2015 AATS Guidelines for Management of Empyema

On Behalf of the AATS Management of Empyema Guidelines Working Group

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Objective

- Establish AATS evidence-based guidelines for the management of empyema
Guidelines Writing Group

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Methods

• Comprehensive literature searches
  • Pubmed, Medline

• Recommendations made based on a review of the data in the literature

• Level of evidence supporting recommendations graded according to standards published by the Institute of Medicine 2011 *Clinical Practice Guidelines We Can Trust: Standards for Developing Trustworthy Clinical Practice Guidelines*; www.iom.edu/cpgstandards
## Applying Classification of Recommendations and Level of Evidence

<table>
<thead>
<tr>
<th>Class I</th>
<th>Class IIa</th>
<th>Class IIb</th>
<th>Class III</th>
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</thead>
<tbody>
<tr>
<td>Benefit &gt;&gt;&gt; Risk</td>
<td>Benefit &gt;&gt; Risk</td>
<td>Benefit ≥ Risk</td>
<td>Risk ≥ Benefit</td>
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<tr>
<td>Procedure/ Treatment SHOULD be performed/administered</td>
<td>Additional studies with focused objectives needed; IT IS REASONABLE to perform procedure/administer treatment</td>
<td>Additional studies with broad objectives needed; Additional registry data would be helpful; Procedure/Treatment MAY BE CONSIDERED</td>
<td>Procedure/Treatment should NOT be performed/administered SINCE IT IS NOT HELPFUL AND MAY BE HARMFUL</td>
</tr>
</tbody>
</table>

- should
- is recommended
- is indicated
- is useful/effective/beneficial
- is reasonable
- can be useful/effective/beneficial
- is probably recommended or indicated
- may/might be considered
- may/might be reasonable
- usefulness/effectiveness is unknown/unclear/uncertain or not well established
- is not recommended
- is not indicated
- should not
- is not useful/effective/beneficial
- may be harmful

<table>
<thead>
<tr>
<th>Level A:</th>
<th>Recommendation based on evidence from multiple randomized trials or meta-analyses</th>
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<tbody>
<tr>
<td></td>
<td>Multiple (3-5) population risk strata evaluated; General consistency of direction and magnitude of effect</td>
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<tr>
<th>Level B:</th>
<th>Recommendation based on evidence from a single randomized trial or non-randomized studies</th>
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<tr>
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<td>Limited (2-3) population risk strata evaluated</td>
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<tr>
<th>Level C:</th>
<th>Recommendation based on expert opinion, case studies, or standard-of-care</th>
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<tr>
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<td>Very limited (1-2) population risk strata evaluated</td>
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</table>
Methods

• Project divided into 8 sections and individuals with expertise in that area assigned to review literature and propose recommendations

• 3 teleconferences to organize the topics to be covered, review the literature summaries, and proposed recommendations

• 1 face-to-face conference to vote on final recommendations and review final manuscript
Methods

• All members of the working group reviewed all of the proposed recommendations and the level of evidence supporting the recommendation and voted on each recommendation

• 75% approval required for accepting a recommendation
Empyema Thoracis

- Defined as “pus in the chest”
- Ancient disease
  - Hippocrates credited with first description of natural history and treatment
- Most common precursor is bacterial pneumonia and subsequent parapneumonic effusion

Hippocrates of Kos 460-370 B.C.
Scope of the problem

- 32,000 patients treated for empyema per year in the USA
- 15% mortality
- 30% require surgical drainage of the pleural space
Incidence of empyema increasing in US

Trends in parapneumonic empyema-related hospitalization USA 1996-2008
Data from Nationwide Inpatient Sample
Which patients are at risk for empyema?

• Class I: The presence of a pleural effusion should be investigated in all patients presenting with signs and symptoms of pneumonia, or unexplained sepsis. (LOE B)

• Class I: Failure of a community or healthcare associated pneumonia to respond clinically to appropriate antibiotic therapy should prompt investigations to identify the presence of a pleural effusion. (LOE B)
What imaging studies should be obtained?

- **Class I**: Pleural ultrasound should be routinely performed in addition to conventional chest X-ray in the evaluation of pleural space infection, both for diagnostic purposes and image-guidance for pleural interventions. (LOE B)

- **Class IIa**: Chest computed tomography should be obtained when pleural space infection is suspected. (LOE B)
How are pleural fluid studies useful in diagnosing empyema?

- **Class I:** The presence of pus, positive Gram’s stain or culture in the pleural fluid establishes the diagnosis of empyema which should be treated with tube thoracostomy followed by surgical intervention when appropriate. (LOE B)

- **Class I:** A pleural pH < 7.2 in a patient with suspected pleural space infection predicts a complicated clinical course, and tube thoracostomy should be performed followed by surgical intervention when appropriate. (LOE B)

- **Class IIa:** A pleural fluid LDH > 1000 IU/L, glucose < 40 mg/dL or a loculated pleural effusion suggests that the pleural effusion is unlikely to resolve with antibiotics alone and we recommend tube thoracostomy (LOE B)
How should pleural fluid cultures be obtained?

- Class I: Obtain pleural fluid cultures only from direct aspiration or drainage procedure, not from previously inserted tubes or drains. (LOE B)

- Class I: Inoculate freshly drained pleural fluid into aerobic and anaerobic blood culture vials in addition to standard, sterile containers used for gram stain and culture. (LOE B)
Ideal antibiotic management of empyema?

- Class Ila: For community-acquired empyema: a parenteral second or third generation cephalosporin (e.g. ceftriaxone) with metronidazole or parenteral aminopenicillin with β-lactamase inhibitor (e.g. ampicillin/sulbactam). (LOE C)

- Class Ila: For hospital-acquired, or post-procedural empyema: include antibiotics active against methicillin resistant Staphylococcus aureus and Pseudomonas aeruginosa (e.g. vancomycin, cefepime, and metronidazole or vancomycin and piperacillin/tazobactam [dosed for activity against P. aeruginosa]). (LOE C)

- Class I: Avoid aminoglycosides in the management of empyema. (LOE B)

- Class Ila: There is no role for intrapleural administration of antibiotics. (LOE C)
Ideal antibiotic management of empyema?

- **Class I:** Whenever possible, choose antibiotic therapy based upon culture results. (LOE C)
- **Class IIa:** Consider continuing anaerobic coverage empirically when the anaerobic cultures are negative unless results reflect a low probability of anaerobic infection, as in the case of culture or antigen-identified pneumococcal infection. (LOE C)
- **Class IIb:** The duration of antibiotic therapy for acute bacterial empyema is influenced by the organism, adequacy of source control, and clinical response. (LOE C)
Role of thoracentesis in management of empyema?

- Class III (no benefit): Thoracentesis without pleural drain placement is not recommended for the treatment of PPE or empyema. (LOE C)
Role of drain placement in management of empyema?

- **Class I**: Image-guided pleural drain placement is useful in the treatment of pleural infection, particularly in early stage, minimally septated empyema. (LOE B)

- **Class IIA**: Small bore catheters are of uncertain utility in complex, organized empyema, but can be considered in patients that are not surgical candidates. (LOE C)

- **Class I**: Routine drain flushing is recommended if small bore catheters are used. (LOE B)

- **Class I**: If tube thoracostomy is chosen as first line therapy, close imaging followup is recommended to assess adequacy of drainage. Persistence of undrained fluid should prompt more aggressive management ( LOE C)
Role of intrapleural fibrinolytic therapy in management of empyema?

- Class IIa: Intrapleural fibrinolytics may be used for select complicated pleural effusions and early empyemas but definitive management continues to be surgical adhesiolysis with or without decortication (LOE A)
Best surgical approach to manage stage II empyema?

• Class IIa: VATS should be the first line approach in all patients with stage II acute empyema (LOE B)
Surgical management of empyema

Stage II or III Empyema requiring surgical intervention

Tolerates Single Lung Ventilation

- YES
- VATS approach

Thoracotomy

Achieve:
1) Full evacuation
2) Full lung expansion
   - Lungs touch chest wall and diaphragm

- YES
- NO
How should patients with chronic empyema be managed?

• Class IIA: Decortication is reasonable in patients with chronic empyemas who are medically operable to tolerate major thoracic surgery. (LOE B)

• Class IIB: Epidural catheter placement may be considered in patients undergoing thoracotomy for empyema if they are otherwise low risk for epidural abscess. (LOE C)
Options to manage patients with empyema who have incomplete lung expansion?

- **Class Ila:** Tissue flaps consisting of pedicled muscle flaps or omentum can be useful to fill empyema cavities where there is space created by incomplete lung expansion or close a bronchopleural fistula. (LOE C)

- **Class IIb:** Thoracoplasty with resection of ribs may be considered in select cases to obliterate the infected pleural space where previous measures (muscle flaps, open window) have failed. (LOE C)
Options to manage chronic empyema in patients in whom decortication not possible?

- **Class Ila**: Open thoracic window with marsupialization of the infected thoracic cavity with resection of several ribs and dressing changes is reasonable to be performed in patients with chronic empyema medically unfit to tolerate decortication and tissue flap placement or those patients with chronic empyema with a bronchopleural fistula. (LOE C)

- **Class IIb**: An empyema tube draining a chronic empyema cavity may be considered in draining chronic infections in which there is a small persistently infected space or small bronchopleural fistula especially in those patients medically unfit to tolerate decortication and tissue flap placement. (LOE C)
Management chronic empyema

Chronic Pleural Empyema
- Peel pressing pleural surface
- Contraction of chest space
- Mediastinal Shift

Decortication
- Open Thoracotomy
- ? VATS

Adjuncts:
- VAC
- Empyema tube

Open Thoracic Window

Adjuncts: Space Filling
- Tissue Flaps
- Pleural Tenting
- Thoracoplasty
How should post-pneumonectomy empyema be managed?

- **Class I:** Prompt intervention to identify or rule out the presence of a bronchopleural fistula and provide drainage of sepsis is recommended in patients suspected of having postpneumonectomy empyema. (LOE C)

- **Class IIA:** An aggressive surgical approach that includes antibiotics, serial debridement, closure of the bronchopleural fistula when present and obliteration of the residual pleural space using vascularized tissue transposition is a reasonable strategy to manage postpneumonectomy empyema. (LOE C)
How should empyema associated with BPF be managed?

- Class IIA: Closure of bronchopleural fistulae should be attempted using a combination of primary closure and buttressing with a well vascularized transposed soft tissue pedicle. (LOE C)

- Class IIB: Transposition of the omentum is preferred over skeletal muscle flaps or mediastinal soft tissue and this should be attempted after the purulent fluid has been completely drained and the pleural cavity has a surface of granulation tissue. (LOE C)

- Class IIB: Primary chest closure should be attempted with the chest cavity filled with antibiotic solution after granulation tissue has formed in the chest cavity and if the patient is medically fit to undergo another operation. (LOE B)
How should empyema in pediatric patients be managed?

• Class I: Tube thoracostomy with or without the subsequent instillation of fibrinolytic agents should be attempted as the initial treatment for pediatric patients with an empyema. (LOE A)

• Class IIA: Thoracoscopic debridement and drainage is recommended in pediatric patients not responding adequately to tube thoracostomy and fibrinolytic instillation. (LOE B)

• Class IIA: VATS debridement is preferred rather than open thoracotomy for the surgical management of empyema in the pediatric population (LOE C)
Next Steps

• Guidelines will be submitted to AATS Guidelines Committee for review and comment

• AATS Guidelines Committee will then present final version to AATS Councilors for approval

• Executive summary of guidelines to be published in *Journal of Thoracic & Cardiovascular Surgery* Summer 2016

• Full version with supporting reasoning and references will be published in the online version
Thank You