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## Successfully non-surgical management of flail chest as first manifestation of multiple myeloma: A case report

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### Abstract

#### BACKGROUND

Multiple myeloma is a malignant neoplasm of the bone marrow characterized by neoplastic proliferation of monoclonal plasma cells with a high relationship with destructive bone disease. We present a case of a patient diagnosed with multiple myeloma and sternal fracture in association with multiple bilateral rib fractures and thoracic kyphosis, who developed a severe acute respiratory failure, thus complicating the initial presentation of multiple myeloma. We discuss the therapeutic implications of this uncommon presentation.

#### CASE SUMMARY

A 56-year-old man presented to Hematological Department after he had been experiencing worsening back pain over the last five months, with easy fatigability and progressive weight loss. He had no history of previous trauma. The chemical blood tests were compatible with a diagnosis of multiple myeloma. A radiographic bone survey of all major bones revealed, in addition to multiple bilateral rib fractures, a sternal fracture and compression fracture at T9, T10, T11 and L1 vertebrae. Subcutaneous fat biopsy was positive for amyloid. We started treatment with bortezomib and dexamethasone. After 24 h of treatment, he presented dyspnea secondary to flail chest. He required urgent intubation and ventilatory support being transferred to intensive care unit for further management. The patient remained connected to mechanical ventilation (positive pressure) as treatment which stabilized the thorax. A second cycle of bortezomib plus dexamethasone was started and analgesia was optimized. The condition of the patient improved, as evidenced by callus formation on successive computed tomography scans. The patient was taken off the ventilator one month later, and he was extubated successfully, being able to breathe unaided without paradoxical

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motion.

## CONCLUSION

This case highlights the importance of combination between bortezomib and dexamethasone to induce remission of multiple myeloma and the initiation of positive airway pressure with mechanical ventilation to stabilize chest wall to solve the respiratory failure. This combined approach allowed to obtain a quick and complete resolution of the clinical situation.

**Key words:** Multiple myeloma; Flail chest; Bortezomib; Mechanical ventilation; Case report

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**Core tip:** This case report describes an adult patient with acute respiratory failure, secondary to flail chest because of a multiple myeloma. It shows how positive pressure in airway, in conjunction with an early treatment with bortezomib and dexamethasone, may lead to a successful outcome for such patients with an otherwise poor prognosis.

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## INTRODUCTION

Multiple myeloma is a malignant neoplasm of the bone marrow characterized by neoplastic proliferation of monoclonal plasma cells<sup>[1]</sup>. Approximately 70%-80% of patients with multiple myeloma eventually develop destructive bone disease<sup>[2]</sup>. Most of the lesions are localized in the spine, pelvis or proximal extremities, according to the regions of hematological active bone marrow<sup>[1,3]</sup>.

## CASE PRESENTATION

### Chief complaints

We present a case of multiple bilateral rib fractures in association with sternal fracture and thoracic kyphosis who developed a severe acute respiratory insufficiency complicating the initial presentation of multiple myeloma.

### History of present illness

A 56-year-old man presented to Hematological Department after he had been experiencing worsening back pain over the last five months, with easy fatigability, and progressive weight loss. He had no history of previous trauma.

### History of past illness

Hypertension and mellitus diabetes, both under pharmacological treatment.

### Physical examination

At intake, his blood pressure was 130/70 mmHg; pulse rate 70 beats/min; respiratory rate 14/min and body temperature 35.7 °C.

### Laboratory examinations

Blood chemical test results were as follows: creatinine 4.22 mg/dL; glomerular filtration rate 15 mL/min; calcium 15.9 mg/dL and hemoglobin 6.7 g/dL. Serum  $\beta$ 2-microglobulin level was elevated at 9.42 mg/L and serum albumin level was 2.7 g/dL. The diagnosis of Kappa -light chain Bence-Jones multiple myeloma was established on the basis of a bone marrow infiltration by 66% atypical plasmatic cells and a monoclonal component kappa in serum (86 mg/dL) and in urine with a proteinuria of 2.9 g/24 h. Urine was positive for Bence-Jones proteins

### **Imaging examinations**

A radiographic bone survey of all major bones revealed, in addition to multiple bilateral rib fractures (4<sup>th</sup> to 11<sup>th</sup>), the presence of a sternal fracture and compression fracture at T9, T10, T11 and L1 vertebrae. The thoracic computed tomography (CT) scan confirmed a depressed pathological fracture of the sternum (Figure 1A).

### **Further diagnostic work-up**

With the results of the different tests, the patient was diagnosed with multiple myeloma. It was staged as Durie-Salmon stage IIIB and International Staging System IIIB. Subcutaneous fat biopsy was positive for amyloid.

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## **FINAL DIAGNOSIS**

The final diagnosis of the presented case was spontaneous sternal fracture secondary to multiple myeloma, with flail chest and acute respiratory failure as the main consequence.

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## **TREATMENT**

On the third day bortezomib was initiated at dose of 1.3 mg/m<sup>2</sup> and dexamethasone at dose of 40 mg/24 h by intravenous route as remission induction. After 24 h of treatment, the patient suddenly presented dyspnea secondary to flail chest resulting from multiple bilateral rib and sternum fractures (Figure 1B). Oxygen saturation by pulse oximetry was 86% (FiO<sub>2</sub> 0.21). He required urgent intubation and ventilatory support being transferred to intensive care unit (ICU) for further management. At the ICU, paradoxical inward movements of the rib cage were evident bilaterally on inspiration. The patient remained connected to mechanical ventilation as treatment which stabilized the thorax on pressure control ventilation of 15 cm H<sub>2</sub>O and positive end expiratory pressure of 7 cm H<sub>2</sub>O. The arterial pH was 7.4, PaO<sub>2</sub> 80 mmHg and PaCO<sub>2</sub> 43 mmHg, breathing 28% oxygen. The patient, at ICU admission, was febrile (axillary temperature, 38 °C), with white blood cells, 19000/μL. Chest radiography revealed an infiltrate in the right lower lung. Methicillin-sensitive *Staphylococcus aureus* was identified from tracheobronchial aspirates and the patient was treated with cloxacillin at dose of 2 g/6 h by i.v. route, resulting in the eradication of the infection after 14 d of treatment. The patient received selective digestive decontamination during ICU-stay. Attempts to wean the patient caused the return of paradoxical movements and respiratory failure. A second cycle of bortezomib plus dexamethasone was started and analgesia was optimized. Surgical stabilization with an external fixator was considered by Thoracic Surgery team but the idea was finally dropped.

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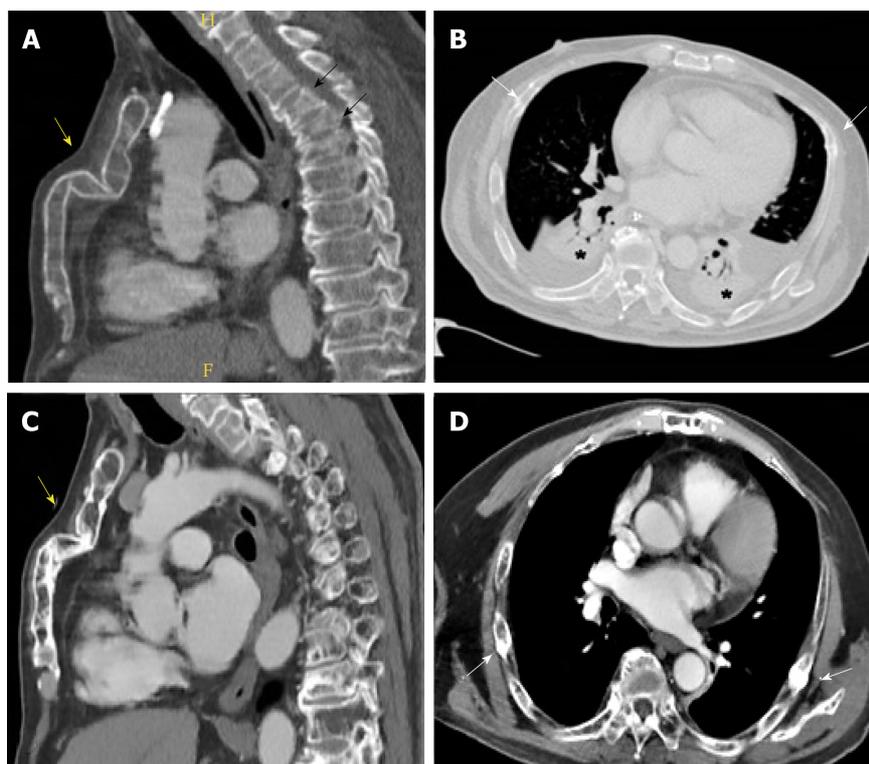
## **OUTCOME AND FOLLOW-UP**

The condition of the patient improved, as evidenced by callus formation on successive CT scans (Figure 1C and D), improvement in his respiratory status and a marked decrease in urine kappa light chain levels to less than half the original value (0.55 g/24 h). The patient was taken off the ventilator one month later, and was extubated successfully, being able to breathe unaided without paradoxical motion. On breathing room air, arterial blood gas analysis revealed: pH, 7.49, PaO<sub>2</sub>, 70 mmHg and PaCO<sub>2</sub>, 40 mmHg. He was discharged from ICU and from the hospital 5 and 9 wk after his hospitalization, respectively. The patient received further treatment with 4 cycles of bortezomib with a good response. An allogeneic transplantation was planned five months after, but patient refused the therapy and subsequently was re-treated with 2 cycles of bortezomib at low doses. One year after his hospital admission the patient is being followed up at the Department of Hemato-Oncology without further dyspnea.

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## **DISCUSSION**

Spontaneous flail chest is rare in multiple myeloma<sup>[4-7]</sup>. The main interest of this case resides in restoring chest stabilization with the use of continuous positive pressure ventilation during a short period of time, without need to perform surgery and tracheostomy, while providing definitive chemotherapy. This objective was achieved



**Figure 1 Sagittal computed tomography image.** A: A depressed pathological fracture of the sternum (yellow arrow) resulting in an evident deformity of the anterior chest wall. Multiple spontaneous compression fractures of the thoracic spine can also be observed (black arrows); B: Axial computed tomography (CT) image demonstrates multiple rib fractures (white arrows) associated to bilateral lung consolidations (asterisks) and pleural effusion; C and D: Control CT scan, realized months later, shows important improvement of both sternal (C, yellow arrow) and rib fractures (D, white arrows), with the appearance of fracture calluses. Complete resolution of lung consolidations and pleural effusion (D).

as determined by the relationship between the substantially decreased urine kappa light chain level, the tolerance to the weaning of the ventilator and the signs of partial bone healing in the control by CT. It is well known that bortezomib has significant activity in patients with relapsed/refractory multiple myeloma and its efficacy and safety in renal failure has been observed in phase II studies<sup>[8]</sup> and more recently the Phase III HOVON-65/GMMG-HD4 trial<sup>[9]</sup> describes the potential benefit of bortezomib in patients with organ failure. The role of surgery for pathological sternal fractures is not well defined and to date there is no standard treatment method for his clinical condition<sup>[10]</sup>. Recently, Lee *et al*<sup>[6]</sup> described a case of multiple myeloma, who presented flail chest and severe respiratory failure following blunt trauma successfully treated by the Nuss operation. On the other hand, Abisheganaden *et al*<sup>[4]</sup> described the use of continuous positive airway pressure ventilation through a tracheostomy for pathological flail chest in multiple myeloma but after a long period of ICU stay (> 3 mo). Surgery was not required in this case.

## CONCLUSION

Despite its alarming presentation, the association of multiple myeloma and flail chest does not necessarily predict a poor prognosis. Starting positive airway pressure to stabilize the chest wall, as well as the association of bortezomib and dexamethasone to induce a remission, may solve the respiratory insufficiency, in a short period of time, without requiring surgical fixation.

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