SPONTANEOUS STERNAL COLLAPSE

M. ITANI, G. A. EVANS, W. M. PARK

From the Robert Jones and Agnes Hunt Orthopaedic Hospital, Oswestry

Spontaneous fracture of the sternum may occur in the elderly, with localised chest pain which may mimic such medical emergencies as myocardial infarction and pulmonary embolism. The diagnosis should be considered in the presence of localised tenderness in association with thoracic kyphosis, and the degree of sternal displacement appears to vary with the severity of the posterior deformity. In extreme instances there is paradoxical upper sternal movement during respiration. The condition can occur in profound osteoporosis or secondary to metastatic infiltration or myeloma.

Spontaneous fracture of the sternum is a rare condition. Urovitz, Fornasier and Czitrom (1977) reported cases and noted that approximately half were related to metastatic tumour deposits. Of historical interest is the fact that the discovery of an abnormal protein by Bence-Jones occurred in a patient who had presented with a "snap" in his chest wall due to spontaneous sternal fracture (Bauer 1977). The association between multiple myeloma and sternal fractures has subsequently been confirmed (Gompels, Votaw and Martel 1972; Law and Jones 1975). In the elderly, osteoporosis has been implicated as a further cause (Vassallo 1969). All these related causes weaken the structure of the sternum. We report here an additional mechanical factor which indicates that this condition should be considered as a flexion deformity of a demineralised thorax.

Case Reports

Case 1. A 76-year-old woman presented with increasing dyspnoea which had started six weeks earlier after she had felt a snapping sensation over the sternum. She had suffered with backache radiating

Fig. 1
Case 1. Figure 1—Photograph showing the marked kyphos with associated sternal deformity. Figure 2—Lateral radiograph of the sternum showing gross demineralisation and a fracture resulting in a Z-like deformity. Figure 3—Lateral radiograph of the thoracic spine. Multiple compression deformity of the mid and lower thoracic vertebrae and upper lumbar spine is evident.

M. Itani, MD, Orthopaedic Registrar
G. A. Evans, FRCS, FRCS Ed(Orth), Consultant Orthopaedic Surgeon
W. M. Park, FRCR, Consultant Radiologist
The Robert Jones and Agnes Hunt Orthopaedic Hospital, Oswestry, Salop SY10 7AG, England.
Requests for reprints should be sent to Mr G. A. Evans.
© 1982 British Editorial Society of Bone and Joint Surgery 0301–620X/82/4096–0432 $2.00

THE JOURNAL OF BONE AND JOINT SURGERY
across the subcostal margins for 18 months, and had received treatment with oral calcium, stilboestrol and vitamin D. She was most comfortable sitting. She showed a marked kyphosis and a severely deformed chest (Fig. 1), with inspiratory recession of the manubrium. Laboratory investigations revealed haemoglobin 11.1 grams per decilitre; white blood count $5.6 \times 10^5$ per litre with three per cent large plasma cells resembling myeloma cells; erythrocyte sedimentation rate 107 millimetres in the first hour; total serum protein 91 grams per litre; albumin 30 grams per litre. Immunoelectrophoresis showed elevated IgG lambda paraprotein; IgA and IgM levels were decreased; and there was no Bence-Jones protein in the urine. There was no evidence of osteomalacia or of impaired renal function, and the electrocardiogram was normal except for tachycardia. A needle biopsy of the iliac crest did not show abnormal cells. Radiographs showed marked under-expansion of both lung fields. The bones were demineralised, with marked buckling of the sternum, (Fig. 2) and kyphosis with collapse of several thoracic vertebral bodies (Fig. 3). Skull radiographs were normal. A diagnosis was made of osteoporosis associated with macroglobulinaemia and she was treated with analgesics, antibiotics, and intensive physiotherapy. The paradoxical movement of the manubrium and proximal sternum during inspiration gradually ceased, with marked improvement of the dyspnoea and sternal pain. When she was discharged from hospital several weeks later there was residual thoracic backache with fixed deformity of the spine and sternum.

Routine chest radiographs showed a healed sternal fracture with a minor buckling deformity (Fig. 6). Lateral radiographs of the thoracic spine showed loss of bone texture and tomography revealed anterior wedging of the body of the third thoracic vertebra. Despite her many symptoms the patient could not recollect having suffered from sternal or dorsal pain. In the past she had been prescribed steroid injections into various joints but never systemic steroids. Laboratory investigations excluded a blood dyscrasia, osteomalacia and renal failure, and the serum proteins and electrophoresis were normal. The patient had a total hip replacement and was discharged two weeks later in good health.

**DISCUSSION**

The sternum is an integral part of the thoracic cage, and slight movement at the manubriosternal joint aids expansion of the chest during inspiration (Last 1966). The stresses of sudden forward angulation of the thoracic spine in violent flexion are transmitted to the sternum by the ribs and clavicles; Park *et al.* (1980) have reported clinically silent upper thoracic or cervicothoracic injury where the main presenting feature was sternal fracture. Similar forces but with more gradual application can also be transmitted to the sternum, as illustrated in these three cases with progressive thoracic kyphosis. If the skeleton is already weakened by osteoporosis, spontaneous sternal and spinal collapse can occur.

The degree of sternal displacement will vary with the severity of the kyphosis. Severe kyphosis can result in major buckling of the sternum, the upper fragment being driven downwards behind the lower fragment, which allows paradoxical movement during inspiration, with consequent respiratory distress (Case 1). Less severe kyphosis and biconcave vertebral deformity may result in an undisplaced sternal fracture (Case 2). Similar forces acting on a manubriosternal joint weakened by rheumatoid arthritis may result in subluxation of this joint rather than fracture (Rapoport, Carrera and Kozin 1979).

The symptoms caused by such a stress fracture are variable. Severe kyphosis may be associated with dorsal

---

**Case 2.** An 85-year-old woman sustained an intercosthrosteric fracture of the right femur which was treated by internal fixation. She made an uneventful recovery. Two months later she suddenly developed presternal pain which simulated myocardial infarction. The electrocardiogram and cardiac enzymes were normal and her general condition remained satisfactory. She was tender over the midsternum and a radiograph revealed an undisplaced fracture (Fig. 4). A radiograph of the thoracic spine showed a kyphosis with osteoporotic biconcavity of the seventh, eighth, ninth and tenth vertebral bodies (Fig. 5). Further investigation revealed normal haematological findings, normal serum proteins, and no evidence of osteomalacia. She was treated with analgesics and physiotherapy, and made a complete symptomatic and functional recovery.

**Case 3.** A 68-year-old woman had seronegative rheumatoid arthritis and was admitted to hospital for total replacement of the right hip.
and radicular pain which is made worse by the sudden collapse of the remaining anterior support from the sternum, with marked respiratory distress (Case 1). Pain localised to the sternum (Case 2) may mimic a myocardial infarction (Rutledge 1962) or pulmonary embolism (Vassallo 1969). The physicians should be well aware of this entity in the differential diagnosis of acute chest pain in the elderly. In some cases the symptoms are trivial or go unnoticed (Case 3), and this fact is in keeping with the relatively high incidence of sternal fractures (34 out of 839) noted at necropsy examination by Urovitz et al. (1977). When spontaneous fracture of the sternum is diagnosed further investigation should be undertaken to exclude predisposing causes such as secondary neoplasm (Urovitz et al. 1977), lymphomatous infiltration (DeBeer, Friedfeld and Kabakow 1977) or myelomatosis (Law and Jones 1975; Bauer 1977). The examination should include a lateral radiograph of the thoracic spine to demonstrate anterior wedging of the vertebral bodies. Tomography may be necessary to demonstrate wedging near the cervicothoracic junction. In all three of our patients the lateral radiographs indicated that the sternal collapse resulted from upper thoracic flexion deformity in a profoundly demineralised skeleton.

REFERENCES


