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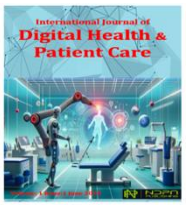

Spontaneous Rib Fractures Secondary to Severe Coughing in a Patient with Chronic Obstructive Pulmonary Disease: a Case Report and Diagnostic Considerations

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ABSTRACT

Purpose: Spontaneous rib fractures following intense coughing are uncommon, particularly without osteoporosis. Chronic obstructive pulmonary disease (COPD) patients face increased fracture risk due to chronic inflammation, persistent coughing, and altered thoracic biomechanics. **Methods:** A 47-year-old male with 10-year COPD history presented with acute left posterior chest/back pain after forceful coughing. Physical examination revealed localized tenderness. Initial chest radiography was negative. Non-contrast thoracic CT (supine, breath-hold; evaluated by two radiologists) was performed due to persistent pain. **Findings:** CT identified nondisplaced fractures of the left seventh/eighth posterior ribs. Analgesics (ibuprofen 600mg every 8hrs) reduced pain from 8/10 to 3/10 on the Numerical Rating Scale. No bone density assessment was conducted. **Conclusion:** Rib fractures may occur spontaneously in COPD patients without trauma or osteoporosis and are frequently missed by radiography. CT is essential for diagnosis. COPD itself constitutes a biomechanical risk factor, warranting preventive strategies (bone density screening, cough management) in high-risk individuals.

1. INTRODUCTION

Rib fractures primarily stem from blunt or high-impact trauma which includes falls and motor vehicle accidents according to Peek et al [1]. The literature shows that spontaneous rib fractures from forceful coughing occur infrequently in patients who do not have osteoporosis or malignancy [2]. The medical literature shows rare reports of such cases which primarily affect older adults and people with risk factors including chronic cough and osteoporosis and chronic obstructive pulmonary disease (COPD) [3]. The data shows that patients with COPD have a significantly increased risk of fractures because of chronic inflammation and mechanical stress. This includes systemic inflammation and mechanical factors, like stress on the ribs and vertebrae caused by repeated coughing [4]. Research indicates a higher prevalence of osteoporosis, osteopenia, and vertebral fractures in patients with this condition; however, further epidemiological studies on cough-induced rib fractures are needed [3, 5, 6].

This report presents an unusual case of rib fractures in a middle-aged patient with COPD who had no previous history of trauma or corticosteroid use or osteoporosis. The case emphasizes the need for healthcare providers to maintain a high level of suspicion while obtaining suitable imaging tests for similar clinical presentations.

2. MATERIALS AND METHODS

A 47-year-old male patient with GOLD Stage II COPD (FEV_1 65% predicted) had been diagnosed for 10 years was admitted to the emergency department with acute sharp chest and back pain in the left posterior region after a 30-minute episode of violent coughing. The patient described his pain as an 8/10 on the Numeric Rating Scale but stated he had no history of trauma or falls or previous fractures. The patient had stable vital signs consisting of blood pressure 133/74 mmHg, oxygen saturation 95% on room air, heart rate 93 beats per minute, and Glasgow Coma Scale score 15/15.
The focused assessment showed tenderness at the left seventh and eighth rib angles but symmetrical bilateral chest expansion of 4 cm and equal breath sounds without adventitious noises and no respiratory distress or crepitus. Initial

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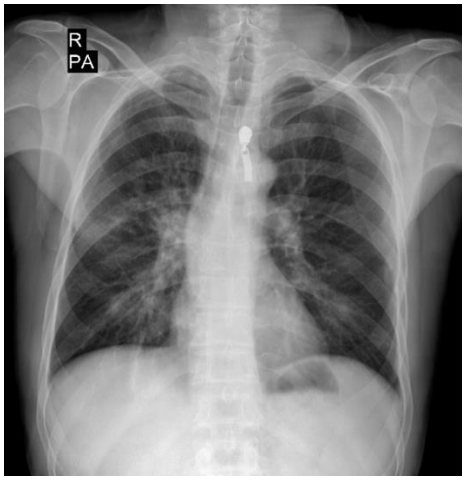
anteroposterior chest radiography (Figure 1) was normal with no pneumothorax, hemothorax, or rib fractures. The complete blood count and renal/hepatic function panels displayed normal results in routine laboratory tests.

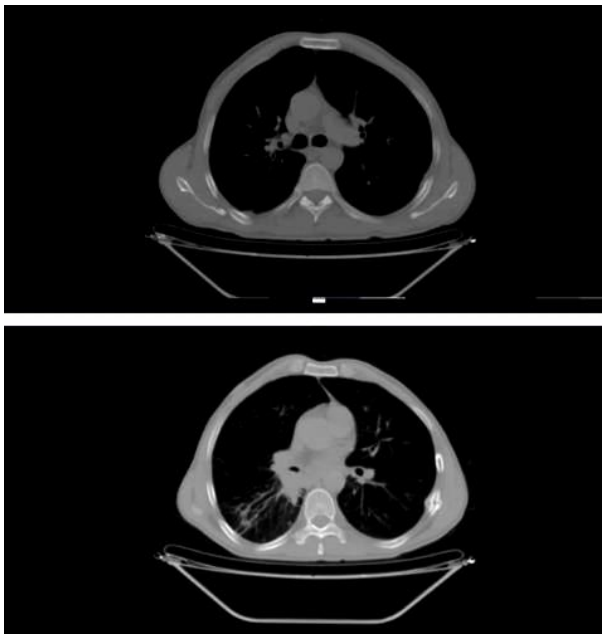
Figure 1. Chest x-ray of the patient



3. RESULTS

The patient underwent non-contrast thoracic CT scan following oral ibuprofen 400mg administration for pain relief while holding his breath during inspiration in a supine position. The imaging results showed that the left seventh and eighth posterior ribs had nondisplaced oblique fractures at their costovertebral junctions (Figure 2). The patient's hemoglobin levels remained within the normal range, between 14.2 g/dL and 13.8 g/dL, indicating no major bleeding. The patient received 1 mg of intravenous morphine after CT imaging for pain relief, which reduced his pain score to 4/10 before being discharged on oral ibuprofen 600mg every 8 hours for pain management. The patient received follow-up care, which included a thoracic evaluation at 48 hours and a pulmonary consultation for budesonide/formoterol cough suppression. The pain diary showed that the patient's pain score decreased from 4/10 to 1/10 while he stopped taking analgesics during week 5. The bone density assessment was not performed at the time of the final follow-up.

Figure 2. Axial non-contrast thoracic CT series demonstrating rib fractures



4. DISCUSSION

Multiple mechanisms work together to explain the development of rib fractures caused by coughing, with the main mechanism resulting from opposing muscle forces on the rib cage, the simultaneous activation of shoulder girdle muscles that elevate and laterally pull the ribs and abdominal muscles that depress and medially pull them, producing strong torsional stresses on individual ribs during coughing, while the high intrathoracic pressures generated during forceful coughing episodes intensify these torsional and bending forces, and repetitive mechanical loading eventually surpasses bone adaptation mechanisms and causes muscle exhaustion, culminating in stress fractures [3].

The extended trauma leads to inelastic deformation, primarily affecting vulnerable structural areas such as the middle sections of ribs five to ten and the costochondral junctions [7]. Cough-induced rib fractures emerge from frequent mechanical forces during strong expiration, according to Özyurtkan et al., but patients with COPD experience increased vulnerability because of particular pathophysiological factors [3]. The combination of diaphragm flattening with thoracic cage expansion through chronic hyperinflation creates high-stress points at the costochondral junctions, where cartilage degeneration weakens the shock-absorbing properties [8].

The combination of oral corticosteroid use for frequent treatment, loss of muscle mass with or without loss of body weight, and vitamin D deficiency in COPD patients leads to osteoporosis [9, 10]. The patient suffered rib fractures at cough pressures, which normally would not cause problems for healthy people, indicating how COPD-related changes create essential weak points that go beyond standard risk elements. The existing

research provides essential background information that enhances our understanding of this patient's demographics and physical mechanisms. Several risk factors for the development of cough-induced rib fractures have been reported. Osteoporosis, COPD, prolonged use of high dose steroids, asthma, and coughing more than three weeks is mentioned as a risk factor [2]. The diagnostic pathway presented in this case demonstrates the recognized constraints of imaging techniques. The initial radiograph missed these posterior fractures because the literature shows that CT provides greater accuracy than conventional chest radiography and the accuracy of CT diagnosis for rib fractures was found to be around 70–90% [11, 12].

4.1. Limitations

Several limitations warrant acknowledgment. The general applicability of this study remains limited because it presents a solitary case report. The study did not include longitudinal CT follow-up data to evaluate fracture healing patterns in COPD patients while also lacking bone mineral density measurements, which represent an important deficiency given the disease's effects on skeletal health. Research on fracture incidence among COPD patients across multiple centers should be conducted to establish standardized screening methods and determine how inflammatory and mechanical factors impact fracture vulnerability.

5. Conclusion

Spontaneous rib fractures due to coughing, though rare, represent a clinically significant issue in patients with COPD. This case underscores the diagnostic challenges of such presentations and emphasizes the importance of advanced imaging modalities, such as CT, for accurate detection. Moreover, it highlights the potential for COPD to act as an independent risk factor for rib fractures, even in the absence of osteoporosis or corticosteroid use. Clinicians should consider early CT imaging in COPD patients with unexplained chest pain and normal chest radiographs to avoid diagnostic delays and prevent complications. Preventive strategies, including bone mineral density screening and cough suppression therapies, should be explored as part of routine care in high-risk COPD populations.

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Written informed consent was obtained from the patient for publication of this case report.

Author Contributions

Conception and design of the study: SE; Data collection: SE, BŞ; Data analysis: SE; Data Interpretation: SE, BŞ; Drafting the article and/or its critical revision: SE, BŞ; All authors have read and agreed to the published version of the manuscript.

Conflict of Interest

No conflict of interest is declared by the authors. In addition, no financial support was received.

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