

Article	
 PEDIATRIC SURGERY IN TROPICS www.pediatricsurgeryintropics.com editor@pediatricsurgeryintropics.com	
Pediatric surgery in tropics- Apr- 2026	
ISSN 3049-3404 (online)	DOI : https://doi.org/10.70947/PST2026.38
Title	Pediatric Empyema Thoracis Basics and Advanced Management
Authors	Dr Rajendra Saoji, Consultant Pediatric Surgeon, Nagpur
Affiliation	GMCH & Superspeciality Hospital, Nagpur.

Core Message

Empyema thoracis is not simply a pus collection. It is a dynamic biological process where timing of intervention determines outcome. For physicians, the crux of the management is in its early diagnosis and prompt involvement of a surgeon without delay and for surgeons, the key question is not whether to intervene, but when and how.

1. Introduction

Pediatric empyema thoracis represents a complication of bacterial pneumonia where infected pleural fluid progresses through stages of inflammation, fibrin deposition, and eventually fibrous organization. Despite advances in antibiotics and imaging, optimal management still requires sound clinical judgment.

2. Epidemiology and Clinical Importance

Pediatric empyema remains a major complication of bacterial pneumonia worldwide. Despite antibiotics, incidence has increased due to resistant organisms and delayed referral.

Common pathogens: Streptococcus pneumoniae, Staphylococcus aureus, Group A Streptococcus and Anaerobic organisms (less common)

Peak age: 3–10 years

Typical presentation: persistent fever, tachypnea, pleural effusion

3. Pathophysiology and Staging

Empyema progresses through three classical stages. Understanding these stages is essential because management strategies differ significantly depending on the stage.

Biological Evolution of Empyema :

Stage I – Exudative Stage

- 1 Thin sterile pleural fluid
- 2 Minimal fibrin deposition
- 3 Lung expands easily
- 4 Responds well to antibiotics ± simple drainage

Stage II – Fibrinopurulent Stage

- 1 Fibrin deposition and septation formation
- 2 Multiple loculations
- 3 Pus formation
- 4 Lung expansion begins to reduce

Stage III – Organizing Stage

- 1 Thick pleural cortex (rind)
- 2 Trapped lung
- 3 Restricted pulmonary expansion
- 4 Often requires surgical decortication

Clinical Presentation

- 1 Persistent fever despite antibiotics
- 2 Respiratory distress
- 3 Chest pain
- 4 Decreased breath sounds
- 5 Failure to improve after pneumonia treatment

Important Teaching Point:

In pediatric empyema, the clinical course may not strictly follow the number of illness days. Imaging findings are more reliable indicators of disease stage.

Ultrasound is the most useful staging tool.

Imaging in Pediatric Empyema:

Chest X-Ray

- 1 Large pleural opacity
- 2 Meniscus sign
- 3 Limited abilities to identify loculations

Ultrasound

- 1 Best bedside tool for staging
- 2 Detects septations and loculations
- 3 Guides chest tube placement

Contrast CT

- 1 Defines pleural rind
- 2 Shows lung entrapment
- 3 Helps plan surgical intervention
4. Provides information on underlying lung status

Basic Management Principles:

1. Management decisions should be based on stage, imaging findings, and clinical response.
2. Appropriate intravenous antibiotics: Longer duration total 4-6weeks, I V antibiotics minimum for 1 week.
3. Adequate pleural drainage
4. Respiratory physiotherapy
5. Nutritional support

Historical Milestones

- 1 Hippocrates described pleural drainage for empyema (460 BC).
- 2 19th century: open thoracotomy and drainage introduced.
- 3 1950–1970: antibiotics reduced mortality, but empyema persisted.
- 4 1990s: Video assisted thoracoscopic surgery (VATS) introduced.
- 5 Modern era: imaging guided and stage based treatment.

Chest Tube Drainage

- 1 Standard first-line intervention
- 2 Ultrasound-guided placement recommended
- 3 Effective mainly in early stages

Intrapleural Fibrinolytics

- 1 Useful in fibrinopurulent stage
- 2 Helps break septations

- 3 May reduce need for surgery

Advanced Surgical Management

Video Assisted Thoracoscopic Surgery (VATS)

- 1 Ideal for early-Stage II disease
- 2 Allows septation breakdown
- 3 Complete evacuation of pus
- 4 Facilitates lung expansion

Open Decortication (French word - Debarking of a tree)

- 1 Indicated in organized Stage III disease. However, initial thoracoscopy attempt can be made and completed at expert's hand.
- 2 Removal of thick pleural rind
- 3 Restores lung expansion
- 4 Technically demanding procedure

Conversion Principle:

Conversion from thoracoscopy to open thoracotomy should be viewed as a strategic decision rather than failure. The primary goal remains complete lung re-expansion and safe removal of infected material.

.

Complications

- 1 Persistent air leak
- 2 Incomplete lung expansion
- 3 Bleeding
- 4 Recurrent empyema

Surgical Pearls

- 1 Early recognition of Stage II improves VATS success
- 2 Enter through safest loculation identified by ultrasound.
- 3 Break loculations systematically from diaphragm upwards
- 4 Avoid injury to lung parenchyma while removing peel.
- 5 Avoid aggressive peel removal near the hilum
- 6 Always check full lung expansion before closure
- 7 Inspect fissure & ensure no collection

Evidence from Major Studies

Study	Key Finding
-------	-------------

Pediatric VATS studies	Shorter hospital stay vs tube drainage
Meta analyses	Earlier recovery with thoracoscopy
Recent guidelines	Ultrasound guided stage-based approach recommended

Final Message:

- **The management of pediatric empyema thoracis is a balance between biology and timing.**
- **The decision between drainage, thoracoscopy, or decortication ultimately reflects surgical judgment rather than technology alone.**
- **Empyema does not demand aggression. It demands timing.**
- **Empyema surgery is not about removing pus. It is about restoring the child's lung at the right moment in the disease timeline.**
- **Early minimally invasive surgery improves outcomes.**
- **Delayed referral increases morbidity, more length of stay in hospital and need for open surgery.**
- **The success of empyema management lies in understanding disease biology and selecting the right intervention at the right time.**

Address for correspondence	Dr Rajendra Saoji GMCH & Superspeciality Hospital, Nagpur. Mob. No. +91 9823094790 rajsaoji@gmail.com
Received on 23 rd May 2025	Published on 1 st Oct 2026
Acknowledgment none	Conflicts of interest none
Source of funds none	Ethical clearance obtained
Citation	https://doi.org/10.70947/PST2026.38
Orcid	



1.