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# PNEUMONIA COMPLICADA: TERAPÊUTICA CIRÚRGICA



Hospital  
Braga



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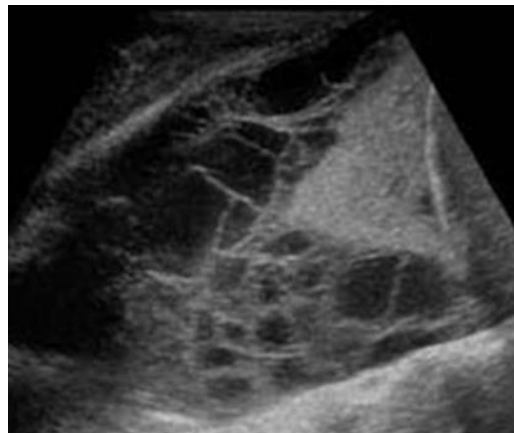
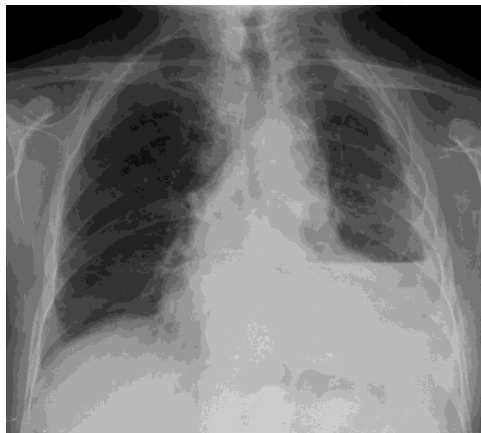


**18º CONGRESSO  
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DE PEDIATRIA**

**25 — 27 out 2017  
Centro de Congressos  
Alfândega do Porto**

# EMPIEMA

Empiema torácico – *colecção de fluído purulento no espaço pleural.*



## Pus

*a thick, opaque, usually yellowish-white, fluid matter that is formed as part of an inflammatory response typically associated with an infection and is composed of exudate chiefly containing dead white blood cells (such as neutrophils), tissue debris, and pathogenic microorganisms (such as bacteria)*

## Críterios de Light

### Transudado

Proteínas LP/ proteínas séricas  $< 0,5$

LDH LP/ LDH sérico  $< 0,6$

LDH LP  $< 2/3$  LDH sérico máximo

### Exsudado

Proteínas LP/ proteínas séricas  $> 0,5$

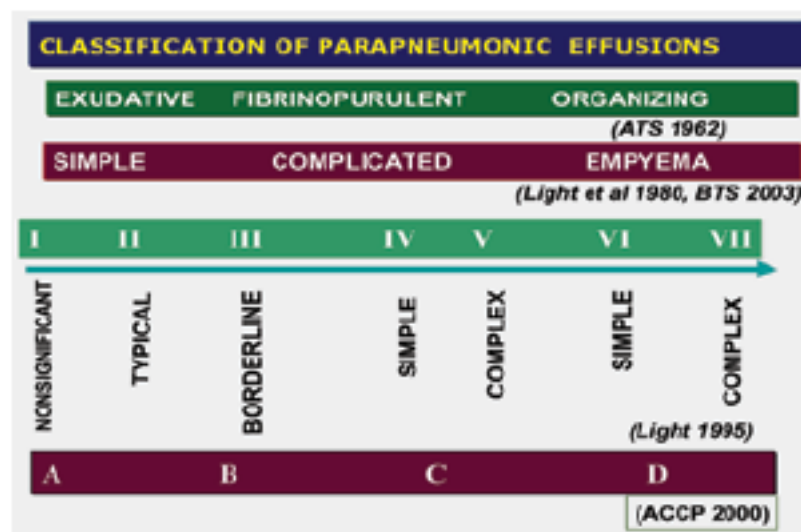
LDH LP/ LDH sérico  $> 0,6$

LDH LP  $> 2/3$  LDH sérico máximo

## Estadios do empiema

- ❖ Estadio I – precoce – exsudativo
- ❖ Estadio II – intermediário – fibrinopurulento
- ❖ Estadio III – tardio – organizativo

# EMPIEMA



**FIGURE 1.** Schematic presentation of the classifications of parapneumonic pleural effusions.

# EMPIEMA

| Stage         | ATS classification                                                  | Light classification                                                                                     | Muirs classification                 |
|---------------|---------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------|--------------------------------------|
| Early stage   | Increase in the permeability of serous layers<br>Re-expandable lung | Parapneumonic effusion<br>10 mm < thick on lateral chest X-ray <10 mm<br>Gram stain and culture negative | Fluid-glucose:<br>serum-glucose >0.5 |
| Complex stage | Trapped lung                                                        | Complex parapneumonic effusion<br>pH<7.0<br>Gram stain and culture positive                              | Fluid-glucose:<br>serum-glucose <0.5 |

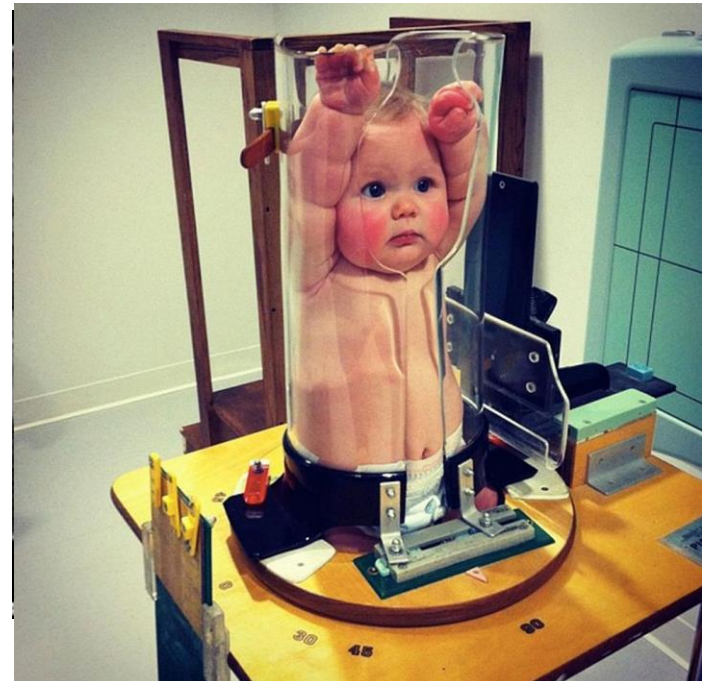
ATS, American Thoracic Society.

## CRITÉRIOS CITOBIOQUÍMICOS DO LÍQUIDO PLEURAL

- ❖ Dificuldade na obtenção da amostra → Sedação?
- ❖ Critérios não validados para a idade pediátrica.
- ❖ Ausência de clara correlação entre as características do derrame e o prognóstico.
- ❖ Múltiplas colheitas podem apresentar resultados citoquímicos dispares.



- ❖ **Radiografia de tórax**
- ❖ **Ecografia torácica**
- ❖ **TC torácica**
- ❖ **RMN**





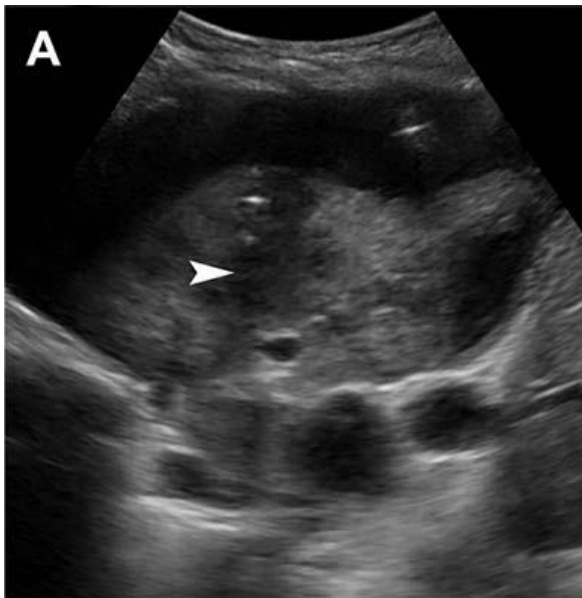
## ❖ Ecografia torácica

### Intravenous and Intracavitary Use of Contrast-Enhanced Ultrasound in the Evaluation and Management of Complicated Pediatric Pneumonia

*Annamaria Deganello, MD, Vasileios Rafailidis, MD, MSc, Maria E. Sellars, FRCR,  
Aikaterini Ntoulia, MD, PhD, Kleanthi Kalogerakou, MD, MSc, Gary Ruiz, FRCP, FRCPCH,  
David O. Cosgrove, FRCR, Paul S. Sidhu, MRCP FRCR *

J Ultrasound Med 2017; 00:00–00

## ❖ Ecografia torácica



- ❖ Terapêutica de Suporte

- ❖ Antibioterapia

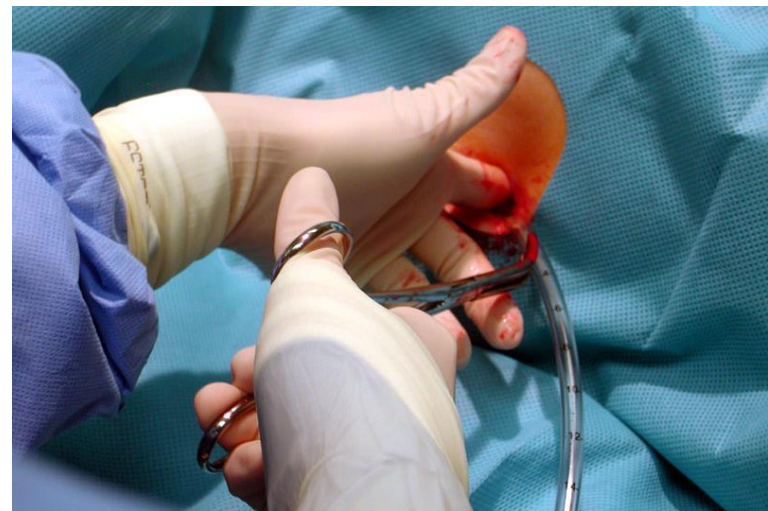
- ❖ Drenagem torácica

- ❖ Instilação de fibrinolíticos

- ❖ Toracoscopia / VATS

- ❖ Toracotomia

## **TORACOSTOMIA (DRENAGEM)**



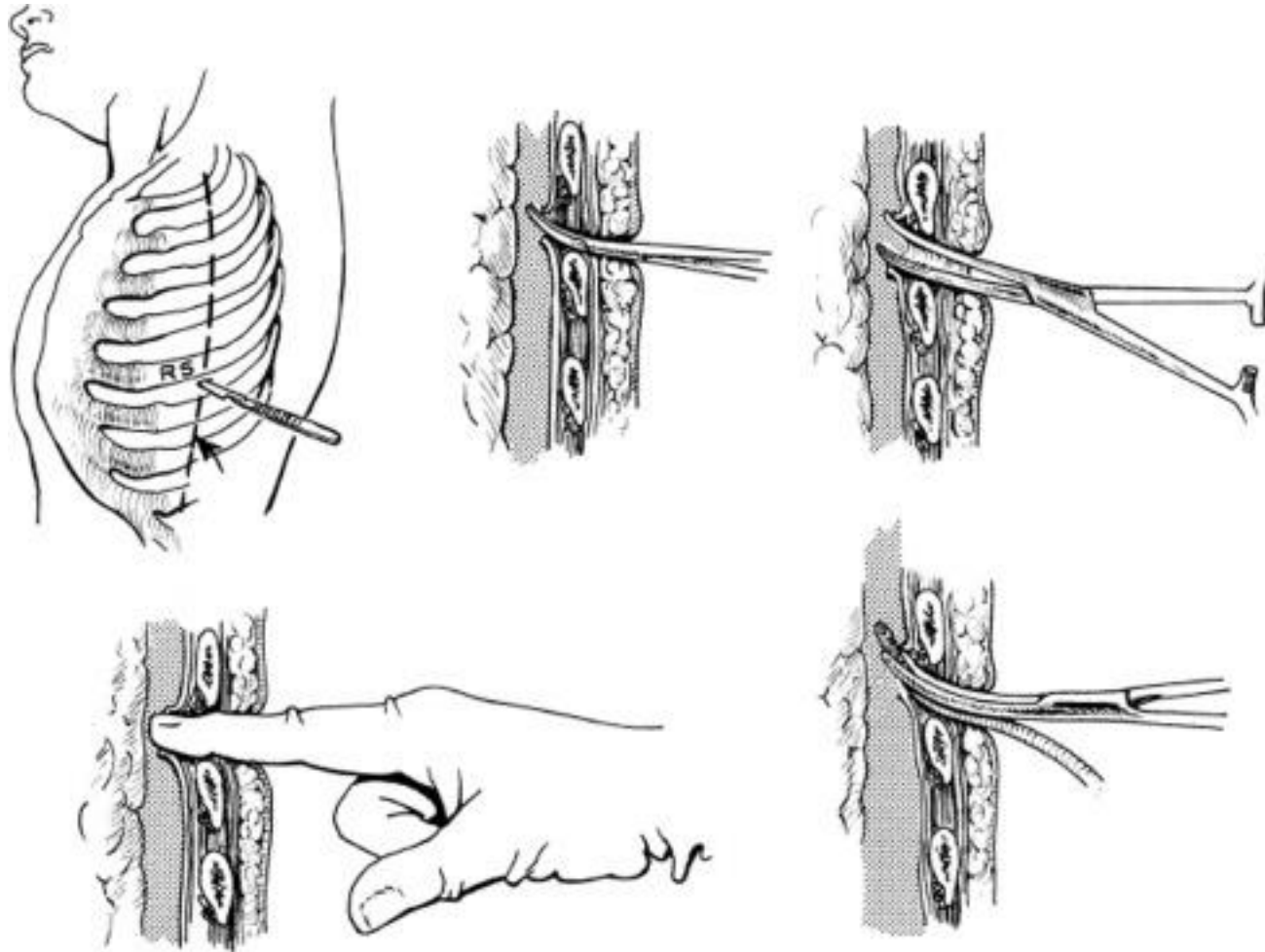
## Indicação para toracostomia (drenagem) - *Ubi pus, ibi evacua*

- ❖ Derrame pleural de médio ou grande volume loculado.
- ❖ Derrame pleural de médio ou grande volume não loculado, e:
  - ❖ > 1/2 hemitórax na radiografia torácica;
  - ❖ Presença de desvio do mediastino;
  - ❖ Dificuldade respiratória (necessidade de O2 suplementar, SDR, dispneia);
  - ❖ Febre persistente (> 5 dias);
  - ❖ Sem evolução clínica ou analítica favorável, 48 a 72h após o início de ATB.

# TORACOSTOMIA



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## Fibrinolíticos no Tratamento de Derrames Pleurais Complicados

## Fibrinolytics in the Treatment of Complicated Pleural Effusions



Ana COELHO✉<sup>1</sup>, Margarida COELHO<sup>2</sup>, Joana PEREIRA<sup>3</sup>, Vasco LAVRADOR<sup>4</sup>, Lurdes MORAIS<sup>2</sup>, Fátima CARVALHO<sup>1</sup>  
Acta Med Port 2016 Nov;29(11):711-715 ▪ <http://dx.doi.org/10.20344/amp.7178>



## Alteplase

- ❖ Dose 0,1 mg/kg/dia
- ❖ Diluição em 40cc de soro fisiológico.
- ❖ Após instilação o dreno deverá permanecer “clampado” durante 60’.
- ❖ 24/24 horas – 3 doses – 3 dias consecutivos



## Contraindicações

- ❖ Pneumonia necrosante
- ❖ Fistula bronco-pleural
- ❖ Discrasia hemorrágica

## Complicações

- ❖ Hemorragia local ou à distancia.
- ❖ Anafilaxia.
- ❖ Pneumotórax.
- ❖ Enfisema subcutâneo.

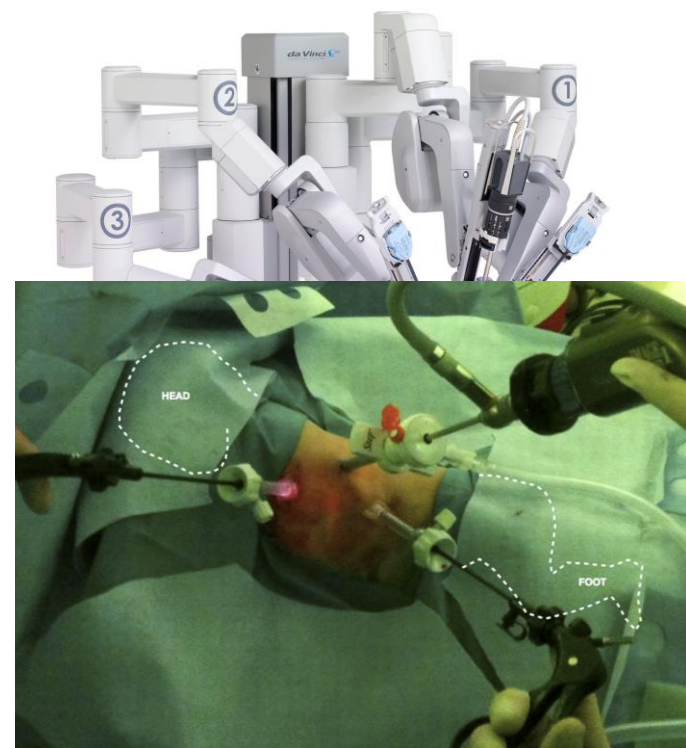
## ❖ **VATS - Video Assisted Thoracoscopic Surgery**

*When Is a VATS Not a VATS?* Daryl P. Pearlstein, 2016

## ❖ **RATS - Robotic Assisted Thoracoscopic Surgery**

## ❖ **Toracoscopia**

2 a 3 acessos torácicos de 5 mm



## CONTRAINDICAÇÕES

- ❖ Dificuldade na intubação;
- ❖ Dificuldade na ventilação;
- ❖ Dificuldade técnica.

| Guidelines  | Indications                                                                                                  | Contraindications                             |
|-------------|--------------------------------------------------------------------------------------------------------------|-----------------------------------------------|
| AATS, 2017  | All stages II–III empyemas                                                                                   | Inability to maintain single-lung ventilation |
|             |                                                                                                              | Impossibility to achieve a complete toilette  |
|             |                                                                                                              | Lung re-expansion failure                     |
| EACTS, 2015 | All stage II empyemas<br><br>Selected cases of stage III empyemas (consider and quantify risk on conversion) | Coagulopathy                                  |
|             |                                                                                                              | Inability to maintain single-lung ventilation |
|             |                                                                                                              | Impossibility to achieve a complete toilette  |
|             |                                                                                                              | Lung re-expansion failure                     |
|             |                                                                                                              | Specific empyemas (TBC, aspergillosis)        |

AATS, American Association for Thoracic Surgery.



revista portuguesa de  
**PNEUMOLOGIA**  
portuguese journal of pulmonology  
[www.revportpneumol.org](http://www.revportpneumol.org)



## ORIGINAL ARTICLE

### Thoracoscopy in the management of pediatric empyemas<sup>☆</sup>



R. Lamas-Pinheiro<sup>a,\*,1</sup>, T. Henriques-Coelho<sup>a,1</sup>, S. Fernandes<sup>a,b</sup>, F. Correia<sup>a,c</sup>,  
C. Ferraz<sup>b</sup>, L. Guedes-Vaz<sup>b</sup>, I. Azevedo<sup>b</sup>, J. Estevão-Costa<sup>a</sup>

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Received 17 September 2015; accepted 11 December 2015

Available online 21 January 2016

#### KEYWORDS

Thoracoscopy;  
Empyema;  
Children;  
Conversion;  
Reintervention

#### Abstract

**Introduction:** Thoracoscopy is increasingly being used in the treatment of empyema. This study assesses feasibility, efficacy and safety in children.

**Material and methods:** Clinical files of patients who underwent primary thoracoscopy for empyema between 2006 and 2014 were reviewed. Demographic, clinical and surgical data were analyzed and a comparison between the period before (period1) and after (period2) the learning curve was performed.

**Results:** Ninety-one patients (53 males, 58%) were submitted to thoracoscopy at a median age of 4 years. There were 19 conversions to thoracotomy with a steady decrease of conversion rate until 2009 (period1) and no conversions thereafter (period2). There was no difference in any of the analyzed parameters between patients submitted to thoracoscopy alone and those requiring conversion in period1. Six cases (6.6%) needed redo-operation (five in period2) and thoracotomy was the elected approach in four. Necrotizing pneumonia was present in 60% of the reoperated cases; in other words, in period2 3 out of 9 cases with necrotizing pneumonia required reintervention ( $p = 0.07$ ). Thoracotomy was avoided in sixty-eight (75%) patients (62% in period1 versus 92% in period2,  $p = 0.001$ ).

**Discussion and conclusions:** Thoracoscopic approach for empyema is feasible and safe avoiding a significant number of thoracotomies after a short learning curve. An increase of reintervention

# PROCEDIMIENTO CIRÚRGICO



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Meta-análise (Paediatrics 2005)

Intervenção Cirúrgica Primária:

- ❖ menor mortalidade hospitalar;
- ❖ menor taxa de reintervenção;
- ❖ internamentos mais curtos;
- ❖ remoção mais precoce do dreno;
- ❖ ciclos mais curto de antibioterapia;
- ❖ menor falência.





## Therapy of Parapneumonic Effusions in Children: Video-Assisted Thoracoscopic Surgery Versus Conventional Thoracostomy Drainage

Beth A. Kurt, MD<sup>a</sup>, Kimberly M. Winterhalter, MD<sup>a</sup>, Robert H. Connors, MD<sup>a,b</sup>, Bradford W. Betz, MD<sup>c</sup>, John W. Winters, MD<sup>a</sup>

**CONCLUSIONS.** The outcomes of this study strongly suggest that primary video-assisted thoracoscopic surgery for evacuation of parapneumonic effusions is superior to conventional thoracostomy drainage.





Journal of Pediatric Surgery (2009) 44, 106–111



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Journal of  
**Pediatric  
Surgery**

[www.elsevier.com/locate/jped surg](http://www.elsevier.com/locate/jped surg)

## Thoracoscopic decortication vs tube thoracostomy with fibrinolysis for empyema in children: a prospective, randomized trial

**Conclusions:** There are no therapeutic or recovery advantages between VATS and fibrinolysis for the treatment of empyema; however, VATS resulted in significantly greater charges. Fibrinolysis may pose less risk of acute clinical deterioration and should be the first-line therapy for children with empyema.



Ensaio Clinico Randomizado Multicentrico (Paediatrics 2014)

*Thoracoscopy and fibrinolysis with urokinase were equally effective for this condition.*



**WHAT'S KNOWN ON THIS SUBJECT:** There are discrepancies regarding which treatment is best in clinical practice for children with parapneumonic empyema, with some authors favoring video-assisted thoracoscopy and others favoring intrapleural fibrinolytic agents.



**WHAT THIS STUDY ADDS:** This study is one of the few randomized clinical trials on this subject in children and the first multicenter trial. It exclusively included patients with septated empyema.

Thoracoscopy and fibrinolysis with urokinase were equally effective for this condition.



# EVIDENCE VS EMINENCE BASED DECISIONS

Ensaio Clinico Randomizado Multicentrico (Paediatrics 2014)

*Thoracoscopy and fibrinolysis with urokinase were equally effective for this condition.*

| Outcome                              | VATS<br>( <i>n</i> = 53) | Urokinase<br>( <i>n</i> = 50) | Median Difference<br>(95% CI) | <i>P</i> |
|--------------------------------------|--------------------------|-------------------------------|-------------------------------|----------|
| Primary outcome                      |                          |                               |                               |          |
| PO hospital stay, median (IQR), d    | 10 (7–13)                | 9 (8–12)                      | 0 (–1 to 1)                   | .45      |
| Secondary outcomes                   |                          |                               |                               |          |
| Total hospital stay, median (IQR), d | 14 (10–16)               | 13 (10–18)                    | 0 (–2 to 2)                   | .60      |
| Chest tube in place, median (IQR), d | 4 (3–5)                  | 5 (4–6)                       | –1 (–2 to –1)                 | <.001    |
| PO fever, median (IQR), d            | 4 (2–7)                  | 6 (3–7)                       | –1 (–2 to 1)                  | .62      |
| Failure rate, <i>n</i> (%)           | 8 (15.1)                 | 5 (10)                        |                               | .47      |



**European Journal of Cardio-Thoracic Surgery Advance Access published August 7, 2015**

European Journal of Cardio-Thoracic Surgery (2015) 1–12  
doi:10.1093/ejcts/ezv272

**POSITION STATEMENT**

Cite this article as: Scarci M, Abah U, Solli P, Page A, Waller D, van Schil P *et al.* EACTS expert consensus statement for surgical management of pleural empyema. Eur J Cardiothorac Surg 2015; doi:10.1093/ejcts/ezv272.

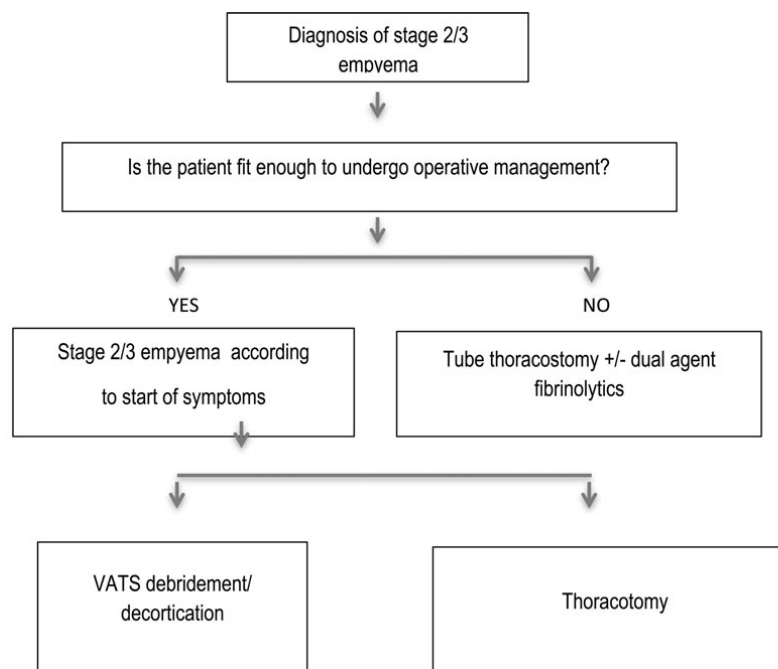
## **EACTS expert consensus statement for surgical management of pleural empyema**

**Marco Scarci<sup>a,\*†</sup>, Udo Abah<sup>a,†</sup>, Piergiorgio Solli<sup>a,†</sup>, Aravinda Page<sup>a</sup>, David Waller<sup>b</sup>, Paul van Schil<sup>c</sup>, Franca Melfi<sup>d,†</sup>,  
Ralph A. Schmid<sup>e</sup>, Kalliopi Athanassiadi<sup>f</sup>, Miguel Sousa Uva<sup>g,¶</sup> and Giuseppe Cardillo<sup>h,§</sup>**

# ALGORITMO TERAPÊUTICO



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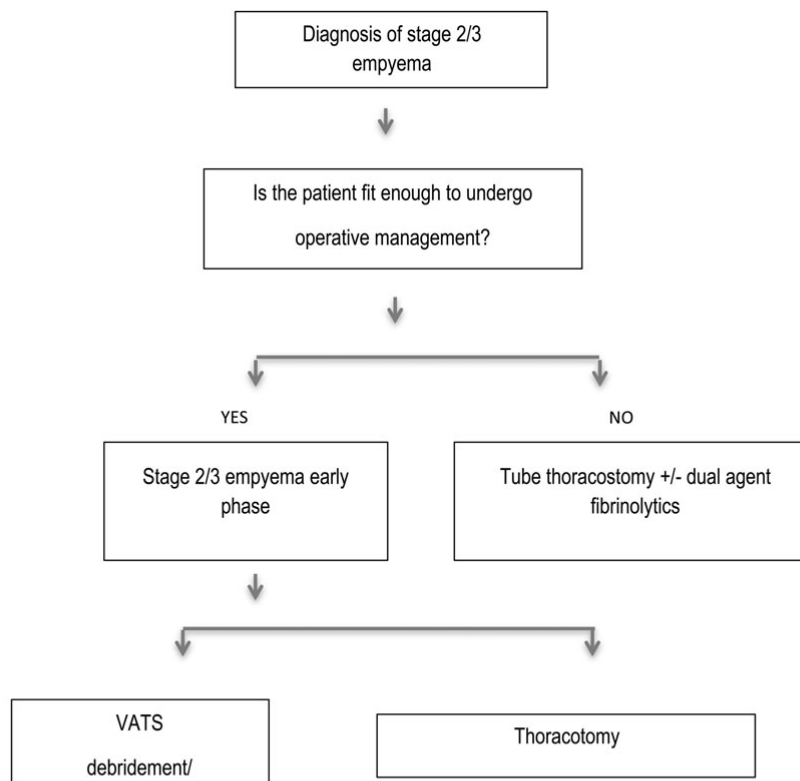
| INDICATIONS FOR THE SURGICAL MANAGEMENT OF EMPYEMA IN ADULTS |                                                                                                                                                                                                                                                                                                                                                              |
|--------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| (1)                                                          | In patients with stage 2 or 3 empyema who are fit enough to undergo an operative procedure surgical intervention with video-assisted thoracoscopic surgery is suggested. Class I Level B                                                                                                                                                                     |
| (2)                                                          | In patients with stage 2 empyema intra-pleural fibrinolysis with dual agent fibrinolytics may be considered as an alternative to surgical intervention Class IIa Level B                                                                                                                                                                                     |
| (3)                                                          | In patients with stage 3 empyema and a prolonged period from symptom onset, decortication may be performed by open decortication. Class IIb Level C. In experienced units VATS might be considered as a primary approach even in stage 3, provided that conversion is justified if the procedure is not able to achieve a complete resolution of the disease |

Management of empyema in the adult. VATS: video-assisted thoracoscopic surgery.

# ALGORITMO TERAPÊUTICO



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| INDICATIONS FOR THE SURGICAL MANAGEMENT OF EMPYEMA IN CHILDREN |                                                                                                                                                                                                                                               |
|----------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| (1)                                                            | Primary operative approach is an effective management strategy, associated with lower a mortality rate and a reduction of tube thoracostomy duration, length of antibiotic therapy, re-intervention rate and hospital stay. Class IIa Level A |
| (2)                                                            | Intra-pleural fibrinolytic therapy is a reasonable alternative to primary operative management. Class IIa Level A                                                                                                                             |

Management of empyema in children. VATS: video-assisted thoroscopic surgery.



## Fibrinolíticos no Tratamento de Derrames Pleurais Complicados

## Fibrinolytics in the Treatment of Complicated Pleural Effusions

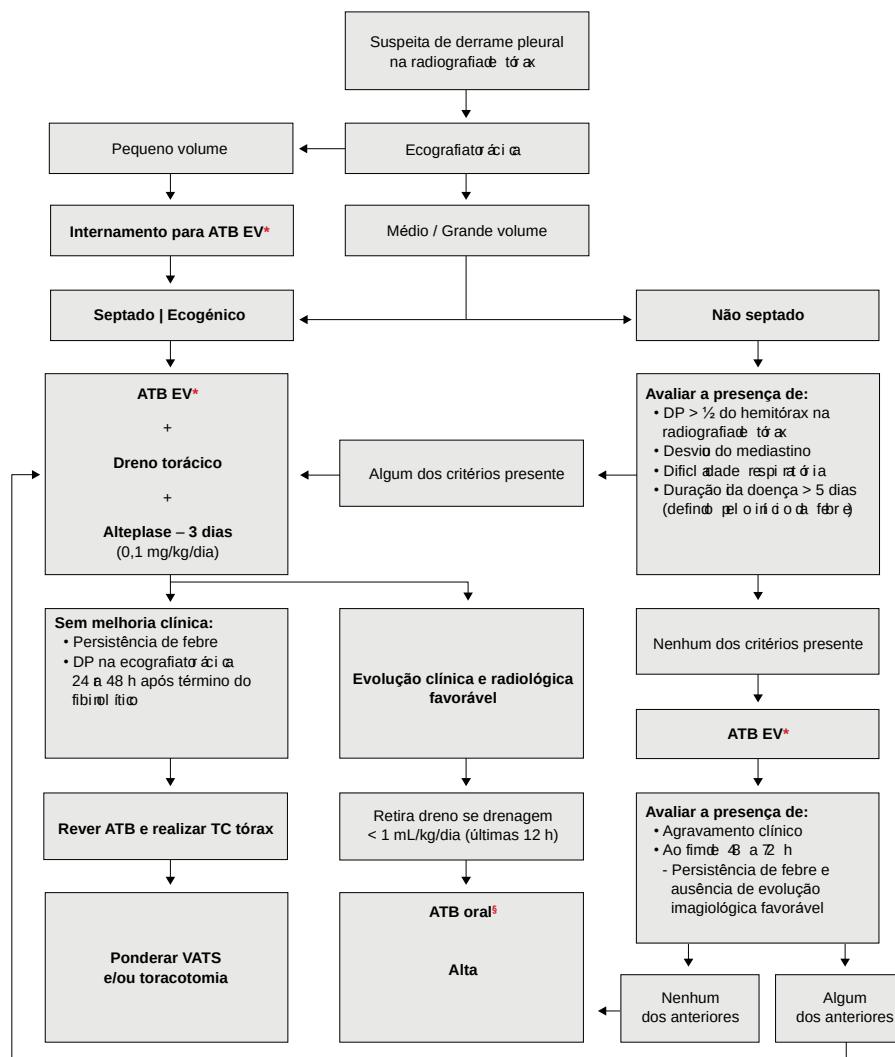


Ana COELHO✉<sup>1</sup>, Margarida COELHO<sup>2</sup>, Joana PEREIRA<sup>3</sup>, Vasco LAVRADOR<sup>4</sup>, Lurdes MORAIS<sup>2</sup>, Fátima CARVALHO<sup>1</sup>  
Acta Med Port 2016 Nov;29(11):711-715 ▪ <http://dx.doi.org/10.20344/amp.7178>

# ALGORITMO TERAPÊUTICO



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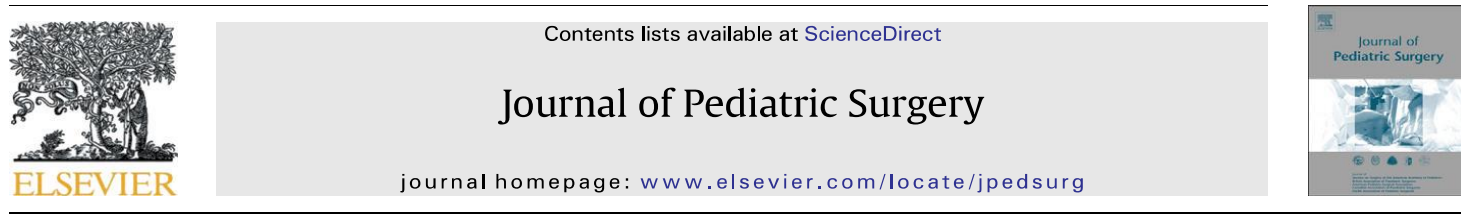


**Quais os doentes em que a terapêutica com fibrinolíticos é ineficaz?**

**Quais os doentes em que o tratamento toracoscópico é ineficaz?**

**Melhor terapêutica fibrinolítica?**

## Quais os doentes em que a terapêutica com fibrinolíticos é ineficaz?



### Are some children with empyema at risk for treatment failure with fibrinolytics? A multicenter cohort study<sup>☆</sup>

Michael H. Livingston<sup>a,b</sup>, Eyal Cohen<sup>e</sup>, Lucy Giglia<sup>c</sup>, David Pirrello<sup>a</sup>, Niraj Mistry<sup>e</sup>, Sanjay Mahant<sup>e</sup>, Michael Weinstein<sup>e</sup>, Bairbre Connolly<sup>f</sup>, Sharifa Himidan<sup>g</sup>, Andreana Bütter<sup>h</sup>, J. Mark Walton<sup>a,d,\*</sup>

*Conclusions:* Predicting which children with empyema are at risk for treatment failure with fibrinolytics remains challenging. Risk factors include positive blood culture, immediate admission to intensive care, and absence of complex septations on ultrasound. Routine blood work and inflammatory markers have little prognostic value.

## Quais os doentes em que o tratamento toracoscópico é ineficaz?



### Conclusions and limitations

In conclusion, thoracoscopic approach for empyema is feasible and safe avoiding a significant number of thoracotomies after a rapid learning curve. An increase in the reintervention rate should be expected thereafter, but thoracoscopy alone is effective in the great majority of the cases.

ORIGINAL ARTICLE

### Thoracoscopy in the management of pediatric empyemas

R. Lamas-Pinheiro<sup>a,\*</sup>, T. Henriques-Coelho<sup>a,1</sup>, S. Fernandes<sup>a,b</sup>, F. Correia<sup>a,c</sup>,  
C. Ferraz<sup>b</sup>, L. Guedes-Vaz<sup>b</sup>, I. Azevedo<sup>b</sup>, J. Estevão-Costa<sup>a</sup>

Necrotizing pneumonia in the CT scan is possibly associated with empyema. In the nature of the study, the major limitation was the mentioned lack of descriptors of empyema, as ultrasound descriptions are not standardized and CT scan is only ordered in few pediatric patients. In the future, preoperative ultrasound or MRI features should also be considered in a larger prospective study in order to determine predictors of failure of thoracoscopic approach.



CrossMark



## Melhor terapêutica (Fibrino) Lítica?

Livingston *et al. Trials* (2017) 18:293  
DOI 10.1186/s13063-017-2026-0

Trials

STUDY PROTOCOL

Open Access



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## Intrapleural Dornase and Tissue Plasminogen Activator in pediatric empyema (DTPA): a study protocol for a randomized controlled trial

Michael H. Livingston<sup>4</sup>, Sanjay Mahant<sup>1</sup>, Felix Ratjen<sup>1</sup>, Bairbre L. Connolly<sup>1</sup>, Kevin Thorpe<sup>2,3</sup>, Muhammad Mamdani<sup>3</sup>, Ian Maclusky<sup>5</sup>, Sophie Laberge<sup>6</sup>, Lucy Giglia<sup>4</sup>, J. Mark Walton<sup>4</sup>, Connie L. Yang<sup>7</sup>, Ashley Roberts<sup>7</sup>, Anna C. Shawyer<sup>8</sup>, Mary Brindle<sup>8</sup>, Simon J. Parsons<sup>8</sup>, Cristina A. Stoian<sup>8</sup> and Eyal Cohen<sup>1\*</sup>

## Indicação para toracostomia (drenagem) - *Ubi pus, ibi evacua*

- ❖ Derrame pleural de médio ou grande volume loculado.
- ❖ Derrame pleural de médio ou grande volume não loculado, e:
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  - ❖ Presença de desvio do mediastino;
  - ❖ Dificuldade respiratória (necessidade de O2 suplementar, SDR, dispneia);
  - ❖ Febre persistente (> 5 dias);
  - ❖ Sem evolução clínica ou analítica favorável, 48 a 72h após o início de ATB.



- ❖ Toracoscopia equivalente à instilação de fibrinolíticos.
- ❖ Importância da experiência com a técnica.



## CONTRAINDICAÇÕES

### Toracoscopia

- ❖ Dificuldade na intubação;
- ❖ Dificuldade na ventilação;
- ❖ Dificuldade técnica.

### Fibrinolíticos

- ❖ Pneumonia necrosante
- ❖ Fistula bronco-pleural
- ❖ Discrasia hemorrágica



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