

# The Role Of Video-Assisted Thoracoscopic Surgery In Complicated Tuberculous Pleural Effusion In An Adolescent: A Case Report

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## **Abstract**

A 15-year-old patient presented with the diagnosis of closed tuberculous pleural effusion on the right, established in a profile institution based on imaging examination. Diagnosis was confirmed by GeneXpert MTB/RIF test and positive pleural fluid culture for *Mycobacterium tuberculosis*.

After a preoperative preparation with the relative normalization of laboratory indices, the patient underwent minimally invasive surgery. The postoperative period evolved without complications. The bacteriological examination of the purulent pleural fluid detected *Pseudomonas aeruginosa*, the repeated GeneXpert test of the pleural fluid taken intraoperatively was positive.

The presented case made it possible to demonstrate that the use of the two-port VATS technique is characterized by a relatively small trauma, allows a relatively satisfactory operative field, can be an effective way to resolve lung collapse in cases of stage III tuberculous empyema. This minimally invasive approach is safe and allows to decrease the length of postoperative hospitalization with a good clinical effect at the distance. However, the duration of the evolution and the severity of the disease can be considered an important preoperative factor in the choice of the method of surgical resolution of pleural empyema in children.

**Keywords:** empyema; tuberculous; pleural; VATS; children.

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## **I. Introduction**

Tuberculous pleural effusions are characterized by an intense chronic accumulation of fluid and inflammatory cells in the pleural space. Pleural involvement in cases of tuberculosis is believed to develop as a result of direct spread of caseous material from a subpleural parenchymal outbreak, from lymph nodes, or by hematogenous spread. The caseous material in the pleural space triggers a hypersensitivity inflammatory response that causes the accumulation of straw-colored serous fluid, which usually contains a limited number of bacilli. In cases of an active caseous process located in the pleural space, thick localized pus will develop, containing many bacilli<sup>1</sup>.

Most cases of pleural effusions in patients diagnosed with tuberculosis respond well to antituberculosis treatment, not progressing to empyema and thus not requiring further investigations in the absence of clinical signs of empyema/sepsis<sup>2</sup>.

Long-term tuberculous empyema leads to thickening of the pleural layers and even calcification, in the pleural effusion being found predominantly neutrophiles, with a high mycobacterial load. Acid-fast bacilli smears have a comparatively better predictive value in the diagnosis of tuberculous empyema than tuberculous pleural effusion<sup>3,4</sup>. Empyema and pyopneumothorax are often caused by insufficient or ineffective antituberculosis therapy, in which mycobacteria become resistant or the drugs do not work<sup>4</sup>.

In the last decades, the proportion of pleural tuberculosis among children suffering from this disease has a tendency to increase. However, the overall treatment completion rate was up to 94.3% and no deaths<sup>5</sup>.

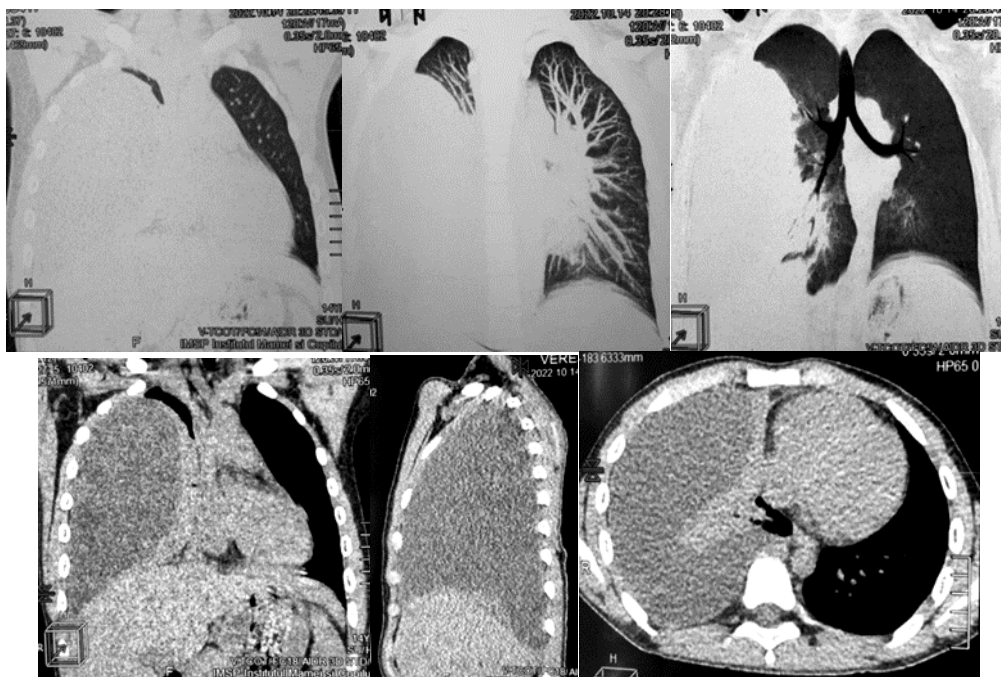
Treatment of empyema consists of early drainage of the pleural cavity, usually by thoracostomy along with antituberculosis treatment and broad-spectrum antibiotics for superimposed bacterial infections. However, chest drainage is often ineffective due to the presence of thick pus blocking the drainage tubes or the presence of multiple loculations that cannot be adequately drained by a single tube. This fact determines the need to use safer and less invasive procedures compared to those used in the past, such as video-assisted thoracoscopic surgery (VATS)<sup>6</sup>.

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## II. Case Presentation

Considering that the specialized literature on tuberculous empyema in children is limited<sup>7</sup>, we present the case of a 15-year-old male patient, diagnosed with tuberculous effusion complicated with thoracic empyema on the right, with the subsequent development of an advanced intrapleural adhesion process.

Patient V. was hospitalized on the basis of a medical consilium of phthisis pneumologists from a specialized institution, who confirmed the diagnosis of closed tuberculous effusion on the right, established radiologically and sonographically and confirmed by computed tomography (fig. 1) and by the GeneXpert test and positive pleural fluid culture for *Mycobacterium tuberculosis*.



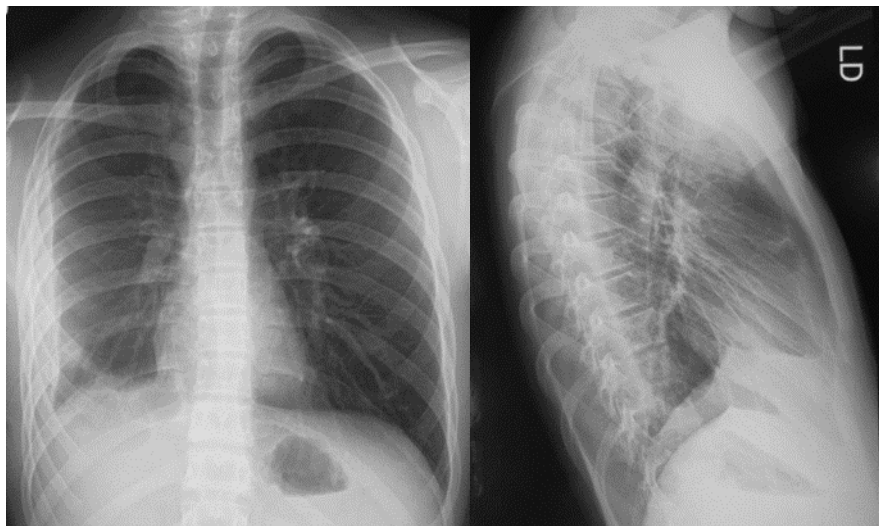
**Fig. 1. Patient V. CT performed preoperatively - imaging data suggestive for a massive pleural effusion on the right with increased protein fluid content; subtotal atelectasis of the right lung with displacement of the mediastinum to the left.**

The anamnestic data made it possible to establish that the child has been sick since October 2022, being diagnosed with right-sided bronchopneumonia and pleurisy. The patient underwent a conservative treatment associated with drainage of the pleural cavity on the right, which initially proved to be effective. We mention that the child's mother was diagnosed and treated for pulmonary tuberculosis.

In January 2023, the patient was repeatedly hospitalized with a pleural effusion on the right, undergoing a thoracostomy, later the diagnosis of tuberculous pleurisy was confirmed by the GeneXpert test, for which the patient was transferred to a specialized institution for specific treatment until December 2023.

After a preoperative preparation with relative normalization of laboratory indices, the patient underwent minimally invasive surgery. After the surgical field preparation, and positioning the patient in the left lateral decubitus, the trocar was inserted into the 4th intercostal space on the posterior axillary line. After entering the pleural cavity, a viscous liquid of a white-grey color was eliminated in the amount of about 600 ml. The liquid was taken for microbiological investigations. After the 2nd working trocar was inserted into the 6th intercostal space on the middle axillary line, the pleural cavity was inspected where purulent-fibrinous deposits were detected on the entire surface of the parietal and visceral pleura, with multiple old pleural adhesions, which obviously limited breathing movements. The process of decortication and removal of fibrinous deposits intimately attached to the surface of the pleura was carried out with technical difficulties. Some fragments were taken for histopathological investigations. The pleural cavity was treated with 350 ml of aminocaproic acid solution. The operation ended with the drainage of the pleural cavity in the 6th intercostal space with a FG 16 tube and the subsequent restoration of the anatomical plane.

The postoperative period evolved without complications, the chest tube was removed on the 6th postoperative day, and the patient was transferred for specific treatment on the 9th day from the surgery (fig. 2).



**Fig. 2. Patient V., 15 years old. Chest X-ray in two projections performed at the discharge from hospital (9th postoperative day).**

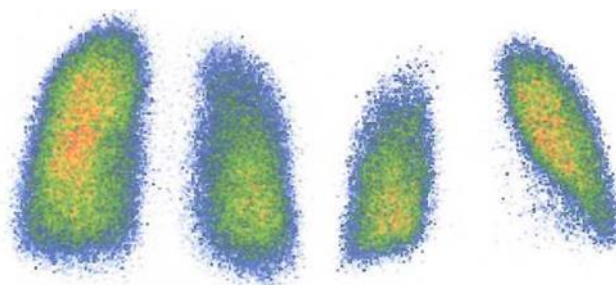
The histological examination of the sampled fragments found a lymphocytic inflammatory infiltrate with single Langhans type giant cells. *Pseudomonas aeruginosa* was detected in the bacteriological examination of purulent pleural fluid. Repeated GeneXpert test of pleural fluid taken intraoperatively was positive.

At the check-up after 6 months, the patient's condition was satisfactory, without any complaints. Recurrence of the disease was not found. Computed tomography shows suggestive data for fibroatelectatic subsegmental areas in S2, S4, S8 and S10 of the right lung (fig. 3).



**Fig. 3. Patient V., CT performed 6 months postoperatively – consolidation-type subsegmental hyperattenuated areas in S2, S4, S8, S10 on the right, clearly outlined without visualization of the air bronchogram. Pulmonary hila are not enlarged. Formations in both lung fields and in the mediastinum were not detected. Mediastinal lymph nodes of usual size. On the left – no pathological changes.**

The lung perfusion scintigraphy showed the uneven distribution of the radiopharmaceutical preparation in posterior and anterior incidence bilaterally. The left lung - of normal sizes with normal blood flow. The right lung - reduced in size, clear contours, with uneven distribution of the radiopharmaceutical preparation, essentially low blood flow in the upper lobe with emphasis in S3 (fig. 4).



**Fig. 4. Patient V. Pulmonary perfusion scintigraphy performed 6 months after surgery (explanations in the text).**

	Post% '	Ant%	Both%
Left Top	16.1	9.7	12.8
'left Middle	24.2	21.6	22.9
Left Bottom	18.9	15.8	17.3
Right Top	8.8	15.8	12.4
Right Middle	16.5	24.7	'wi
Right Bottom	15.5	12.3	13.9

### III. Discussion

Tuberculosis remains a global health problem, and children are among the most vulnerable groups affected by this disease with approximately one million cases reported in 2020, which represents an incidence of approximately 12%<sup>8,9</sup>.

In endemic areas, tuberculosis is a major factor contributing to the global number of deaths of children under the age of five, but only 35% of cases of the disease in children are correctly diagnosed<sup>6</sup>, until currently not being available official guidelines for the diagnosis and treatment of tuberculous pleurisy<sup>10</sup>. Some reports estimate that the in-hospital case-fatality rate for tuberculosis-associated pneumonia in some regions of the world ranges from 4 to 21%<sup>11</sup>.

Tuberculous pleural effusion in adults is the second most common form of extrapulmonary tuberculosis and the most common cause of pleural effusion in tuberculosis-endemic areas<sup>12</sup>, while pleural effusions caused by tuberculosis in children meets rarely. In the Republic of Moldova, pleural effusions of tuberculous origin constituted about 0.6% of all forms of tuberculosis in children diagnosed in 2018, with unilateral forms predominating, the right hemithorax being more frequently affected<sup>13</sup>. At the same time, in some developing countries such as India, tuberculous pleural effusions represent 5.3% - 15.4% of cases in children under 10 years of age<sup>14,15</sup>.

*Mycobacterium tuberculosis* alone as the causative organism of thoracic empyema is rarely found, especially in children<sup>16</sup>. Some authors found pleural fluid culture for *Mycobacterium tuberculosis* positive in only 7.4% of children with tuberculous empyema<sup>17</sup>.

The main imaging methods for diagnosing thoracic tuberculosis in children are chest radiography, ultrasound examination, and computed tomography. Magnetic resonance imaging may be considered and is particularly beneficial for children who may require multiple imaging examinations. Thoracic ultrasound can be useful for evaluating mediastinal and hilar lymphadenopathy and pleural and pericardial disease<sup>18</sup>. This modality is quite effective in detecting pleural effusions of even a modest amount, in some cases performing better than chest radiography. The method is useful not only in differentiating effusion from consolidated lung (while both appear "white" on chest X-rays), but also in assessing the "quality" of fluid changes<sup>19</sup>. A scan with 18F-fluorodeoxyglucose positron emission tomography can be useful for a differential diagnosis between malignant pleural effusions and those of tuberculous origin, the PET scan method not being specific for tuberculous effusions<sup>20</sup>.

Definitive diagnosis of tuberculous pleural effusions depends on identification of *Mycobacterium tuberculosis* in sputum, pleural fluid, or pleural biopsy specimens. The presumptive diagnosis can be established with reasonable certainty by demonstration of granuloma in the parietal pleura or elevated concentrations of adenosine deaminase or interferon- $\gamma$  in the pleural fluid in the appropriate clinical setting, etc.<sup>20,21</sup>.

The complex treatment of tuberculous pleural empyema in children and adolescents with the use of modern surgical methods is followed by satisfactory results, the surgical technique, postoperative morbidity and length of hospitalization being dependent on the stage of the process<sup>22</sup>. Surgical interventions are still required in a significant number of children with pleural tuberculosis, this finding emphasizing that surgical treatment can help improve the management of childhood pleural tuberculosis and minimize the risk of poor outcomes<sup>23</sup>,

especially in advanced chronic forms, which require extensive and traumatic surgical interventions<sup>22,24</sup>. Stage III tuberculous empyema is a type of encapsulated empyema that usually cannot be treated with antituberculosis drugs alone and requires surgical evacuation of the pus, most of these patients requiring surgical treatment. Traditionally, thoracotomy was the preferred surgical approach, which had high surgical trauma and more intraoperative bleeding<sup>25,26</sup>.

Complications related to decortication mainly include severe postoperative pain, hemorrhage, and prolonged air leakages, which can be significantly reduced if decortication is done early, as soon as stage III empyema is confirmed. Fibrinolytic therapy and thoracoscopic decortication should be considered in the early stages of empyema<sup>27</sup>.

#### IV. Conclusion

In conclusion, the case presented allowed to demonstrate that the use of the two-port VATS procedure is characterized by a relatively small trauma, allows a relatively satisfactory operative field, can be an effective way to resolve pulmonary collapse in cases of stage III tuberculous empyema. This minimally invasive approach is safe and allows to decrease the length of postoperative hospitalization with a good clinical effect at the distance. However, the duration of the evolution and the severity of the disease can be considered an important preoperative factor in the choice of the method of surgical resolution of pleural empyema in children.

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