CASE REPORT

Spontaneous Sternal Fracture in Multiple Myeloma: A Case Report

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Chest pain is a frequent complaint among patients in both the emergency department and outpatient clinics. Several urgent cardiac conditions, including acute coronary syndrome, aortic dissection, and pericarditis, must always be ruled out through meticulous clinical evaluations. Chest pain due to spontaneous sternal fractures is relatively common in patients diagnosed with multiple myeloma. Nevertheless, the clinical manifestation is usually subtle and progressive. In this particular case, the patient's primary symptom during the treatment of multiple myeloma was acute chest pain, resulting from a spontaneous sternal fracture. The patient received pain management and chemotherapy for multiple myeloma, which effectively alleviated the pain.

Keywords: Sternal fracture; Multiple myeloma; Spontaneous

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Multiple myeloma, a malignancy of plasma cells, is characterized by a monoclonal proliferation of plasma cells in the bone marrow, leading to the presence of a monoclonal protein in the serum or urine[1]. The disease is commonly associated with organ or tissue impairment, such as hypercalcemia, renal insufficiency, anemia, or bone disease, known as CRAB symptoms[1]. Among these, bone disease occurs in approximately 80% of multiple myeloma patients, and it manifests as osteolytic lesions, osteopenia, and pathologic fractures[1]. The spine, pelvis, and long bones are the most frequently affected sites, but fractures can also occur in the sternum[2-10]. However, spontaneous sternal fractures are rare in multiple myeloma patients and can pose diagnostic challenges due to the variability of clinical presentations.

In recent years, a few cases of spontaneous sternal fractures in multiple myeloma patients have been reported, broadening our understanding of this unusual clinical presentation[1,6-8]. Sternal fractures, when they occur, typically present with chronic symptoms such as progressive dyspnea and chest wall deformity due to restrictive lung disease. However, these fractures might manifest acutely with severe chest pain, as in the presented case. This symptomatology underlines the need for a thorough investigation and differential diagnosis in patients with multiple myeloma who present with chest pain.

The authors hereby presented a case report of a patient with multiple myeloma who experienced acute chest pain, underscoring the importance of this atypical manifestation and the subsequent discussion on its clinical implications.

Case Report

A 63-year-old male, currently undergoing treatment for κ light-chain multiple myeloma, reported to the outpatient clinic with persistent mechanical chest pain over the past two weeks. The pain intensified when he bent down or turned his body in any direction. Analgesics provided minimal relief. The patient denied any physical trauma prior to the onset of the pain. His previous treatment regimen included a nine-month course of anti-tuberculosis drugs for suspected pulmonary tuberculosis in his left lower lung, a result of unresolving pneumonia. A month after completing the anti-tuberculosis medication, the infiltrate visible on the chest radiograph had resolved. Regarding the multiple myeloma, the patient presented with chronic low back pain resulting from multiple thoracolumbar

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vertebral collapse fractures, anemia, acute kidney disease, and hypercalcemia 14 months prior to the present admission. A bone marrow biopsy revealed diffused involvement of both mature and immature plasma cells, which was compatible with a plasma cell neoplasm. The initial β2-microglobulin level was 25.74 milligrams per liter (reference range 0.81 to 2.19). The serum κ to λ ratio was 46.29 (851.34/18.39 milligrams per liter) (reference range 0.26 to 1.65). The patient was treated with bortezomib and dexamethasone. However, after 4 months of treatment, the serum κ to λ ratio increased to 113.85, prompting a change in the regimen to lenalidomide and dexamethasone up to the present admission. However, bisphosphonate treatment was delayed due to the patient's refusal to undergo dental examination. Physical examination of the chest revealed tenderness and a step-off at the mid-sternum. Other physical examinations yielded no notable results, aside from moderately pale conjunctivae. Electrocardiogram and chest radiograph showed no abnormalities. The clinician decided to perform a chest computed tomography (CT) scan in light of the patient's history of pulmonary tuberculosis, aimed to follow-up on the previous pulmonary infiltrates. The CT scan revealed a mid-sternal displaced fracture, diffuse osteoporosis, and multiple vertebral compression fractures (Figure 1). Absence of a callus suggested the fracture was acute. Blood tests showed anemia with a hemoglobin level of 9.2 grams per deciliter (reference range 13 to 16), unchanged from a study performed a month prior. Cardiac troponin-I levels remained stable after serial measurement. The patient's current β2-microglobulin level was 1.6 milligrams per liter (reference range 0.81 to 2.19), a decrease from the pre-treatment level of 25.74 milligrams per liter.

The patient commenced opioid therapy for pain management and continued chemotherapy with lenalidomide and dexamethasone for multiple myeloma. Dental caries extraction was planned before initiating bisphosphonate treatment. At the two-week follow-up, the patient reported less pain and no progressive dyspnea. Hence, due to the observed clinical improvement, radiotherapy or surgical correction was unnecessary and did not offered. Unfortunately, the patient was lost to follow-up at one month and later discovered that he suffered sudden cardiac arrest at home without an identifiable cause.

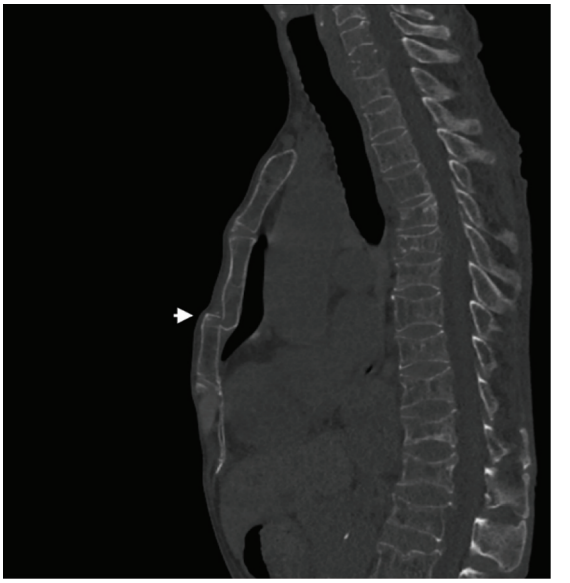

Figure 1. Computed tomography of the chest in a 63-year-old male undergoing lenalidomide and dexamethasone treatment for multiple myeloma revealed a displaced fracture at mid-sternum, osteolytic lesions at T1 and T7 vertebrae, compression fracture at T11 and L2 vertebrae, and diffuse osteoporosis. No callus was observed.

Discussion

Although spontaneous sternal fractures are rare, there are frequently reported in patients with multiple myeloma[2]. From a historical perspective, a spontaneous sternal fracture (then referred to as "idiopathic") in a patient with undiagnosed multiple myeloma and nephrotic features led to the discovery of Bence Jones protein in urine by Dr. Henry Bence Jones[3]. In addition to multiple myeloma, pathologic sternal fractures can also result from metastatic solid tumors, tuberculosis, or severe osteoporosis secondary to autoimmune diseases or steroids[2]. The typical presentation involves chest wall deformities or progressive dyspnea due to restrictive lung pathology (Table 1)[4,7-9]. Acute chest pain has been reported occasionally[5,6]. The present case emphasized the importance of expanding the differential diagnosis in patients with multiple myeloma who present with acute chest pain. A thorough physical examination should reveal a sternum deformity and guide the diagnosis even before radiographic confirmation. Yet, it is not uncommon to encounter an asymptomatic chest wall deformity resulting from a past unrecognized spontaneous sternal fracture[10,11]. An extensive investigation is crucial to cover all potential causes of chest pain, thereby preventing a misdiagnosis that attributes a sternal fracture as the sole cause of acute chest pain.

For the authors' literature review on spontaneous

Table 1. Published case reports pertaining to spontaneous sternal fractures in patients with multiple myeloma

Reference (type of literature)	Age (years)	Sex	Type of light chain	Duration of MM	Presentation	Imaging or pathologic report	Treatment	Outcome
4 (Case report)	61	Male	IgA kappa	First diagnosis	Sternal deformity after trivial injury 10 months prior	Imaging: NA Pathology of sternum: diffuse plasma cells infiltrate separated by fine trabeculae with myelomatous lesions	Melphalan, prednisone	Death due to aspiration pneumonitis
5 (Case report)	75	Female	NA	18 months	Pain in the sternum after cardiac thumb	Plain radiography (not specified)	Melphalan, prednisone	NA
6 (Case report)	66	Male	IgG kappa	First diagnosis	Sudden pleuritic chest pain while pushing a metal frame into the ground PE: distressed on deep inspiration and tenderness at sternum	Chest radiography (lateral)	Cyclophosphamide	Death from renal failure 4 months later
7 (Case report)	53	Female	Kappa light chain	First diagnosis	Progressive dyspnea and thoracic pain after minor fall PE: tenderness on right hemithorax	Computed tomography of chest and (99 m) Tc-MDP bone scintigraphy	Bortezomib, cyclophosphamide, dexamethasone, surgery with open reduction and internal screw fixation, and radiotherapy	Improved
8 (Case report)	58	Male	IgA kappa	After the third cycle of chemotherapy	Chest wall deformity and chest pain PE: pectus excavatum	Computed tomography of chest	Continue chemotherapy (cyclophosphamide, thalidomide, and dexamethasone) and radiotherapy	Improved
9 (Case report)	56	Male	Kappa light chain	5 months	Dyspnea and respiratory failure due to concomitant rib fractures and flail chest	Computed tomography of chest	Bortezomib and dexamethasone	Improved

MM=multiple myeloma; NA=not available; MDP=methylene diphosphonate

sternal fracture by searching PubMed using the terms "Spontaneous" and "Sternal fractures or sternal collapse". The authors found six relevant case reports[4-9]. There were two likely pathogenic mechanisms involved in sternal fractures. The first was osteoporotic bone resulting from increased bone resorption due to the myeloma disease itself. The second was the invasion of myeloma cells into the sternum, leading to fracture, as demonstrated in the case report[4]. These two mechanisms may coexist in a single patient. Differentiating between the two mechanisms requires thorough pathology of the fractured sternal bones. Radiographic differentiation could reveal plasmacytoma features rather than solely osteoporotic features.

The treatment approach for spontaneous sternal fractures mirrors that of other osteoporotic fractures. Pain management, bisphosphonates, and chemotherapy for multiple myeloma usually suffice for stable fractures. However, some patients experiencing symptoms such as restricted activity due to dyspnea from restrictive lung disease might benefit from surgical correction of chest wall deformity[7]. Persistent pain may also respond to radiation therapy[7,8]. Moreover, radiotherapy could be beneficial for patients with a sternal plasmacytoma leading to subsequent fracture. There is, however, no well-documented evidence supporting this approach. Therefore, this treatment option should be individualized and discussed with the patient.

In conclusion, the authors presented an unusual case of acute chest pain resulting from a spontaneous sternal fracture in a patient with multiple myeloma. Comprehensive history-taking, physical examination, and radiographic confirmation are essential for diagnosing this condition. Poor long-term outcomes are typically due to restrictive lung disease following severe chest wall deformity. While no established preventative strategy exists, osteoporotic fractures are common in multiple myeloma, necessitating bisphosphonate treatment to prevent further fractures.

What is already known on this topic?

Spontaneous sternal fractures frequently occur

in patients with multiple myeloma. However, these fractures gradually occur. Progressive dyspnea, due to restrictive lung pathology or chest wall deformity, is a commonly reported feature. Acute chest pain arising from a spontaneous sternal fracture is rare.

What does this study add?

The present case differs from most previous studies as acute chest pain was the primary symptom. Given that chest pain is a frequent complaint in both the emergency department and outpatient clinics, the present case underscores the importance of broadening the differential diagnosis to consider spontaneous sternal fractures, particularly in patients with multiple myeloma.

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Conflicts of interest

The authors declare no conflicts of interest.

References

1. Cowan AJ, Green DJ, Kwok M, Lee S, Coffey DG, Holmberg LA, et al. Diagnosis and management of multiple myeloma: A review. JAMA 2022;327:464-77.
2. Sarbay I, Dogan H. A rare cause of chest pain: spontaneous sternum fracture. J Emerg Crit Care Med 2018;2:59.
3. Bauer FW. Mr. McBean's sternal fracture and multiple myeloma. N Engl J Med 1977;297:674.
4. Law IP, Jones C. Letter: IgA myeloma and sternal fracture. JAMA 1975;233:767-8.
5. Abramson N, Strachan JB. "Idiopathic" sternal fracture. N Engl J Med 1977;296:1538.
6. Bowyer RC, Touquet VL. Spontaneous sternal fracture--a misnomer. J R Soc Med 1986;79:175-6.
7. Reuling EM, Jakma TS, Schnater JM, Westerweel PE. Spontaneous sternal fracture due to multiple myeloma requiring extensive surgical repair. BMJ Case Rep 2015;2015:bcr2015211498.
8. Pickard L, Whittaker C, Jayakar V. Spontaneous sternal collapse in multiple myeloma. Br J Haematol 2015;168:316.
9. Muñoz-Bermúdez R, Abella E, Zuccarino F, Masclans JR, Nolla-Salas J. Successfully non-surgical management of flail chest as first manifestation of multiple myeloma: A case report. World J Crit Care Med 2019;8:82-6.
10. Butler JS, Malhotra K, Patel A, Sewell MD, Benton A, Kyriakou C, et al. Pathologic sternal involvement is a potential risk factor for severe sagittal plane deformity in multiple myeloma with concomitant thoracic fractures. Spine J 2015;15:2503-8.
11. Gompels BM, Votaw ML, Martel W. Correlation of radiological manifestations of multiple myeloma with immunoglobulin abnormalities and prognosis. Radiology 1972;104:509-14.