The capsules were separated ..... the two cut edges retracted, leaving a gap of about 2 centimetres".

Judging by the arthrographic check-ups, no damage was done to the tendon apparatus. All 36 cases with intact rotator cuff on the pre-manipulative arthrographies who were also arthrographed after the manipulation, again showed intact tendon apparatus.

Even where the rigidity was a consequence of juxtaarticular fractures or arthrotomy, there was arthrographically a characteristic obliteration of the joint capsule before the procedure as well as a typical capsular rupture after the manipulation. However, the limitation of movements was usually of a different quality. The resistance to the manipulation is tough and more definitive, presumably a sign of co-existing contracture or fibrosis of periarticular structures.

The appearance of the joint capsule at various times after the manipulation could also be studied in connection with re-manipulation of shoulder joints which still remained rigid. In 6 out of 11 cases a capsular leakage was demonstrable on arthrographies 10 days to 6 weeks after a manipulative procedure. In the remaining 5 it had healed 10 days to 6 months later, and the capsules were again more or less retracted (Figs. 4 a–c, 5 b).

SUMMARY

A series of rigid shoulders was studied arthrographically before and after manipulation under general anaesthesia. An almost constant finding on the pre-manipulative arthrograms was obliteration of the articular recesses. The changes of the joint capsule were similar, regardless of the underlying cause. On the basis of these findings, shrinkage or retraction of the joint capsule, most marked in the medial axillary fold, seems to constitute an anatomical bases, if any, of the limitation of movement in rigid shoulders.

An equeally constant finding on the post-manipulative arthrograms, and also independent of the aetiology, was rupture of the changed joint capsule. The distribution of the contrast medium indicates that during a manipulative procedure the retracted joint capsule ruptures, arthrographically visualized mainly at the site where the retraction is as a

rule most marked, *i.e.* in the medial axillary fold. When the capsular retraction also comprises the subcapsular recess, the rupture may also include this structure and other parts of a changed joint capsule, making up a presupposition of increased mobility.

The material gave no evidence of damage to the rotator cuff during the manipulation.

In cases where mobility is not attained by the manipulation, the ruptured joint capsule may resume its retracted shape.

RESUME

Une série d'épaules raides ont été étudiées arthrographiquement tant avant qu'après la mobilisation sous narcose.

Une des trouvailles pratiquement constantes a été une oblitération du recessus de la capsule articulaire. Les modifications de la capsule articulaire ont été similaires, quel que soit le diagnostic. La rupture de la capsule articulaire modifiéee enregistrée sur les arthrogrammes après la mobilisation est tout aussi constante et indépendante de l'étiologie. On n'a aucune preuve que la mobilisation ait provoqué une lésion de l'aponévrose. La capsule articulaire rompue peut dans les cas où la mobilité n'a pas été obtenue après la manipulation reprendre sa forme rétractive.

ZUSAMMENFASSUNG

Eine Reihe von steifen Schultern wurden sowohl vor als auch nach der Mobilisierung in Narkose mittels Arthrographie untersucht.

Ein nahezu konstanter Befund was dabei eine Obliteration der Gelenksrezesse in den vor der Mobilisierung aufgenommenen Arthrogrammen. Die Gelenskapselveränderungen waren die gleichen unabhängig von der Diagnose. Ebenso konstant und unabhängig von der Ethieologie wurde eine Ruptur der veränderten Gelenkskapsel in Arthrogram nach der Mobilisierung beobachtet. Haltepunkte, dass es bei der Mobilisierung zu einer Schädigung der Aponeurose kommt sind niemals vorhanden gewesen.

Die rupturierte Gelenkskapsel kann in den Fällen in denen Beweglichkeit nach der Mobilisierung nicht erreicht wurde, ihre retrahierte Form wiedereinnehmen.

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