Case Report

Early t-cell precursor acute lymphoblastic leukemia presenting as pericardial tamponade

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Abstract

Background: Acute Lymphoblastic Leukemia (ALL) is a malignant disorder of lymphoid progenitor cells that commonly presents with symptoms related to bone marrow failure. However, extramedullary manifestations may occasionally be the initial presentation. Pericardial effusion leading to cardiac tamponade is a rare but life-threatening complication associated with hematological malignancies. We report the case of a 31-year-old female with no known comorbidities who presented with dry cough for two months and breathlessness for one week. Echocardiography revealed massive pericardial effusion with features of cardiac tamponade, for which emergency pericardiocentesis was performed. Further evaluation with flow cytometry confirmed Early T-cell Precursor Acute Lymphoblastic Leukemia (ETP-ALL). This case highlights the importance of considering hematological malignancy in patients presenting with unexplained pericardial effusion and mediastinal masses.

Key words: Acute Lymphoblastic Leukemia (ALL); Early T-cell Precursor Acute Lymphoblastic. Leukemia (ETP-ALL).

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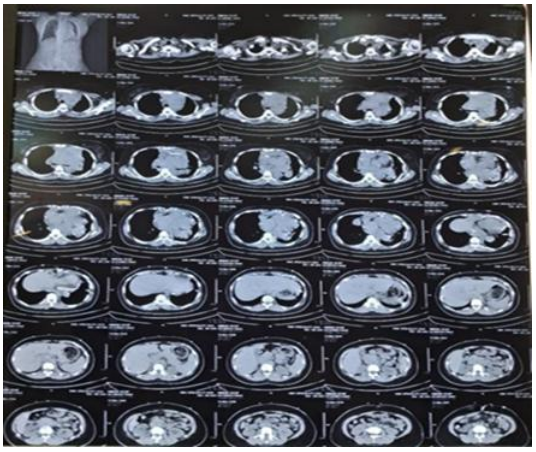
1. Introduction

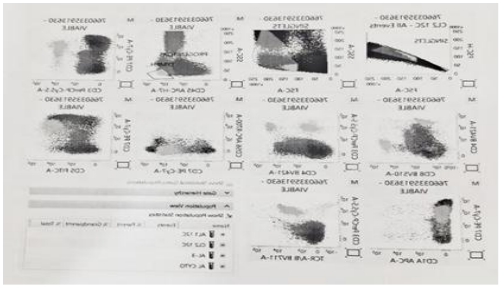
Acute Lymphoblastic Leukemia (ALL) is characterized by the clonal proliferation of immature lymphoid cells in the bone marrow, peripheral blood, and extramedullary tissues. Among its subtypes, Early T-cell Precursor Acute Lymphoblastic Leukemia (ETP-ALL) is a distinct and aggressive variant of T-cell ALL with unique immunophenotypic characteristics and relatively poor prognosis. Pericardial involvement in leukemia is uncommon and may manifest as pericardial effusion due to leukemic infiltration, infection, or inflammatory mechanisms. In rare instances, rapid accumulation of pericardial fluid may result in cardiac tamponade, a medical emergency requiring immediate intervention. Recognition of this rare presentation is important for early diagnosis and management.

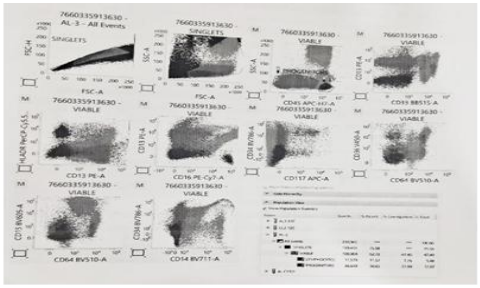
2. Case presentation

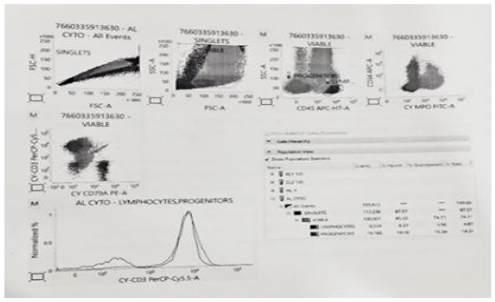
A 31-year-old female with no prior comorbidities presented with complaints of dry cough for two months and progressive shortness of breath for one week. Clinical evaluation suggested features of hemodynamic compromise, raising suspicion of pericardial tamponade. Echocardiography revealed massive pericardial effusion with tamponade physiology. The patient underwent urgent pericardiocentesis, which led to symptomatic improvement. Analysis of the pericardial fluid revealed atypical lymphoid proliferation on cytology. The adenosine deaminase (ADA) level was markedly elevated to 310 U/L. Further imaging with computed tomography (CT) of the chest demonstrated a large anterior mediastinal mass, suggesting possible lymphoid malignancy. Peripheral blood smear showed mild leukocytosis without significant abnormal cells initially.

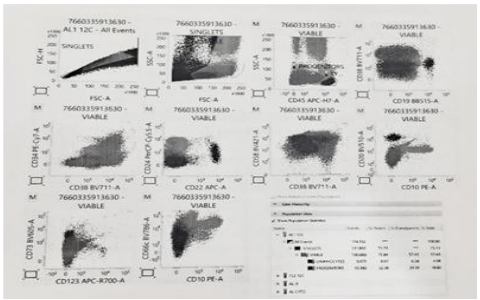


To establish the diagnosis, flow cytometry was performed, which confirmed Early T-cell Precursor Acute Lymphoblastic Leukemia (ETP-ALL). The patient was subsequently referred to as hematology evaluation and initiation of systemic chemotherapy according to ALL treatment protocols.









3. Discussion

Pericardial tamponade in patients with Acute Lymphoblastic Leukemia (ALL) occurs due to rapid accumulation of fluid in the pericardial sac, leading to increased intrapericardial pressure and impaired cardiac filling.

Several mechanisms can explain this complication:

3.1 Leukemic infiltration of the pericardium

Leukemic lymphoblasts may infiltrate the pericardium or pericardial layers. This infiltration causes inflammation and increases vascular permeability, resulting in exudative pericardial effusion. Continuous accumulation of fluid can eventually compress the heart and lead to tamponade.

3.2 Mediastinal mass obstruction

In T-cell ALL, particularly subtypes such as ETP-ALL, leukemic proliferation often produces a large anterior mediastinal mass originating from the thymus. This mass can obstruct lymphatic drainage and compress mediastinal veins. This leads to impaired pericardial fluid drainage and progressive accumulation, contributing to pericardial effusion and tamponade.

3.3 Lymphatic obstruction

Leukemic cells may infiltrate or compress pericardial lymphatic channels, preventing normal fluid reabsorption. The imbalance between production and drainage of pericardial fluid results in effusion buildup.

3.4 Inflammatory cytokine release

Leukemic cells can release inflammatory mediators and cytokines, causing: Increased capillary permeability, Exudative fluid accumulation in the pericardial space.

3.5 Secondary causes

In some cases, tamponade may also result from: Infections due to immunosuppression. Bleeding into the pericardial sac due to thrombocytopenia Treatment-related effects (less common at presentation).

4. Conclusion

Pericardial tamponade as the initial manifestation of Early T-cell Precursor Acute Lymphoblastic Leukemia is extremely rare. This case emphasizes the importance of thorough evaluation of unexplained pericardial effusion, especially in the presence of mediastinal masses or atypical cytology findings. Early diagnosis through appropriate imaging and immunophenotypic analysis is essential for prompt treatment and improved patient outcomes.