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FRACTURE OF THE SCAPULAR NOTCH ASSOCIATED WITH LESION OF THE SUPRASCAPULAR NERVE

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Fractures of the scapula are not common. Due to the muscular coverage and the ability of this bone to glide and recoil in relation to the chest wall, considerable violence is needed to cause the fracture. The scapula fracture is generally one among other injuries caused by a serious trauma, often a crush injury. In a comprehensive study Rowe (1963) found fractures of the scapula to have occurred in 54 out of 1,603 injuries of the shoulder girdle. According to DeCoulx et al. (1956) the fractures of the scapula may be classified anatomically in three groups: I. Fractures of the body, II. Fractures of the apophysis, III. Fractures through the superior lateral angle. In the latter type the scapular notch may be involved by the fracture.

Anatomy

The scapular notch (incisura scapulae) of the superior lateral angle of the scapula is of varying dimensions and shapes but most often forms an approximately 2 cm deep, 1 cm wide "bay" of the scapula bone (Figure 1). Laterally the incisure is bordered by the base of the coracoid process. The incisure carries the mixed sensory and motor suprascapular nerve on its way from the brachial plexus to the shoulder girdle. The nerve originates from the fourth, fifth and sixth cervical nerves. After passage through the scapular notch it ramifies to the supraspinatus and infraspinatus muscles, to parts of the acromioclavicular and humeroscapular joints, and to the scapula itself. The notch is bridged at its entrance by a thick, well vascularized ligamentous structure (lig. transversum scapulae), with deviations carrying vessels and nerves to the lateral parts of the clavicula and to the acromion (Moseley 1969).

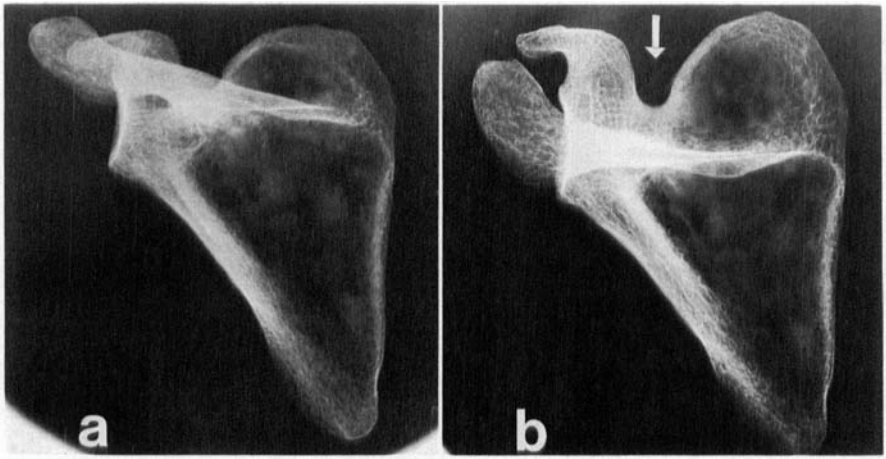

Figure 1. Scapula specimen in antero-posterior projection. a) The central X-ray beam is vertical to the body. b) The tube is angled 30° caudally. In this projection the scapular notch (→) is fully visualized, while in a) the scapular spine is projected over the notch.

Purpose of the study

The hypothesis initiating and guiding this study was that residual disability following a scapula fracture might be due to a lesion of the suprascapular nerve on its passage through the scapular notch. This hypothesis is in part supported by the effect of the suprascapular nerve block, obtained by infiltration of local anaesthetics at the notch (Bonica 1953, Gordh 1969, Edeland & Stefánsson 1973) but is contradicted by the reported absence of any loss of shoulder or upper-arm muscle strength in a group consisting of 28 patients, all with type III scapula fractures (Zdravkovic & Damholt 1974). Hence, the purpose of the present investigation was to search for correlated scapular nerve lesions in patients having sustained scapula fracture with scapular notch involvement.

MATERIAL AND METHODS

During a 21-month period (1972–1973), fractures of the scapula were found in 18 patients (15 males and 3 females) examined at the Roentgendiagnostic Department I of the Sahlgren Hospital in Gothenburg, Sweden. All patients were treated non-operatively and were re-examined clinically. Of the 18 patients, 11 did not complain of any residual shoulder girdle functional losses. Seven of the 18 patients who had subjective symptoms were also re-examined roentgenologically with a minimum follow-up time of 1.5 months and maximum follow-up time of 23 months (mean 10 months).

The roentgenograms from the primary 18 examinations consisted of conventional antero-posterior and lateral projections (Clark 1973, Fritz & Köhler 1968). The films were reviewed regarding the type of scapular fracture. At the re-examinations the scapular notch was examined by an antero-posterior projection with the tube angled approximately 15°–30° caudally. This tube angle was chosen after a primary study of scapula specimens in different antero-posterior projections (Figure 1). In order to avoid interference with the thoracic wall structures the patients were told to extend the arm laterally and cranially. TV-monitored positioning was found to considerably facilitate the examination.

In four of the patients there were reasons—arm abduction and outward rotation weakness, and/or fracture location—to include an electromyographic examination (EMG) of the supraspinatus muscle (Basmajian 1967, Kendall et al. 1971) in the follow-up examination. The EMG was evaluated according to a conventional clinical electromyographic method. Coaxial needle electrodes were employed. Duration and amplitude as well as the number of phases of the individual motor unit potentials were assessed on the screen of the oscilloscope.

RESULTS

Three of the 18 fractures of the scapula were located at the lateral angle of the scapula (type III according to the classification of DeCoulx et al. 1956). In two of these cases the scapular notch was involved by the fracture. The radiologically re-examined seven cases had healed or showed progressing healing.

By conventional X-ray technique with antero-posterior and lateral projections the scapular notch was visualized in only three of the 18 cases, while antero-posterior projection with the tube angled approximately 15°–30° caudally in all the re-examined seven cases gave a clear visualization of the scapular notch.

All seven patients with subjective symptoms were found to have a reduced supraspinatus function. One of the four patients examined with EMG showed obvious signs of suprascapular nerve involvement, as judged by physical examination, roentgenologically primarily derangement of the entire supraspinous fossa and fracture of the surgical neck of the scapula (Figure 2a) and pathological EMG findings. The patient had been injured in a traffic accident more than 1½ years prior to the re-examination. The patient had not experienced any functional improvement—or impairment—during the year prior to the follow-up examination. At the follow-up examination the supraspinatus muscle was found to have considerably reduced volume and strength. The roentgenograms from the follow-up revealed a callus encroachment of the scapular notch (Figure 2b). EMG performed 5 months thereafter showed partial restitution (Figure 3).

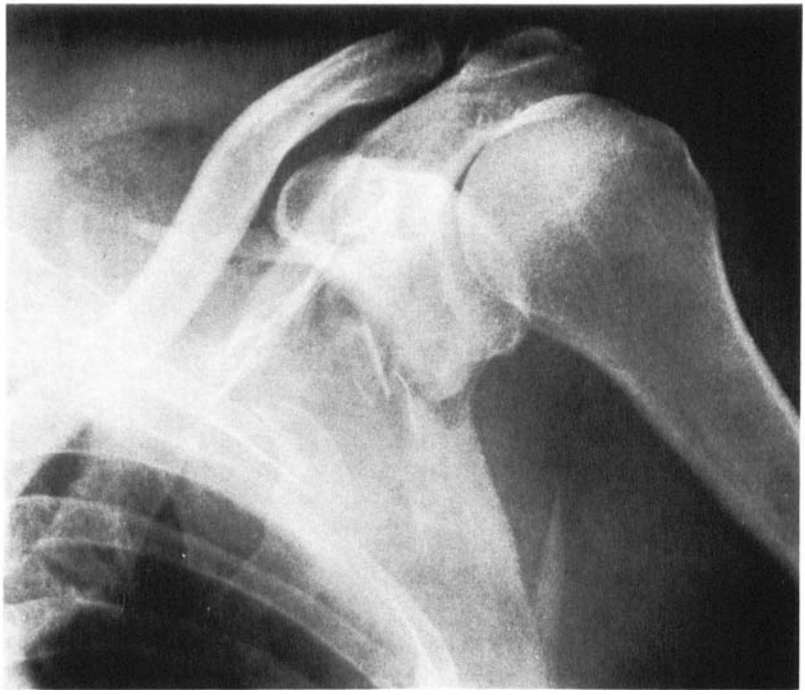

Figure 2 a. Fresh comminuted grade III scapula fracture.

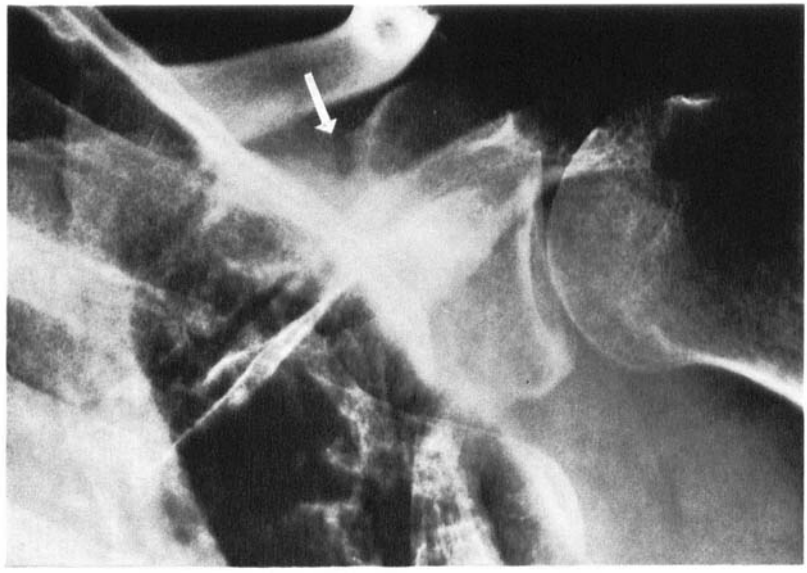

Figure 2 b. The same region 1½ years later. Note the callus contouring of the scapular notch (→).

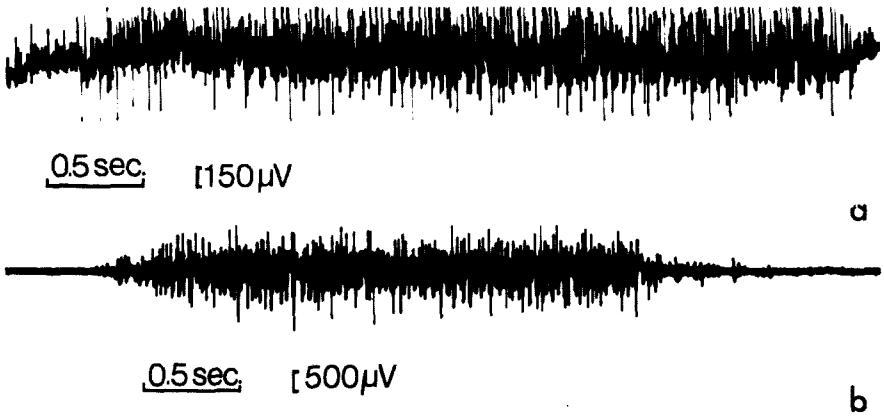

Figure 3. EMG's of the supraspinatus muscle of the same patient as illustrated in Figure 2. The two pictures show signs of lesion of the peripheral motor neurone, more evident on the first examination (a) than on the re-examination (b) performed 5 months after the first examination.

DISCUSSION

Fractures through the superior lateral angle of the scapula (type III, according to the classification of DeCoulx et al. 1956) might involve the scapular notch. There are obviously reasons to consider the presence of injury to the suprascapular nerve in these cases.

The suspicion of a suprascapular nerve lesion in the patient referred to above was not raised until the primary roentgenograms were compared with those from the re-examination. The physical examination and the EMG confirmed the diagnosis of nerve injury. The material is, however, too small to draw any conclusions of the frequency of damage to the suprascapular nerve in fractures involving the scapular notch.

According to this material the conventional X-ray examination of the scapula seems, in most cases, to be insufficient for visualizing the scapular notch, at least in the presence of a scapula fracture. Pain and the general condition of patients who have recently sustained fractures of the scapula may prohibit more than only a screening examination of the prevailing fractures. It is, however, recommended that the simple, (from caudal) angled antero-posterior projections described above should be routinely included in the X-ray examination of patients with scapula fracture, type III.

In cases with reduced supraspinatus muscle strength following scapula fracture involving the scapular notch, EMG examination of the

suprascapular nerve function is of value in the determination of the nerve injury. A suprascapular nerve decompression operation could be considered in these cases.

SUMMARY

In a material consisting of 18 patients with scapula fractures, the scapular notch was involved in two cases. In one of these cases injury of the suprascapular nerve function was proved. The value of X-ray examination with projections visualizing the scapular notch is pointed out. EMG examination in selected cases with the combination of reduced supraspinatus muscle function and a fracture of the scapular notch is recommended in order to diagnose injury of the suprascapular nerve.

REFERENCES

Basmajian, J. V. (1967) *Muscles alive. Their functions, revealed by electromyography.* 2nd ed. Williams & Wilkins, Baltimore.

Bonica, J. J. (1953) *Management of pain.* Lea & Febiger, Pittsburgh.

Clark, K. C. (1973) *Positioning in radiography,* Vol. 1, 9th ed. Ilford Ltd./Wm. Heinemann Ltd., London.

DeCoulx, M. P., Minet, P. & Lemerle, P. (1956) Fracture d'omoplate; à propos de 26 observations. *Lille chir.* **11**, 215–227.

Edeland, H. G. & Stefánsson, T. (1973) Block of the suprascapular nerve in reduction of acute anterior shoulder dislocation. *Acta anaesth. scand.* **17**, 46–49. (Last line, Material, should read: four patients, *one* having ....).

Fritz, H. & Köhler, V. (1968) *Röntgendiagnostische Praxis.* George Thieme, Leipzig.

Gordh, T. (1969) *Suprascapular nerve block, Illustrated handbook in local anaesthesia,* ed. Ejnar Eriksson. Munksgaard, Copenhagen.

Kendall, H. O., Kendall, F. P. & Wadsworth, G. E. (1971) *Muscles. Testing and function.* 2nd ed. Williams & Wilkins, Baltimore.

Moseley, H. F. (1969) *Shoulder lesions.* Livingstone, Edinburgh & London.

Rowe, C. R. (1963) Fractures of the scapula. *Surg. Clin. N. Amer.* **43**, 1565–1571.

Zdravkovic, D. & Damholt, V. V. (1974) Comminuted and severely displaced fractures of the scapula. *Acta orthop. scand.* **45**, 60–65.

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