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Curative Outcome of Osteosarcoma with Associated Pleural Effusion: A Case Report

—Bone Tumor with Pleural Effusion in an Adolescent

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Abstract

Background: Osteosarcoma is the most common primary malignant bone tumor in children and young adults. Pulmonary metastasis is frequent, but pleural effusion is an unusual and challenging concomitant finding. We present a case of osteosarcoma with pleural effusion, managed successfully with multimodal therapy, and no recurrence after 3 years of follow-up. **Case Presentation**: We report a 17-year-old boy with osteosarcoma of the distal femur and reactive left-sided pleural effusion. The patient underwent thoracentesis followed by neoadjuvant chemotherapy, limb-salvage surgery, and adjuvant chemotherapy. The effusion resolved and did not recur. Conclusion: This case highlights that pleural effusion may accompany bone tumors even without metastasis, and that multidisciplinary management can achieve excellent outcomes.

Keywords

Osteosarcoma, Pleural Effusion, Adolescent, Bone Tumor, Case Report, Limb-Salvage Surgery

1. Introduction

Osteosarcoma is the most frequent primary malignant bone tumor in adolescents and young adults. The most common sites are the metaphysis of long bones, particularly around the knee. Common sites of metastasis include the lungs, but pleural effusion as an initial presentation is rare [1]. The presence of pleural effusion may complicate both diagnosis and management. We present a case of a 17-year-old boy with osteosarcoma and concurrent pleural effusion who achieved complete recovery after multimodal therapy.

2. Case Presentation

2.1. Clinical Findings

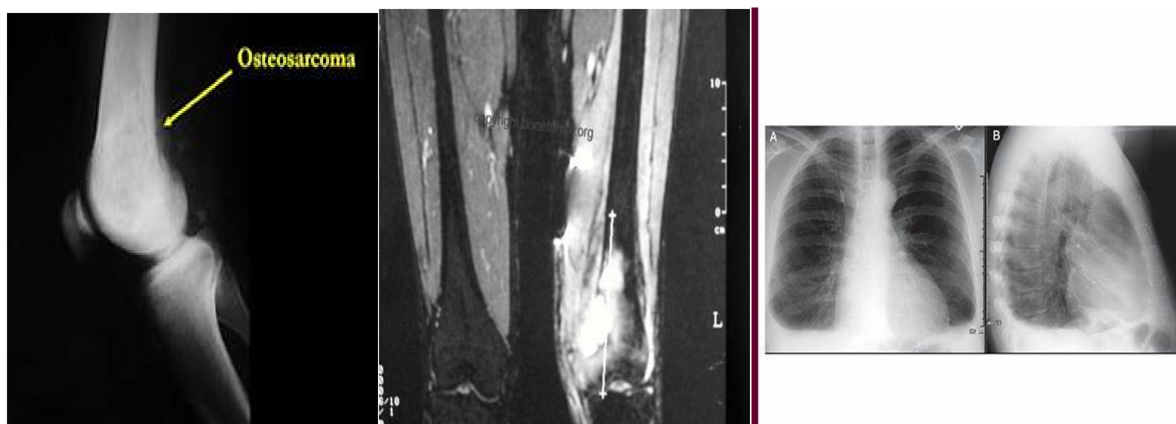
- Progressive pain and swelling over the left distal femur for 2 months
- Low-grade fever, dry cough, and weight loss over the last 3 weeks
- Mild exertional dyspnea

Examination revealed a firm, tender swelling (8 × 6 cm) over the distal femur. Decreased breath sounds and dull percussion were noted over the left lower chest.

2.2. Investigations

2.2.1. Bone Lesion

- X-ray: Mixed lytic–sclerotic lesion, periosteal reaction
- MRI: Large intramedullary tumor extending into soft tissues
- Core needle biopsy: Osteoblastic osteosarcoma



2.2.2. Pleural Effusion

- Chest X-ray: Moderate left-sided pleural effusion
- Ultrasound: Free anechoic fluid
- Diagnostic thoracentesis: Straw-coloured, exudative fluid, cytology negative for malignancy. The fluid showed low cellularity with predominantly lymphocytes and no atypical cells. No organisms were identified on Gram stain or culture, and adenosine deaminase (ADA) levels were within normal limits, supporting a reactive, non-infectious aetiology
- Chest CT: No pulmonary nodules, only pleural fluid

2.3. Management

- Pleural effusion: Therapeutic thoracentesis drained 700 mL with complete symptom relief
- Bone tumor: Treated as non-metastatic osteosarcoma with standard multimodal therapy:
  - Neoadjuvant chemotherapy (MAP protocol—high-dose methotrexate, doxorubicin, cisplatin)
  - Limb-salvage surgery with wide tumor excision and Endo prosthetic re-

construction
- Adjuvant chemotherapy for 6 cycles

Postoperative histopathology showed >90% tumor necrosis, indicating a good response.

2.4. Outcome and Follow-Up

- Pleural effusion resolved completely and did not recur
- At 18 months and 3-year follow-up
  - Patient is disease-free
  - Walking unaided
  - Normal pulmonary function and clear chest imaging

3. Discussion

Osteosarcoma is the most common primary malignant bone tumour in adolescents and young adults, accounting for approximately 20% of all primary bone malignancies. It typically arises from the metaphyseal regions of long bones, particularly around the knee. Although pulmonary metastasis is a well-recognized complication, pleural effusion is an uncommon finding and is rarely reported at initial presentation [1]. In our case, the effusion was reactive and non-malignant. This underscores the need for a thorough diagnostic evaluation, including cytology and imaging, to rule out metastasis.

Pleural Effusion in Osteosarcoma

Pleural effusion associated with osteosarcoma can occur through several mechanisms [2]:

- **Metastatic spread to the pleura** resulting in malignant pleural effusion
- **Reactive or paraneoplastic effusion** due to inflammatory cytokines, or adjacent lung irritation
- **Infective causes** secondary to immunosuppression from tumour-related cachexia or chemotherapy

In the present case, the pleural fluid was exudative but cytologically negative for malignant cells, and there were no radiologic features of lung or pleural metastases. This strongly supports a reactive or paraneoplastic aetiology rather than metastatic disease. Similar findings have been reported sporadically in the literature, highlighting the rarity of this presentation.

4. Diagnostic Challenges

The presence of a pleural effusion in a patient with suspected bone malignancy poses several diagnostic challenges. It can mimic infectious or inflammatory pathology, leading to diagnostic delay. Comprehensive evaluation including:

- Chest imaging (X-ray, ultrasound, and CT)
- Diagnostic thoracentesis with cytology, biochemistry, and microbiology is essential to rule out malignancy or infection

In our case, early thoracentesis allowed symptomatic relief and helped guide further oncologic treatment by confirming the absence of malignant cells.

Importantly, the identification of a non-malignant pleural effusion has significant implications for the formal staging of osteosarcoma. According to the American Joint Committee on Cancer (AJCC) TNM staging system [3] [4], the presence of distant metastases—including pulmonary involvement—upstages the disease to Stage IV, which carries a poorer prognosis and may alter therapeutic decisions. In this case, the absence of malignant cells in pleural fluid cytology, negative microbiological cultures, and lack of pulmonary nodules on imaging support a reactive, non-malignant aetiology. Recognizing the effusion as reactive rather than metastatic is therefore critical to avoid misclassification of the disease stage, which could lead to overtreatment or inappropriate prognostication [5].

5. Importance of Multidisciplinary Management

Osteosarcoma requires a multimodal treatment approach combining neoadjuvant chemotherapy, surgical excision with wide margins, and adjuvant chemotherapy. This strategy improves local control and reduces the risk of systemic spread. The standard MAP regimen (high-dose methotrexate, doxorubicin, and cisplatin) remains the backbone of therapy, with limb-salvage procedures preferred over amputation whenever feasible [6].

This patient responded well to chemotherapy, with histological analysis showing >90% tumour necrosis, indicating a favourable prognosis. The resolution and non-recurrence of the pleural effusion after tumour control for 3 years further support its reactive nature.

6. Prognosis and Follow-Up

Historically, the prognosis for osteosarcoma was poor, but survival has improved substantially with modern therapy [7]. The 5-year overall survival for localized disease is now around 60% - 70%. Close surveillance with periodic chest imaging is critical, especially during the first 2 - 3 years after treatment, when the risk of relapse is highest.

In our case, the patient has remained disease-free at 18 months and 3 years follow up with full functional recovery of the limb and normal pulmonary function, highlighting the effectiveness of timely multidisciplinary management.

7. Literature Perspective

Only a handful of published case reports describe osteosarcoma presenting with pleural effusion without pulmonary metastases, underlining the rarity of this clinical association [8]. These reports emphasize that effusion often resolves with primary tumour treatment, as observed here. Awareness of this phenomenon is important to avoid over staging the disease or unnecessarily labelling the patient as having metastatic disease.

8. Conclusion

This case underscores a rare but clinically important presentation of osteosarcoma with reactive pleural effusion in an adolescent, occurring without evidence of metastatic disease. Early diagnostic thoracentesis played a pivotal role in distinguishing non-malignant from malignant effusions, thereby preventing disease overstaging and guiding appropriate therapy. Multidisciplinary management—including chemotherapy and limb-salvage surgery—resulted in excellent oncologic and functional outcomes. Recognizing such atypical manifestations is essential to avoid misinterpretation and ensure timely, curative treatment in similar cases.

Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

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