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Case Report

Pleural Effusion During Tyrosine-Kinase Inhibitor (Imatinib) Treatment in Chronic Myeloid Leukemia - A Case Report

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Background: Chronic myeloid leukemia (CML) is effectively managed with tyrosine kinase inhibitors (TKIs) like imatinib. However, adverse effects such as pleural effusion, although rare, can complicate treatment. This report discusses a case of pleural effusion during imatinib therapy, highlighting the challenges and considerations in managing such complications.
Methods: A single-case study was conducted at RNT Medical College, Udaipur, involving a CML patient who developed pleural effusion 18 months after starting imatinib. Diagnostic assessments included chest X-rays, CT scans, and thoracentesis.
Results: Discontinuation of imatinib and symptomatic management led to the resolution of pleural effusion. The patient's respiratory symptoms improved significantly with alternative management strategies for CML considered to avoid recurrence of the effusion.
Conclusion: This case underscores the need for vigilant monitoring for adverse effects like pleural effusion in patients treated with TKIs. Early detection and appropriate management are crucial to prevent significant morbidity.
Keywords: Chronic myeloid leukemia, Imatinib, Pleural effusion, Tyrosine kinase inhibitors, Case report

Introduction

Chronic myeloid leukemia (CML) is a myeloproliferative neoplasm characterized by the uncontrolled growth of predominantly myeloid cells in the bone marrow and the accumulation of these cells in the blood.[1,2] The discovery of the Philadelphia chromosome, the cytogenetic hallmark of CML, led to the identification of the BCR-ABL1 fusion gene, a constitutively active tyrosine kinase that drives the pathogenesis of the disease. The introduction of tyrosine-kinase inhibitors (TKIs) has revolutionized the treatment landscape for CML, transforming a once fatal leukemia into a manageable chronic condition. Imatinib mesylate, the first-generation TKI, specifically targets the BCR-ABL1 oncoprotein and has shown remarkable efficacy in achieving

hematologic and cytogenetic remissions in patients with CML.[3,4]

Despite its efficacy, the use of imatinib is associated with various side effects, including hematologic toxicities, liver dysfunction, and fluid retention. Pleural effusion, a less common but clinically significant side effect, poses a diagnostic and therapeutic challenge. The development of pleural effusion in patients undergoing imatinib therapy is not only distressing for the patient due to its symptoms, such as dyspnea and chest discomfort, but also complicates the clinical management of CML. The pathophysiology of TKI-induced pleural effusion is poorly understood, but it is thought to involve immune-mediated mechanisms and alterations in vascular and lymphatic endothelial permeability.[5,6,7]

This case report describes a unique instance of a patient with chronic myeloid leukemia developing pleural effusion during treatment with imatinib. The occurrence of pleural effusion as a complication of imatinib therapy in CML is relatively rare, and documenting such cases is crucial for enhancing our understanding of the side effect profile of TKIs and refining approaches to the management of complications. This report aims to add to the body of evidence on TKI-induced pleural effusions, discussing the clinical presentation, diagnostic challenges, management strategies, and outcomes in the context of CML treatment.[8,9,10]

Through this discussion, we aim to highlight the need for vigilance and proactive management in patients treated with TKIs, particularly in monitoring for signs of pleural effusion, to ensure timely intervention and prevent complications that could impact the overall prognosis of CML patients. This case underscores the importance of personalized care in the era of targeted cancer therapy, where understanding and managing side effects is as crucial as controlling the primary disease.

Materials and Methods

Study Setting and Design

This case report was conducted at RNT Medical College, Udaipur, known for its comprehensive healthcare services. It focuses on a patient with chronic myeloid leukemia (CML) who developed pleural effusion as a complication during treatment with imatinib. This report provides an in-depth analysis of the patient's diagnosis, management strategies, and outcomes, with a particular emphasis on the challenges posed by pleural effusion.

Patient Selection

The patient reported here was under care at RNT Medical College. Inclusion criteria for this case report included a confirmed diagnosis of CML, ongoing treatment with imatinib, and the subsequent development of pleural effusion during treatment. This case was selected due to the unusual presentation of pleural effusion in a patient undergoing imatinib therapy for CML.

Data Collection

Data were meticulously collected from the patient’s medical records, which included demographic details, a comprehensive medical history, specifics of the CML diagnosis and treatment, and relevant imaging and laboratory results. Special attention was given to the timing of imatinib therapy and the onset of symptoms related to pleural effusion. Diagnostic imaging such as chest X-rays and computed tomography (CT) scans were reviewed to evaluate the progression and management response of the effusion.

Diagnostic Methods

The diagnosis of pleural effusion was confirmed through radiological assessments and thoracentesis. Fluid analysis included biochemical, cytological, and microbiological evaluations to rule out other causes of the effusion. The timing of imatinib therapy initiation and symptom onset was critically examined to establish a potential causal relationship.

Management

Management of the pleural effusion included the temporary discontinuation of imatinib, therapeutic thoracentesis to relieve symptoms, and close monitoring of the patient's respiratory status. Adjustments to the oncological treatment regimen were tailored based on the patient's response to interventions, overall health status, and the severity of the effusion.

Ethical Considerations

This case report was conducted in accordance with the ethical standards of the institutional research committee at RNT Medical College, Udaipur. All procedures were within the framework of standard care, with stringent measures to maintain patient confidentiality by removing all personal identifiers to protect privacy.

Case Presentation

Clinical History

The patient, a 57-year-old male, was diagnosed with chronic myeloid leukemia (CML) and had been under treatment with imatinib.

Clinical Findings

At presentation, the patient showed signs of respiratory distress characterized by tachypnea and diminished breath sounds on the left side of the chest. His initial vital signs included mild tachycardia and an oxygen saturation of 88% on room air.

Diagnostic Focus and Assessment

Initial diagnostic imaging, including a chest X-ray followed by CT scans, confirmed a significant left-sided pleural effusion. Laboratory evaluations showed normal white blood cell counts and negative blood cultures, indicating no infectious process. A thoracentesis was performed, extracting serous fluid which was analyzed biochemically, cytologically, and microbiologically. Results revealed no malignant cells and were negative for bacterial, fungal, and tubercular pathogens, supporting a non-infectious cause of the effusion.

Therapeutic Intervention

The clinical presentation and diagnostic results suggested a drug-induced pleural effusion. Consequently, imatinib therapy was halted, and diuretic treatment was initiated to manage the effusion. A subsequent thoracentesis was performed two weeks later, removing approximately 500 mL of fluid to alleviate symptoms. Supplemental oxygen therapy was also provided during this period to support respiratory function.

Follow-up and Outcomes

Following the discontinuation of imatinib and effusion management, the patient experienced a marked improvement in respiratory symptoms. Follow-up imaging conducted one month later showed substantial resolution of the pleural effusion. In light of continuing the necessary CML treatment, alternative tyrosine kinase inhibitors were considered for future management, with a plan to monitor for similar adverse reactions.

Results

The pleural effusion resolved with the discontinuation of imatinib and symptomatic management. The patient's case underscores the importance of considering drug-induced side effects in patients presenting with new respiratory symptoms, particularly when on medications known to cause fluid retention. The successful resolution of the pleural effusion following the withdrawal of imatinib and the use of supportive measures confirmed the suspected adverse drug reaction.

Table 1: Diagnostic Findings

Parameter	Result	Reference Range	Notes
White Blood Cell Count	7.2 x 10^3/uL	4.5 - 11.0 x 10^3/uL	Normal, suggesting no infectious process
Chest X-ray	Left-sided pleural effusion	-	Initial imaging finding
CT Scan	Confirmed pleural effusion	-	Detailed extent and volume
Thoracentesis Fluid Analysis	Serous fluid	-	Negative for malignant cells
Biochemical Markers	Within normal limits	-	Supports non-malignant etiology
Microbiology	Negative	-	No bacterial, fungal, or TB infection

Table 2: Therapeutic Interventions and Outcomes

Intervention	Description	Outcome
Discontinuation of Imatinib	Suspected cause of pleural effusion	Led to improvement of symptoms
Diuretic Therapy	To manage fluid retention	Assisted in fluid reduction
Thoracentesis	Performed to relieve symptoms	Removed 500 mL of pleural fluid
Oxygen Therapy	Supplemental oxygen during recovery	Improved oxygen saturation
Repeat Imaging	Chest X-ray and CT scan one month post-intervention	Substantial resolution of effusion

Discussion

The development of pleural effusion in patients undergoing treatment with imatinib, while rare, presents a significant clinical challenge. This side effect, although not commonly associated with the early phase of therapy, can manifest after prolonged exposure to the drug, as illustrated by the presented case. The management of such complications involves a multidisciplinary approach that includes cessation of the offending agent and symptomatic management. In the discussed case, the quick identification and management of the pleural effusion, characterized by dyspnea and chest discomfort, were crucial in preventing further complications.[11,12,13]

The pathophysiological mechanisms underlying TKI-induced pleural effusion may involve alterations in vascular and lymphatic endothelial permeability, potentially mediated by an immune response. Such complications necessitate a careful reassessment of the therapeutic regimens, weighing the benefits of continued TKI therapy against the risks of severe side effects. The decision to discontinue imatinib, a pivotal component of CML management, underscores the complexity of balancing effective cancer control with quality of life considerations.[14,15]

Furthermore, the switch to alternative TKIs or the introduction of adjunct therapies to manage side effects without compromising the oncological outcomes is an area that requires more clinical research. This case contributes to the growing literature on the side effect profile of TKIs and serves as a reminder of the dynamic nature of cancer therapy, where treatment adjustments are often necessary to align with individual patient responses and tolerance.

Conclusion

This case report of pleural effusion in a CML patient treated with imatinib highlights an important clinical consideration in the era of targeted therapies. It emphasizes the necessity for ongoing monitoring and readiness to adapt treatment plans to manage side effects effectively. Ensuring patient safety and optimizing therapeutic outcomes require a balance of vigilant monitoring and flexible treatment strategies. This report adds valuable insights into the management of TKI-induced

pleural effusion, advocating for a personalized approach to oncology care.

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