CASE REPORT

Atraumatic sternum fracture

Sebastian Ørskov Abrahamsen,[1] Christina Friis Madsen[2]

[1]Medical Department, Regionshospitalet Randers, Randers, Denmark
[2]Aarhus Universitetshopital, Aarhus, Denmark

Correspondence to
Dr Sebastian Ørskov Abrahamsen, sebastianabrahamsen@hotmail.com

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SUMMARY

The spine, pelvic bones and long bones of the lower extremities are common sites for insufficiency fractures. Cases of sternum insufficiency fractures have rarely been reported among elderly patients. Insufficiency fractures tend to occur in bones with decreased mechanical strength especially among elderly patients, in postmenopausal women and patients with underlying diseases. We describe a case of spontaneous sternum insufficiency fracture in a healthy man, with no known risk factors to fracture, or previous history of fractures. Sternum insufficiency fracture is a rare cause of chest pain. This case serves to remind the emergency physician to remain vigilant for other non-cardiac, non-pulmonary and non-traumatic causes of chest pain, especially among patients with known risk factors such as osteoporosis, chronic obstructive pulmonary disease, rheumatoid arthritis, systemic lupus erythematosus and patients on long-term steroid treatment. If diagnosed correctly, these patients can be discharged and treated as outpatients as this case emphasises.

BACKGROUND

Atraumatic sternum fracture is a relative rare condition, and this case serves to remind the emergency physician to remain vigilant for other non-cardiac, non-pulmonary and non-traumatic causes of chest pain, especially among patients with known risk factors such as osteoporosis, chronic obstructive pulmonary disease, rheumatoid arthritis, systemic lupus erythematosus and patients on long-term steroid treatment. If diagnosed correctly, these patients can be discharged and treated as outpatients.

CASE PRESENTATION

A 73-year-old man was referred to the medical emergency department of a minor Danish hospital by his physician, reporting of pain located at the anterior side of the thorax. He was under medical treatment for diabetes mellitus type 2, hypercholesterolaemia and hypertension. Additionally, he had several episodes with lipothymia over the past 20 years. He had been carefully examined by neurologists and cardiologists who concluded that the episodes of lipothymia were triggered on a vasovagal basis. Otherwise the patient had no known diseases and no signs of dementia. He habitually had a high functional level. He was a non-smoker and denied alcohol abuse.

Ten days ago the patient woke up with severe pain located over his anterior chest region. There was no known trauma. There were no episodes of lipothymia in the weeks up to the onset of chest pain. The pain was at a relatively constant low rate (2–3 on the Visual Analogue Scale (VAS)) at rest, but was provoked by activity, inspiration and coughing (up to 8–9 on the VAS). He had no problems sleeping at night.

His physician had examined him thoroughly with ECG, X-ray of the thorax and a standard blood test, which were all normal. A dynamic spirometry test was 80% of expected, with respect to age, height and weight. His physician ran out of diagnostic tools and wanted the medical department to evaluate the patient. At the time of admission to the hospital the patient's condition worsened with increasing chest pain and fatigue.

The objective findings were chest pain located from nipple to nipple in an approximately 10 cm wide belt. There were no marks on the skin and no signs of infection or emphysema on the thorax. There was pain directly over the entire sternum and indirect pain located over the manubrium and corpus sterni when the upper extremities were moved in any direction, and with flexion, extension and rotations of the columna lumbalis and thoracalis. It was difficult to tell if the punctum maximum came from the sternum or the sternoclavicular joints. Otherwise the objective findings were normal and there were no clinical signs of cardiovascular or pulmonary disease.

The patient had clinical signs of sternum fracture, but without a known trauma it seemed unlikely. Six days prior to admission to the hospital, the X-ray of the thorax was described as normal. A second look revealed a line in the upper part of the corpus sterni, suspective of fracture (figure 1). Regular sternum X-ray photography confirmed our suspicion (figure 2). Plasma troponin T (<9 ng/L, ref. <50 ng/L) and ECG were normal. The rest of the blood tests were normal as well.

According to the official guidelines of the hospital, it is standard procedure to observe the patient at the intensive care unit for at least 24 h when a fracture of the sternum is proven. However, we found it sufficient to observe the patient at the medical department due to the normal ECG and troponin T, and the fact that the fracture had been present for at least 6 days. Owing to the fact that the patient denied having had any trauma to the sternum, we thought of diseases that could weaken the bone, primarily cancer and diseases causing low bone mineral density (eg, osteopenia or osteoporosis). Therefore a Computed Axial Tomography (CAT) scan of the thorax, abdomen and pelvis was conducted, which showed no signs of pathology, except the sternal fracture. The fracture was described as traumatic by the doctor who analysed the CAT scan.

An orthopaedic doctor was consulted. He concluded that there was no need for surgical

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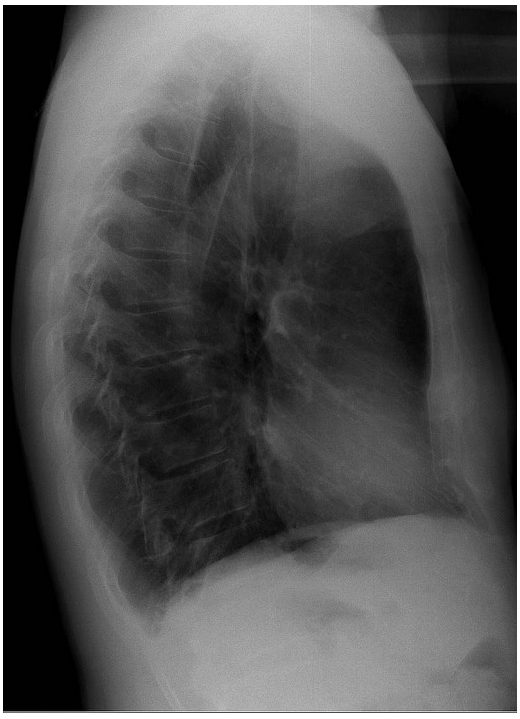

Figure 1 Lateral projection of the thorax. The fracture line is seen in the upper part of the corpus sterni.

treatment. The day after admission the patient was discharged home with paracetamol and tradolan tablets.

A few weeks later a bone mineral density scan was performed, which showed no signs of decreased bone mineral density (T score >−1 (lumbal L1–L4: −0.1, right hip: −0.3, left hip: −0.6)).

Three months after the sternum fracture was discovered the patient had recovered without any sequelae or reports and he is now free of pain.

INVESTIGATIONS

Chest pain is the most common presentation of sternum fracture, and a lateral radiograph is the most useful test in providing an accurate diagnosis.[1] Before taking the X-ray it is important to rule out cardiopulmonary disease as a cause of the patient's chest pain, as atraumatic sternal fracture can mimic acute myocardial infarction and pulmonary embolism. Most often this can be achieved by measuring cardiac markers (troponin T and creatine kinase), ECG and D-dimer compared with symptom presentation and vital parameters (blood pressure, saturation, temperature and respiration frequency).

Patients with isolated sternal injury, normal myocardial enzymes and ECG can be discharged after a short period of observation, with analgaesics for sufficient pain relief, and treated as outpatients. Admission and cardiac monitoring are not warranted in this group of patients.[2–4]

DIFFERENTIAL DIAGNOSIS

Clinically, sternal fractures can be silent. However, the fracture can cause spontaneous and severe chest pain, which is sometimes misdiagnosed as myocardial infarction and pulmonary embolism.[5–8]

TREATMENT

Primary treatment consists of sufficient pain relief combined with information about the non-lethal situation. Operation is rarely necessary; when it is, it is mostly in patients with gross instability and dislocation without signs of fraction union and may consist of a wire cerclage.[9 10] According to Sarkar *et al*,[10] modest sternal deformity can be accepted but they emphasise that if you need to reduce a displaced sternal fracture it can often be done under local anaesthesia, which, if done properly, will produce instant relief of pain and avoid the need for open surgery.

Figure 2 Lateral projection of the sternum. The fracture line is clearly visible.

OUTCOME AND FOLLOW-UP

Patients with isolated sternal injury, normal myocardial enzymes and ECG can be discharged after a short period of observation and sufficient pain-relieving treatment, as mentioned earlier. It is important to rule out underlying disease or medical treatment as a course of the fracture. In uncomplicated cases there is no need for follow-up.[2–4]

DISCUSSION

We describe a case of spontaneous sternum insufficiency fracture in a healthy 73-year-old man with no known risk factors to fracture and no history of fractures. Examinations showed no signs of cardiovascular, pulmonary or bone disease.

To the best of our knowledge, there have been between 40 and 50 cases of sternal insufficiency fracture reported in the literature.[6]

Most of the reported cases with sternum insufficiency fractures occurred in the sternal body, as in this case and rarely in

the manubrium sterni.[6] Stress fractures can be classified into fatigue fractures caused by repetitive subthreshold trauma, insufficiency fractures occurring in bones with decreased mechanical strength and pathological fractures, which occur in diseased bones.[7]

As suggested by Chen *et al*,[11] a sternum fracture can be classified as either a buckling type or a non-buckling type. A buckling sternal fracture is defined as a sternal deformity in which the upper portion of the sternum is located posterior to the lower portion and in which there has been no cortical disruption, focal bone resorption or callus formation. All the other sternal fractures, excluding the buckling type, were classified as the non-buckling type.[6 11]

Insufficiency fractures are rare but prone to develop in different groups of patients. All diseases that induce osteoporosis are prone to develop insufficiency fractures. Min and Sung found that chronic obstructive pulmonary disease was the most commonly associated disease condition in a study of 15 patients identified with sternal insufficiency fracture (5 of 15).[12] Two of these patients had rheumatoid arthritis. Kuo Hung Lin *et al* describe a correlation between rheumatoid arthritis, lupus erythematosus and insufficiency fractures of the sternum. These patients have generalised osteoporosis from the disease condition itself, disease-related inactivity and long-term disease control by corticosteroid therapy.[7]

Fractures of the sternum have mainly been reported as resulting from trauma, secondary malignancy, myeloma and, rarely, secondary to osteoporosis.[6 13] Sternum insufficiency fracture typically occurs in osteoporotic bone among the elderly. This can partly be explained by Fowlers flexion—compression theory, where fractures occur secondary to bending and compression stresses from the thoracic kyphotic deformity with multiple osteoporotic thoracal vertebral compression fractures. The deforming stress on the sternum, combined with the loss of elasticity associated with the ossification of the costal cartilages in elderly patients increases the risk of sternal fracture, and these bones may not even have the elastic strength to withstand minimal stress from activities of daily living.[6 7 13 14] Sternum insufficiency fractures also occur without thoracic kyphosis as emphasised by Chen *et al*.[11]

In this case, however, there was no sign of any of the aforementioned factors leading to sternal fracture. The patient had no history of fractures and the bone mineral density scan was normal. The CT scan showed no signs of pathology of the sternum and the patient had no back problems and was not more thoracic kyphotic compared with the background population. The patient and his wife decline trauma. A possible explanation is that the patient had a previous trauma not so long ago (the fracture seems to be new at the X-ray and CT scan as it shows no signs of callus), that he does not recall. Initially the fracture was silent, as described by Chen *et al*.[11] The onset of pain probably occurred after dislocating the fracture during sleep.

Learning points

- Remain vigilant for other non-cardiac, non-pulmonary and non-traumatic causes of chest pain.
- When a patient presents with chest pain, the first thing to do is to rule out the aforementioned life-threatening conditions.
- A lateral radiograph is the most useful test in providing an accurate diagnosis of sternal fracture.
- Search for a course to sternum fracture.
- Patients with isolated sternal injury, normal myocardial enzymes and ECG can be discharged after a short period of observation and sufficient analgaesic treatment, and treated as outpatients.

Competing interests None.

Patient consent Obtained.

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Reminder of important clinical lesson

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