Case Report

Interventional diagnosis loculated pleural effusion due to tuberculosis in children: case report

Dimas Bayu Firdaus, Finny Fitry Yani, Oea Khairsyaf

Abstract:

Introduction: Tuberculosis (TB) remains a significant health concern for children worldwide, with approximately one million cases reported in 2020. Extrapulmonary tuberculosis occurs in about 20% of tuberculosis cases in children. Childhood pleural tuberculosis is a frequent manifestation of TB in pediatric patients. Numerous studies have outlined the clinical features of pleural TB in children. However, accurately diagnosing childhood pleural TB continues to be a difficult task.

Case: A 13-year-old girl with clinical symptoms of TB, but still not proven bacteriologically. A minimally invasive diagnostic search is carried out to determine the therapy given. VATS results showed a loculated pleural cavity and a caseous mass was found on the posterolateral left lung.

Discussion: The diagnosis of pleural TB is based on the presence of tuberculosis bacilli in the pleural fluid, pleural biopsy, and pleural granulomas on histopathological examination. Pediatric TB is difficult to diagnose because it can be confirmed by culture in only 20% to 40% of cases (compared to 90% of adult cases). Thoracoscopy is a safe, simple, and accurate tool to assist in the diagnosis of pleural disease.

Conclusion:

Diagnosing pleural effusion can be challenging due to the presence of tuberculosis, which often necessitates less invasive methods like bronchoscopy and thoracoscopy as the preferred means of diagnosis, helping to eliminate other potential causes.

JK-Practitioner2023;28(1-2):64-68

INTRODUCTION

Tuberculosis (TB) remains a significant health concern for children worldwide, with approximately one million cases reported in 2020.[1]Children and adolescents younger than 15 years represent about 12% of incident cases but this group accounts for 16% of the estimated 1,4 million deaths from TB in 2019. The relatively high mortality rate in these children creates an urgent need for better case detection in this group[2] Diagnosis can be challenging due to nonspecific signs and symptoms, and difficulty in obtaining adequate samples.[3]

Extrapulmonary tuberculosis occurs in about 20% of tuberculosis cases in children. Childhood pleural tuberculosis is a frequent manifestation of TB in pediatric patients. Numerous studies have outlined the clinical features of pleural TB in children. Studies conducted in developing countries have found that pleural tuberculosis to be the most common type of extrapulmonary tuberculosis among children and adolescents. Several reports have summarized the clinical characteristics of childhood pleural TB however, accurately diagnosing childhood pleural TB continues to be a difficult task. [4,5]

The diagnostic and treatment approaches for tuberculosis (TB) in children differ depending on factors such as the doctor's expertise, the healthcare setting, and the child's age.[5] Thoracoscopy is an effective and secure method for identifying pleural TB in children, but its applicability is limited due to its invasive procedure.[6] Here we report the diagnosis course of loculated pleural effusion due to tuberculosis in children.

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Cite This Article as

Firdaus DB, Yani FF, Khairsyaf O, Interventional diagnosis loculated pleural effusion due to tuberculosis in children: case report. JK Pract2023;28 (1-2):64-68

Full length article available at **jkpractitioner.com** one month after publication

Keywords

Pleural effusion, tuberculosis, thoracoscopic

CASE

A 13-year-old girl with a cough for more than 2 weeks accompanied by shortness of breath, and a history of recurrent fever was referred from the previous hospital because there was no clinical improvement after treatment. Tuberculosis contact history is unknown. The patient has been vaccinated with BCG. Physical examination of the thorax revealed dullness to percussion and absent breath sounds at the bottom of the right hemithorax. No palpable lymph node enlargement was found in this patient.

Laboratory examinations showed an increase in the erythrocyte sedimentation rate (36mm/hour), there were no significant abnormalities in other laboratories. Tuberculin test and Sputum Rapid Molecular Test were performed on this patient with negative results. A chest X-ray shows a pleural effusion and is confirmed by a chest ultrasound that shows a separated (loculated) pleural effusion. A *Chest CT scan was* performed on a patient with left lower lobe atelectasis with pleural effusion.

Table 1. Laboratory Test

	Result	
Hb	10,1	g/dl
Leukocytes	7,7	$10^3/mm^3$
Platelets	714	$10^3/mm^3$
Diff Count		
-Basophils	0	%
-Eosinophils	3	%
-Band Neutrophils	1	%
-Segmented Neutrophils	61	%
-Lymphocytes	30	%
-Monocytes	5	%
Absolute Lymphocytes Count	2,3	$10^3/mm^3$
Erythrocyte Sedimentation Rate	36	mm/H
LDH	197	U/L
Total Protein	7,1	g/dl
Albumins	3,3	g/dl
Globulins	3,8	g/dl
Blood Glucous	107	mg/dl

Thoracentesis was performed on this patient and seropurulent pleural fluid was obtained, then the procedure was followed by the insertion of a chest tube. The pleural fluid analysis described an acute exudate process (based on Light's criteria), no bacterial growth was found on culture examination, the impression of chronic inflammation of an acute exacerbation was obtained based on cytology results, Adenosine Deaminase (ADA) examination was performed with a result of 37 U/L. During the observation that the total fluid drained was 520cc, clinical improvement was found in the patient, but the evaluation chest X-ray did not show any significant improvement.

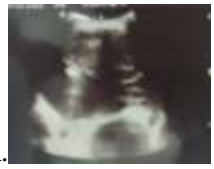
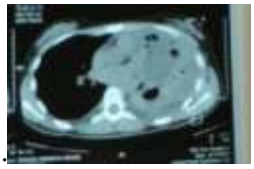
A.  B. 

Figure 1. Thoracic Ultrasound (A), and Thoracic CT-Scan (B)

Further investigations were carried out on the patient to determine the cause of the persistent atelectasis. Bronchoscopy showed narrowing of segment B5 of the left lung, with good mucosa. The examination was continued with Video-Assisted Thoracoscopy Surgery (VATS) which found a loculated pleural cavity and a caseous mass was found on the posterolateral left lung. The results of the caseous tissue biopsy in the patient showed a large caseous area with an appearance of a mycobacterium infection otherwise the result of the MTB culture is negative. Following a comprehensive evaluation, the patient was prescribed anti-tuberculosis medications. As the patient exhibited clinical and radiological improvements after two months of treatment, the administration of anti-tuberculosis drugs was continued until the ninth month.

Table 2. Pleural fluid examination

	Result	
Total Liquid	520	Ml
Rivalta	Positive	
Albumin	3	g/dl
LDH	643	u/l
Glucose	76,5	Mg/dl
Total Cell	625	$/mm^3$
PMN	60%	%
MN	40%	%
Impression	Exudative acute process	
Cytology	Acute exacerbation of chronic inflammation	
Culture	No Growth	
ADA	37	U/l

DISCUSSION

This case described, a 13-year-old girl presented with pleural effusion, and tuberculosis was suspected as the underlying cause. Pleural tuberculosis is more commonly observed in children aged over 5 years compared to those under 5, and it is frequently seen during adolescence. Studies have reported a median age of 13 years for the occurrence of pleural tuberculosis in pediatric patients.[7] Early signs and symptoms include acute fever with nonproductive cough and unilateral chest pain.[8]. This is under the patient, who has similar symptoms, so the patient is suspected of having TB.

The results of the Mantoux examination and the patient's rapid molecular sputum test were negative. Diagnosing tuberculosis in pediatric cases is challenging as culture confirmation is possible only in 20% to 40% of cases, in contrast to the higher rate of 90% in adults. Consequently, numerous cases of pediatric TB remain undiagnosed, and clinical

diagnosis is often relied upon. This delay in diagnosis significantly impacts the timely identification and treatment of TB in children. Moreover, the accuracy of diagnosis plays a crucial role in the successful management of TB in pediatric patients.[9]

The patient's chest X-ray showed a pleural effusion with a right paracardial infiltrate. Confirmation of the presence of fluid in the pleural space in the patient was performed by Thoracic Ultrasound with the impression of a loculated pleural effusion and a CT-Scan of the thorax which gave the impression of a pleural effusion with atelectasis. Pleural effusion is significantly more common on ultrasound than on chest X-rays. This is consistent with previous studies that have shown ultrasound to be superior to chest X-ray for pleural effusions, and for differentiating consolidation from pleural effusions.[10]

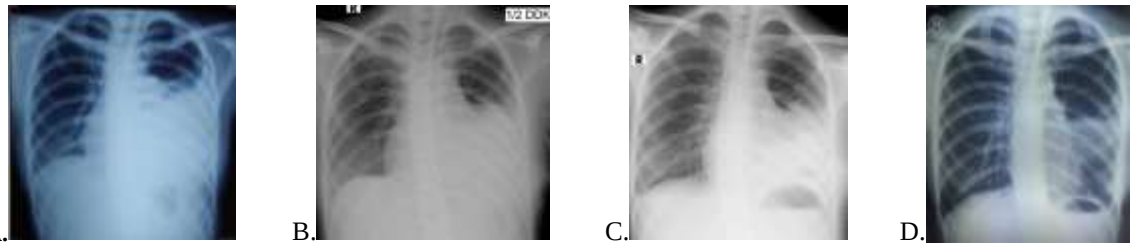


Figure 2. Serial chest X-ray; Initial chest X-ray (A), Chest X-ray after chest tube insertion (B), X-ray evaluation 3 days after chest tube insertion(C), and X-ray after the intensive phase of anti-tuberculosis drugs (D)

The study by Charlotte et al mentioned that chest ultrasound could be useful for detecting findings related to pulmonary TB and for treatment follow-up in children.[11] Ultrasound has a higher inter-operator concordance of interpretation than chest X-ray in 0.5 cm consolidation, pleural effusion, or enlarged mediastinal lymph nodes. Ultrasonography has the advantage of being relatively easy to perform as a bedside examination, quick to perform, and can be performed directly by the clinician.[10]

Pleural effusion is a frequent occurrence in children diagnosed with pulmonary tuberculosis, with approximately 30% of confirmed pulmonary TB cases experiencing this complication, particularly among older children. This aligns with previous findings reporting pleural effusion in 2-38% of pediatric TB cases, occurring more commonly in older children. Pleural effusion can arise as an immune response to Mycobacterium tuberculosis or as a result of the spread of adjacent pulmonary TB.[11]A thoracic tube was placed on the patient, with a total production of 520cc seropurulent fluid. The results of the pleural fluid analysis gave the impression of an exudative acute process with LDH levels reaching 643 U/L. The levels of pleural lactate dehydrogenase (LDH) as a biomarker can fluctuate during the progression of pleural inflammation. The initial level of pleural LDH is believed to mirror the serum LDH level due to filtration into the pleural space. On the other hand, elevated LDH levels are presumed to have a cellular origin rather than being derived from filtration. Pleural LDH can serve as a useful biomarker for diagnosing empyema.[12]

Pleural effusion is a frequent complication of pneumonia in children. When the pleural Adenosine Deaminase (ADA) level exceeds 40 U/L, pleural tuberculosis (TB) is typically considered as a potential cause. ADA is an enzyme that plays a role in converting adenosine to inosine and is involved in the differentiation of lymphoid cells. Increased ADA activity is associated with enhanced cellular immunity. The presence of elevated ADA in pleural fluid indicates the activation of T cells and monocytes within the effusion.[6]

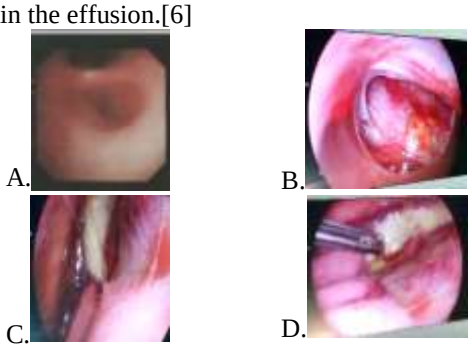


Figure 3. Bronchoscopy (A), septa and tissue on VATS (B&C), Sampling (D)

In this case, the patient's ADA result was not available or did not indicate a value below 40 U/L. Certain risk factors were associated with negative pleural ADA results in children with pleural tuberculosis, such as the absence of chest pain and higher levels of pleural total protein, pleural LDH, and blood urea nitrogen. The usual presentation of tuberculous pleural effusion involves a predominance of lymphocytes. However, in up to 10% of tuberculous effusions, a neutrophil dominant pattern may be observed, which corresponds to lower levels of pleural ADA activity.[6]

The diagnosis of pleural TB is based on the presence of tuberculous bacilli in the pleural fluid, pleural biopsy, and pleural granulomas on histopathological examination. Conventional methods such as direct pleural fluid examination, pleural fluid culture, and pleural biopsy have been proven to establish pleural TB.[8] Pleural tuberculosis often presents with a very low bacilli count in the pleural fluid, which contributes to negative results in smear staining and mycobacterial cultures. Positive smear staining is observed in less than 20% of cases, while culture positivity for Mycobacterium tuberculosis ranges

from 18% to 38%. Polymerase chain reaction (PCR) testing shows positive results in approximately 14.3% of cases. In the pediatric population, these ratios are even lower, indicating greater difficulty in diagnosing pleural TB in children.[7]After the insertion of segment B5 of the left lung, with good mucosa. Atelectasis typically resolves on its own without intervention. However, persistent and recurrent atelectasis serves as an important indication for diagnostic flexible bronchoscopy. Depending on the findings during the endoscopic examination, additional procedures may be performed, including suctioning, extraction of foreign bodies, sampling of various materials, and other specialized procedures tailored to the specific situation.[13]

The examination was followed by Video-assisted thoracoscopy surgery (VATS) which found a loculated pleural cavity and found a caseous mass on the posterolateral left lung. Thoracoscopy is a reliable, straightforward, and precise method for aiding in the diagnosis of pleural diseases. In the case of pleural tuberculosis, the combined sensitivity of histology and culture when using rigid thoracoscopy is nearly 100%. A study conducted by Maoshui et al. demonstrated that this technique has an 80% sensitivity rate and serves as a sensitive diagnostic approach for identifying pleural TB in children residing in countries with a high burden of TB. The study also reported various complications, with only one child requiring additional treatment for pneumothorax.[9]

The results of the caseous tissue biopsy in the patient showed a large caseous area with an appearance of a mycobacterium infection. Histological examination can provide valuable supporting evidence for diagnosing tuberculosis. The accuracy of the histological assessment relies on obtaining a sufficient tissue sample. Various techniques for tissue sampling have been assessed in children to aid in the diagnosis of TB, including endobronchial ultrasound-guided transbronchial needle aspiration, ultrasound-guided biopsy, and CT-guided biopsy.[9]

Parapneumonia effusion and empyema are usually progressively worse and then divided into three stages namely, exudative, fibrinopurulent, and organizational. The thick, fibrous fibrin organized in the pleural cavity limits lung expansion in the third or organizational stage.[14] Pleural fibrosis, or fibrothorax is an important complication of pleural TB, causing impaired lung function, chronic chest pain, and dyspnea. Pleural tuberculosis sometimes remains undiagnosed until severe pleural fibrosis occurs. Late diagnosis is an important risk factor for pleural fibrosis.[7]

CONCLUSION

The difficulty of establishing the diagnosis of pleural effusion due to tuberculosis makes minimally invasive procedures such as bronchoscopy and thoracoscopy a modality of choice in establishing the the chest tube, the patient experienced clinical improvement, but the *follow-up* chest X-ray did not show significant improvement. Further investigations were carried out on the patient to determine the cause of the atelectasis. Bronchoscopy showed narrowing of diagnosis and ruling out other possible diagnoses. This case report demonstrates that thoracoscopy can demonstrate a loculated pleural effusion.

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