Posttraumatic Emphyema Thoracis

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EMPYEMA THORACIS

Derived from Greek word

empyein

Means pus-producing

Refers to accumulation of pus within the pleural space
POST TRAUMATIC EMPYEMA THORACIS (ET)

Hippocrates 600BC advocated drainage

Can be consequence:

- Penetrating
- Blunt
- Iatrogenic Trauma
Mostly further management not required, other than intercostal drain insertion

**Risk factors for development of Empyema:**

- Alcoholism
- HIV
- Drug usage
- Pre-existing lung disease
**PATHOGENESIS**

Most commonly consequence of parapneumonic process

American Thoracic Society divides ET into 3 evolutionary stages

<table>
<thead>
<tr>
<th>STAGE</th>
<th>PATHOLOGY</th>
<th>EVOLUTION</th>
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<tr>
<td>I. Exudative/Acute</td>
<td>Protein-rich sterile fluid</td>
<td>0 - 2 weeks</td>
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<td>Low cellular count</td>
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<td>II. Fibrinopurulent</td>
<td>Bacterial invasion of fluid</td>
<td>1 - 6 weeks</td>
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<td>Polymorphs</td>
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<td>Activated coagulation &amp; fibroblastic activity</td>
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<td>III. Organized phase</td>
<td>Thick pus</td>
<td>5 weeks</td>
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<td>Thick inelastic peel over pleua</td>
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PATHOGENESIS
TRAUMA SETTING

- Disruption of pleural space
- Blood in pleural space
- Contamination of space from:
  - Injury
  - Pneumonia
  - Intrabdominal source
  - ICD

• Intrabdominal source
ET does not develop in all cases of simple inoculation of pleural space.

More common in severely injured patient.

- Monocyte & neutrophil dysfunction
- Anti-inflammatory cytokine release

Resulting in state of relative immunosuppression
FACTORS PREDICTIVE OF DEVELOPMENT OF POSTTRAUMATIC EMPYEMA

- Ventilated patient
- Splinting secondary to pain
- Pulmonary contusion
- Onset of pneumonia
- Abdominal hollow viscus injury
- Shock
- Intercostal drain
- Penetrating injury (Gunshot > Stab wound)
MICROBIOLOGY

- Staph aureus - most common organism
- Incidence ranging from 35-75%
  (Aguilar et al 1997, Mandal et al 1998)
- Different from post infectious empyema – Streptococcus
- Anaerobes & other gram neg organisms
  (Klebsiella, Pseudomonas) increasing in frequency
- More common in thoracoabdominal injuries
- No growth from fluid → up to 35%
CLINICAL PRESENTATION

Fever → Chills → Chest pain

Dyspnoea → Tachypnoea → Leucocytosis

Raised CRP

Acute Phase
EMPYEMA NECESSITANS

Late presentation

Fistulous connection between pleural Collection & skin

Posttraumatic may discharge onto skin where chest wall originally breached
DIAGNOSIS

Made on characteristic clinical features:

- Symptoms
- Signs of hydrothorax

- CXR
- CT Chest
- Ultrasonography
- Diagnostic Thoracentesis
CT CHEST
DIAGNOSTIC THORACENTESIS

- Gold standard of diagnosis
- Following suggests Empyema:
  - Presence of frank pus
  - Organism on Gram Stain or culture
  - Biochem:
    - High protein < 30 mg/dl
    - PH < 7.2
    - LDH > 1000iu/l
    - Glucose < 5mg/dl
Empyema thoracis still a substantial challenge because of resultant long time in hospital, great expense and at times disappointing results.

Principle of management of ET

*Ubi pus evacua*

“If you find pus, remove it”
The aim is to:

- Eliminate the pus
- Re-expand the lung
- Restore the mobility of chest wall and diaphragm
- Improve pulmonary function
- Eliminate complications of chronicity
ANTIBIOTIC THERAPY FOR EMPYEMA THORACIS

Antibiotics an essential requirement

Antibiotic choice based on gram stain or culture or on local epidemiological data

Should have good pleural fluid/empyema penetration:

- Penicillin
- Clindamycin
- Ceftriazone
- Vancomycin
- Metronidazole
- Ciprofloxacin

Aminoglycosides best avoided - poor penetration
INTERCOSTAL TUBE DRAINAGE (ICD)

First line intervention

Aim – Evacuate pus  Allow expansion of lung

Large bore drain (>28F)

Dependant part of pleural collection
INTERCOSTAL TUBE DRAINAGE (ICD)

Simple placement of ICD – known risk factor for developing posttraumatic empyema with incidence of 2 - 16%

RISK FACTORS

- Experience of Medical Personnel
- Setting in which tube inserted
- Number of tubes
- Deviation of tube drainage
- Incomplete evac of blood
USE OF PROPHYLACTIC ANTIBIOTICS POST DRAIN INSERTION

Ideally administered before the procedure

Unequivocally been shown to decrease incidence of infectious complications after abdominal surgery

Several authors have tried to address role of prophylactic antibiotics in patients requiring ICD

EAST – Eastern Association for Surgery of Trauma

Insufficient published evidence to support use of prophylactic antibiotics
MAXWELL ET AL (2004)

- Designed multicentre trial
- Prospective double blind study
- Ran for 39 months
- Able to obtain only 20% cases for sufficient analysis

CONCLUDED

- Incidence of development of empyema small
- Does not seem to reduce risk of development of empyema
- Study under powered to draw any definitive conclusions
Systematic literature search to identify randomized clinical trials on antibiotic prophylaxis in ICD placement for thoracic trauma

Included 11 articles, encompassing 1241 ICD in 1234 patients

Patients who received prophylactic antibiotics had 3 times lower risk of empyema thoracis
GONZABO & HOLEVAR

CONCLUDED: Although complication rate was low it was statistically significant.
FIBRINOLYTICS

The use and installation of fibrinolytic agents Streptokinase & Urokinase is appealing.

They activate plasmin through cleavage of plasminogen.

- Initiate degradation of fibrin
- Reduce viscosity of fluid
- Dissolve loculations
- Dissolve peel
Reported success rate of intrapleural fibrinolytic agents vary from 71% - 90% (Robinson, 1994, Jerges-Sanchez 1966). However, most pertain to post infectious empyema.

Cameron et al (2004) examined the published studies for the Cochrane database and concluded – was insufficient evidence to recommend their use.

MIST Study UK - No difference between Saline and Streptokinase installation, in terms of treatment failures, need for surgery or mortality
CONCLUSION

The role of fibrinolytics in setting of post traumatic empyema should be further studied.

Cannot currently be recommended as routine therapy:

Prohibitive cost

Limited evidence of efficacy
VATS

- Proven favourable decrease in morbidity compared to open thoracotomy in other diseases
- Increasingly being used in field of trauma
- Early evacuation of hemothoraces shown to effectively decrease development of posttraumatic empyema
- Therefore most efficient use of VATS is in prophylaxis, evacuating the hemothorax before development of an empyema
- Review of literature indicates that successful intervention with VATS for posttraumatic empyema is dependant on timely intervention with the aim of evacuating retained collections after trauma
VATS

VATS has Limitations

Need for:

- Expertise
- Special instruments
- Single lung ventilation

Most effective in Stage I and early Stage II disease
Open drainage
Reserved for debilitated patient

**RIB RESECTION**

- Skin incision over the lowest rib overlying the empyema space
- 1.5cm portion of rib excised
- Pleura breached - histo obtained
- Space entered - debridement
- Dependant drain placed
CHEST WALL FENESTRATION (Eloessor flap)

- U-shaped skin incision
- Short fragment 2+-3 ribs excised
- Skin flap introduced into pleural space and sutured to parietal pleura
THORACOTOMY / DECORTICATION

Most invasive procedure in management of ET

Reserved for Stage III disease

Procedure
- GA
- Single lung ventilation

Aim
- Fully evacuate the space
- Remove the fibrous rind
- Re-expand the lung

Restores the mechanical function of lung and improves vital capacity
In Conclusion

Posttraumatic empyema remains a significant clinical problem occurring in 2 - 10% of victims of trauma. Factors leading to development of ET are mostly preventable. Primary feature is a retained haematoma which needs to be evacuated, either by ICD, or by VATS, within 5 days of trauma. Once an ET has developed the management is prolonged with increased risk of morbidity and mortality.

Thank you for your attention.