

FRACTURE OF THE FIRST RIB

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Fifteen cases of isolated fracture of the first rib are submitted. The mechanism of the fracture is discussed. It proved compatible with the descriptions in the literature, caused either by direct trauma to the shoulder, a sudden violent contraction of juxtacostal muscles; or else it was a chance finding, without any history of trauma and as such interpreted as a fatigue fracture. A case of Horner's syndrome complicating a fracture of the first rib is also described.

Key words: complications; first rib; fracture; mechanism of fracture

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The first rib lies deep in the cervical root protected by the muscles and bones of the shoulder girdle. Therefore, an isolated fracture of this rib is rare. A total of about 270 cases are on record, 28 of them bilateral. Isolated fracture of the first rib often occurs without a history of trauma (Alderson 1947), or after a trauma which is rarely linked to the fracture. Therefore, the mechanism of this fracture has been discussed by many authors in the past (Jones 1869, Aitken & Lincoln 1939, Proctor et al. 1945, Brook 1959, Joshi et al. 1965, Frangakis 1967, Blichert-Toft & Nielsen 1968, Guillermand 1971). Some authors have even doubted the existence of such a fracture, interpreting the finding instead as a developmental anomaly (Bowie & Jacobson 1945).

The object of submitting the present series of 15 consecutive cases of first-rib fractures is partly to elucidate the fracture mechanism and partly to emphasize two cases which gave rise to erroneous diagnostic reflections.

PATIENTS AND METHODS

Fifteen patients, all males aged 9-63, were treated in the Frederiksberg Hospital, Copenhagen, from 1966 to 1970. In 14 cases, the fracture was unilateral and the fifteenth was bilateral. By nature of trauma the 15 patients may be divided into three groups:

Group 1. Fracture arising after direct trauma to the shoulder girdle.

Four patients sustained direct trauma to the shoulder in traffic accidents. In two of them the fracture was unilateral, the third patient had a bilateral fracture after the steering column of his car had pressed against the manubrium sterni, and the fourth case will be described in some detail:

A 9-year-old boy was admitted to hospital after being knocked over by a lorry. He sustained a left-sided fracture of the first rib, bilateral clavicular fracture, pneumothorax, and cranial contusion. The patient was unconscious, and as his left pupil was inactive to light and contracted, there was a suspicion of brain-stem contusion and/or hypoxic brain damage. When the acute phase was over, it was found that a left-sided Horner's syndrome had developed (miosis, ptosis, and enophthalmos) due to injury of the inferior cervical ganglion elicited by fracture of the first rib.

Group 2. Fracture arising after indirect trauma to the shoulder girdle.

There were three patients in this group. Two sustained fractures on heavy lifting and the third while playing tennis. The symptoms were sudden severe pain anteriorly on the neck at the site of the scalenic muscles.

Group 3. Fracture occurring without a history of trauma.

While the seven patients in groups 1 and 2 showed symptoms leading to treatment in the emergency ward or an in-patient department, fractures in eight patients were found accidentally in routine chest radiography. While none of the patients had symptoms or histories of trauma, all eight were exposed to daily physical stress on their shoulder girdle in their occupation. One of the case histories will be given below:

A 21-year-old man was admitted to hospital in a poor general condition, with low-grade fever which he had had for about a month. Four years previously he had undergone an operation for a tumour of the right parotid gland. The histological diagnosis had been a benign mixed parotid tumour. Chest radiography revealed a swelling on the middle of the first rib on the right (Figure 1). It was interpreted as a metastasis. To confirm the diagnosis a biopsy was taken, but it merely showed ordinary callus, without gross or microscopic signs of malignancy. Subsequent tomography confirmed that this was a fracture of the first rib with callus formation. The patient, who never before had any symptoms from the shoulder, was alive and well five years later.

DISCUSSION

As early as 1869 it was pointed out by Jones that traumatic fracture of the first rib was extremely rare. Owing to the deep situation of the first rib in the cervical root, most cases of traumatic fractures are associated with fractures of the clavicle (Breslin 1937, Knoep 1941, Iqbal 1971). Of the four cases in our series, however, only one co-existed with clavicular fracture. Incidentally, this was the only patient who developed complications in the form of pneumothorax and, more interestingly, Horner's syndrome. We have not been able to find any report of such a complication in the literature, but it has been mentioned as a theoretical possibility.

The three patients in group 2 presu-

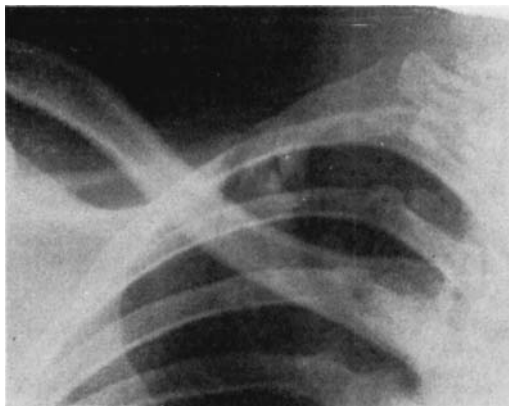


Figure 1.

ably sustained their fractures as a result of sudden violent contraction of the scalenus anterior muscle (two by heavy lifting and one by playing tennis). According to several authors (Aitken & Lincoln 1939, Brook 1959, Frangakis 1967), the mechanism of this form of fracture is a sudden strong contraction of the scalenus anterior muscle combined with traction on the arm. The scalenus anterior and the upper slip of the anterior serratus insert and exert opposite traction on each side of the subclavian sulcus—leading to fracture of the weak point on a level with the sulcus (Figure 2). A similar mechanism is said to be elicited by a sudden unexpected hyperextension of the cervical spine (Joshi et al. 1965, Frangakis 1967). All three patients in this group had fractures at the site of the subclavian sulcus.

The most published cases of isolated

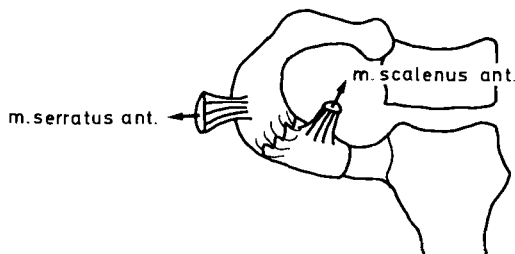


Figure 2.

fractures of the first rib, like ours, have occurred without a history of trauma and have been silent. Most authors have interpreted this type of fracture as fatigue fracture (Alderson 1947, Jenkins 1952, Freiburger & Mayer 1964, Jamil & Nath 1970, Dietzel & Schirmer 1972). However, the most convincing description is that by Proctor et al. (1945) who found this fracture in infantry soldiers carrying heavy barracks bags—"barracks-bag" fracture.

The absence of symptoms made Bowie & Jacobson (1945) doubt that a fracture was present and they suggested it was a congenital developmental anomaly. This was later rejected by Alderson (1947), Freiburger & Mayer (1964), and by Blichert-Toft & Nielsen's (1968) independent follow-up study of stress fractures which revealed spontaneous bony union and which could not be taken to mean that this was a developmental anomaly.

In one of our cases a pathological fracture of the first rib was suspected, but this suspicion was disproved. In the literature we have been unable to find any accounts of pathological fractures of the first rib. Guillermand (1971) reported three cases of tuberculous metastases, but this diagnosis was not confirmed by biopsy, and Guillermand himself suggests the possibility of a fatigue fracture.

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