The role of medical thoracoscopy in primary spontaneous pneumothorax (PSP)

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Thoracoscopy course, Halle, October 2016
☐ Pathophysiology
☐ Treatment (PSP, SSP)

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ERS task force statement: diagnosis and treatment of primary spontaneous pneumothorax

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- Cause unknown

- Incidence: males: $7.4 - 18 / 10^5 / \text{year}$
  females: $1.2 - 10 / 10^5 / \text{year}$

- Demographics:
  - Age: 20-25 years
  - Tall, thin
  - Smoker
Pathophysiology

Treatment (PSP, SSP)
Vanderschueren classification

- Stage I: normal
- Stage II: adhesions
- Stage III: blebs
- Stage IV: bullae

Vanderschueren. Lung 1990; 168 (suppl.): 1122 – 25
Surgeon Observation: Rupture of a bulla?

- 3.6% (6/166)  
  Weissberg, Chest 2000; 117: 1279-85

- 25% (7/28)  
  Radomsky, Pneumologie 1989; 43: 250-3

- 73% (72/95)  
  Hatz, Ann Thor Surg 2000; 70: 253-7
Is really a bulla the cause of PSP?

Courtesy of Prof. Marc Noppen

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**PSP pathophysiology: Observations from different studies**

- **Histology:** Bullae has no communication with the visceral pleura in resected lung (electron microscopy)

- **In PSP:** CTs and surgically resected parenchyma:
  - 70 - 100% sub-pleural blebs look like emphysema (« emphysema-like changes » - ELC ‘s)

- **ELC ’s are bilateral in patients with sternotony**

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PSP pathophysiology: Observations from different studies

Where is the leak?

Ohata M. Chest 1980;77:771

◆ Electron Microscopy

⇒ No communication with visceral pleura
⇒ No mesothelial cells on the visceral pleura (elasto-fibrosis)
⇒ Pores (10-20 microns)

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PSP pathophysiology:
What happens to blebs/bullae (b/b) after treatment of PSP

- **CT scan**: n = 101
  - 68 first episode PSP: b/b 56%, 33 recurrences PSP avec new b/b 64% (Smit HJM Brit J Radiol 2000;73:356)

- **Thoracoscopy**: n = 82

- **Between 1st episode and recurrence**:
  - No significant difference in size, localization…

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PSP pathophysiology: smoking effect

- Tobacco: PSP risk X 9 in F and X 22 in M  
  (Bense 1987)

- 89% of homolateral end 80% of contralateral ELC’s in young non smoker patients healed from first PSP versus 0% in smokers group (p < .001)  
  (Lesur 1990, Mittlehner 1992, Bense 1993)
**PSP pathophysiology: inflammation of the pleura?**

*n = BAL in 29 PSP vs 30 controls*  

De Smedt Eur Respir J 2004;23:896

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### Table 1. Lavage cell counts

<table>
<thead>
<tr>
<th></th>
<th>PSP per mm³</th>
<th>CONTR per mm³</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>WBC</strong></td>
<td>1973 (547–3040)</td>
<td>159 (74–214)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td><strong>NEU</strong></td>
<td>384 (59–1052)</td>
<td>1 (0–2)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td><strong>EO</strong></td>
<td>243 (120–635)</td>
<td>0 (0–0)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td><strong>BASO</strong></td>
<td>22 (3–48)</td>
<td>0 (0–0)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td><strong>LYMPH</strong></td>
<td>102 (46–201)</td>
<td>27 (14–60)</td>
<td>0.024</td>
</tr>
<tr>
<td><strong>MACR</strong></td>
<td>671 (268–919)</td>
<td>118 (47–146)</td>
<td>&lt;0.004</td>
</tr>
<tr>
<td><strong>MESO</strong></td>
<td>10 (0–35)</td>
<td>0 (0–2)</td>
<td>0.034</td>
</tr>
</tbody>
</table>

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Respiratory Bronchiolitis (RB) in PSP patients?

- Retrospective study in 79 pts
- Results:
  - RB: 70/79 (89%)

Subpleural inflammation

Ohata M. Chest 1980;77:771
« Autofluorescence Thoracoscopy » in PSP patients

- Surface lesions more important and wider than the bulla itself

Noppen M. Am J Respiratory Crit Care Med 2006;174:26

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PSP: Where is the leak?

- True rupture of ELC’s (blebs/bullae)?
- Inflammation of the interstitium – elasto-fibrosis?
- Pleural porosity?

What is finally the cause is probably a diffused and extended process of inflammation and destruction of pulmonary parenchyma


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Pathophysiology
Treatment (PSP, SSP)
PSP treatment goals

I. Air evacuation
II. Prevention of recurrences

Almost 100% present a spontaneous improvement within 48h

- Sahn, NEJM 2000;342:868-74

Before 1970: Conservative treatment successful in 83%

All pts must be drained?
All pts must be drained?

- 34 year old
- No comorbidity
- Asymptomatic
- Leaving close to the hospital
PSP aspiration: 1st episode

- Indication: symptomatic patient
- Method: manual aspiration or pleurocath


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# Simple Aspiration? Yes!

<table>
<thead>
<tr>
<th></th>
<th>Aspiration (n = 27)</th>
<th>Chest tube (n = 33)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Immediate result</td>
<td>16/27 (59%)</td>
<td>21/33 (64%)</td>
<td>ns</td>
</tr>
<tr>
<td>1-week result</td>
<td>25/27 (93%)</td>
<td>28/33 (85%)</td>
<td>ns</td>
</tr>
<tr>
<td>Hospitalisation (n of patients)</td>
<td>14/27 (52%)</td>
<td>33/33 (100%)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Hospital stay (days)</td>
<td>3.4 ± 1.6</td>
<td>4.5 ± 2.7</td>
<td>ns</td>
</tr>
<tr>
<td>1-year result</td>
<td>7/27 (26%)</td>
<td>9/33 (27%)</td>
<td>ns</td>
</tr>
<tr>
<td>Time to recurrence (weeks)</td>
<td>13.4 ± 10.2</td>
<td>9 ± 8.5</td>
<td>ns</td>
</tr>
</tbody>
</table>


Noppen et al. AJRCCM 2002;165:1240-4
Who should perform aspiration?

**Respiratory Physician vs GP**

<table>
<thead>
<tr>
<th></th>
<th>RP</th>
<th>MG</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Success rate</td>
<td>62%</td>
<td>35%</td>
<td>.001</td>
</tr>
<tr>
<td>Complications</td>
<td>11%</td>
<td>32%</td>
<td>.001</td>
</tr>
<tr>
<td>Hospitalisation</td>
<td>5.6</td>
<td>9.5</td>
<td>.005</td>
</tr>
<tr>
<td>Follow-up</td>
<td>86</td>
<td>61</td>
<td>.01</td>
</tr>
</tbody>
</table>

Packham S. Postgr Med J 2003;79: 945-947
If failure: Small or large caliber?

Large TUBE

The classic TS treatment
Large drain?

Forbidden
DOES THE SIZE REALLY MATTER?

☑ YES: Smaller is better
Axillary line

$5^\circ$ intercostal

Front line

$> 2$ cm from sternum to avoid internal mammary artery
Insertion of pleurocath

Courtesy of Prof. Charles-Hugo Marquette (Nice, France)
Pleurocath

Courtesy of Prof. Charles-Hugo Marquette (Nice, France)
Pleurocath 8.5 F associated to a valve

8.5 F = 2,8 mm

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PSP recurrences: facts

- Overall (drainage including)
  - 30% (16-57%)
  - So 70% no recurrence

- Recurrence depend on
  - Time: 2 yrs after 1st episode
  - Smoking
  - Pleurodesis

- Recurrence do not depend on
  - Patient’s age
  - The importance of PSP

Recurrence rates after treatment of bullae:  
**Bullectomy vs Pleurodesis**

- **VATS Bullectomy alone - 50 pts**: 16% recurrences  
  Bullectomy + Pleurodesis - 53 pts: 1.9% recurrences  
  *Horio, Surg Endosc 2002; 16: 630*

- **VATS Bullectomy alone - 25 pts**: 20% recurrences  
  Bullectomy + Pleurodesis - 24 pts: 4% recurrences  
  *Loubani, Respir Med 2000; 94: 888*

- **VATS Bullectomy alone - 72 pts**: 6% recurrences  
  Pleurodesis alone - 37 pts: 0% recurrences  
  *Hatz, Ann Thor Surg 2000; 70: 253*

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<table>
<thead>
<tr>
<th>Strategy</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Routine excision of the apex of the lung</td>
<td>Controversial</td>
</tr>
<tr>
<td>Selective excision of blebs or bullae</td>
<td>Controversial, as not evidence-based for pulmonologists; general agreement among surgeons</td>
</tr>
<tr>
<td>Bullectomy</td>
<td>Controversial, not better results than bullae ligation in non-randomised studies</td>
</tr>
<tr>
<td>Coverage of staple line with absorbable mesh</td>
<td>To be confirmed</td>
</tr>
<tr>
<td>Electro- or cold coagulation of blebs and bullae</td>
<td>Controversial</td>
</tr>
<tr>
<td>Endobronchial valves to close persistent air leak</td>
<td>Still anecdotal</td>
</tr>
<tr>
<td>Talc poudrage</td>
<td>95% success rate at follow-up; not advisable as sole treatment in cases of significant bullae</td>
</tr>
</tbody>
</table>
Treatment of bullae

Bleb/bullectomie should not be performed routinely

- Not more efficient
- Increase cost
- The leak is not necessarily due to a bleb

ERS Statement 2015. Recurrence prevention: Pleurodesis

- Talc poudrage is the most efficient and less costly method
- Surgery: Thoracoscopy better than thoracotomy


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So, why don’t we perform simply pleurodesis to these patients?
Medical Thoracoscopy with talc poudrage:

95 - 100 % efficient in the treatment of PSP recurrences

Milanez de Campos, Chest 2001;119:801-6
Loddenkemper, Eur Respir J 1993;6:1544-5
Tschopp, Respiration 2000;67:108-11

Thoracoscopy course, Halle, October 2016
European randomized controlled study: Simple Talcage under thoracoscopy (TT) versus drainage (D)

- n = 108 -> 2 groups: TT versus D
- Failures after 5 ans
  - TT = 5% vs D = 27% (p < .01)
- No difference in complication rates
- No difference in immediate costs
- Total Cost TT < Cost D (considering recurrences)

Tschopp JM et al, Eur Respir J 2002;20: 1003

Thoracoscropy course, Halle, October 2016
Management of PSP: a low cost approach

PSP

Small bore catheter
Heimlich valve

Persistent air leak
(>4 days)

Resolution

Thoracoscopy

No visible air leak

Pleurodesis

Air leak

Air leak treatment + pleurodesis

Massongo M et al. ERJ 2014; 43: 582
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Indications for pleurodesis?

- After the 1st recurrence
- After the 1st episode of prolonged air leak
- After the 1st episode in high risk patients
  - Flying personnel
  - Climbers
  - High altitude guides
  - Divers

American College of Chest Physicians Delphi Consensus Statement

Baumann, Chest 2001;119:590-602

Tschopp JM et al, Eur Respir J 2002;20: 1003
Practical approach for PSP

PSP

Asymptomatic ± loss of parietal contact
- No comorbidity
  - Compliance
  - Close to hospital

Dyspnea ± loss of parietal contact
- 2nd episode or Special groups
- 1st episode
  - Aspiration or small bore with valve
  - Failure after 48h

Failure
- Thoracoscopic Pleurodesis ± leak treatment
- Thoracoscopy course, Halle, October 2016
Secondary spontaneous Pneumothorax (SSP)

- Incidence: male: $6.3 \times 10^5$ / year
  female: $2 \times 10^5$ / year

- Causes:
  - COPD
  - TBC
  - Cystic fibrosis
  - AIDS
  - DILD
  - Lung carcinoma

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Clinical presentation more severe than PSP

Mortality
- 15% in the first 6 months
- 40% 5 years

Recurrences: higher than PSP
- 45% COPD
Treatment of SSP

- Aspiration less effective
- 1st episode: pleurodesis
Alexandroupolis

ERS Thoracoscopy Course, November 12-14, 2015

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