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Management of Primary Spontaneous Pneumothorax in Children: A Single Institution Protocol Analysis

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Management of Primary Spontaneous Pneumothorax in Children: A Single Institution Protocol Analysis

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Background

• Primary spontaneous pneumothorax (PSP) affects 3.4 per 100,000 children in the United States.

• 4:1 predilection for tall, slender male teenagers.

• Typically results from a spontaneous apical bleb rupture.

• Regardless of the initial management, additional procedures, and prolonged hospital length of stay (LOS) are common.
The Problem

• There is currently no consensus in the pediatric surgical community

• Marked variability in management

• Most perform non-operative management with tube thoracostomy at the initial presentation, reserving surgical intervention for recurrence or persistent air leak.
  • prolonged LOS and recurrence rates of up to 61%
More Problems

• Conflicting guidelines

• ACCP – Delphi consensus statement 2001
  • No role for simple aspiration

• BTS 2010 Guidelines
  • simple aspiration should be first line therapy
Existing Evidence

<table>
<thead>
<tr>
<th>Study</th>
<th>Number of paediatric patients (defined as age &lt; 18 years) and age of subjects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Archer et al 1985</td>
<td>0/18</td>
</tr>
<tr>
<td>Hayes et al 1983</td>
<td>At least 1 of 17</td>
</tr>
<tr>
<td>Markos et al 1990</td>
<td>Age range 17–71 years</td>
</tr>
<tr>
<td>Delius et al 1989</td>
<td>Unclear/40</td>
</tr>
<tr>
<td>Harvey 1994</td>
<td>28.3 ± 12.4 years for the successful group</td>
</tr>
<tr>
<td>Ng et al 1994</td>
<td>Suggests some paediatric</td>
</tr>
<tr>
<td>Andrievet al 1995</td>
<td>0/28</td>
</tr>
<tr>
<td>Soulsby et al 1998</td>
<td>Entry criteria included those &gt; 18 years</td>
</tr>
<tr>
<td>Mendis et al 2002</td>
<td>11 patients in second decade/115</td>
</tr>
<tr>
<td>Noppen et al 2002</td>
<td>Some/45 PSP</td>
</tr>
<tr>
<td>Packham et al 2003</td>
<td>Age range 14–59</td>
</tr>
<tr>
<td>Faruqi et al 2004</td>
<td>3/60*</td>
</tr>
<tr>
<td>Chen et al 2005</td>
<td>Aged 14–17 years, mean 15.8 years</td>
</tr>
<tr>
<td>Kelly et al 2008</td>
<td>0/203</td>
</tr>
<tr>
<td>Kelly et al 2008</td>
<td>Entry criteria included those &gt; 18 years</td>
</tr>
</tbody>
</table>

* Personal communication from the author.

Most evidence from adult retrospective series and that included some patients <18yo

Clear need for quality studies focused on children

Needing a more clearly defined problem
Hypothesis

• PSP cannot be managed like a traumatic pneumothorax

• One clear question when a patient presents
  • Is the ruptured bleb leaking or not?

• Simple aspiration is an effective initial intervention for spontaneous pneumothorax in children.
Methods

• Retrospective analysis on patients <18 years who were diagnosed with PSP from 2016 to 2021

• Initial management was aspiration with a ≤12F percutaneous thoracostomy tube followed by clamping of the tube and CXR at 6 hours.

• Success was defined as ≤2cm distance between chest wall and lung at the apex and no air leak when the clamp was released.

• VATS followed if aspiration failed.
Exclusion Criteria

• Previous ipsilateral episode of pneumothorax that required medical treatment.

• Pneumothorax secondary to a co-morbid medical condition (underlying pulmonary disease, malignancy, trauma etc).

• Pneumothorax is small (<2cm)

• Bilateral pneumothorax

• Unstable patient in need of emergent intervention at surgeon discretion.
The Protocol

- Simple aspiration with small bore catheter (≤12Fr)
- Local anesthetic +/- sedation
- Must document expansion with CXR
- Must observe minimum 6 hours then repeat CXR
- Aspiration catheter left in place and clamped during observation – may be used as chest drain if recurrent pneumothorax
- Success was defined as ≤2cm distance between chest wall and lung at the apex and no air leak when the clamp was released.
- VATS followed if aspiration failed.
Results

- Fifty-nine patients included. Median age was 16.8 years (IQR 15.9, 17.3).
- Aspiration successful in 33% (n=20), while 66% (n=39) required VATS.
- Median LOS with successful aspiration = 20.4 hours (IQR 16.8, 34.8).
- VATS group had a median LOS of 3.1 days (IQR 2.6, 4).
- Compared to two recent publications where LOS post VATS was median 5.5 days (IQR 5, 7) and a mean of 3.7 days ± 1.4 [1,2].
- Median time to recurrence after successful aspiration was sooner than that of the VATS group [16.6 days (IQR 5.4, 19.2) vs. 389.5 days (IQR 94.1, 907.0) p=0.01]
Let’s see this in action
This is what failure looks like – air continues to leak
Another one
This is what success looks like – no pneumothorax
Conclusion

• Simple aspiration reliably predicts the need for operative intervention

• The decision to operate may be made within 6 hours; likely reducing

  LOS, morbidity and cost
Difficult Problem to Manage

Simple aspiration with ≤12 F percutaneous thoracostomy tube
N=59

- Aspiration successful 33% (n=20)
  - Recurrence 45% (N=9)
    - VATS 88.9% (n=8)
      - Aspiration 11.1% (n=1)
  - Aspiration Failed 66% (n=39)
    - Immediate VATS
      - Recurrence 25% (n=10)
        - VATS 90% (n=9)
          - Aspiration 10% (n=1)
• The primary clinical feature that must be distinguished is which patients are not still leaking air into their pleural space after the initial bleb rupture, and which ones are (and hence warrant operative intervention).

• More updated data suggests an initial trial of observation is possible to discern between these two patient populations, with results demonstrating a decrease in the overall need for any intervention.
Current Protocol

Figure 2.

1. Diagnosis of PSP
2. Surgical consultation
3. Observation (4hrs)
4. Repeat A/P CXR
   - Stable or improved PTX size with controlled symptoms
5. Discharge from ED
   - 6 week follow up with A/P CXR and outpatient or telehealth visit
Current Protocol

Figure 3.

1. Diagnosis of PSP
2. Surgical consultation
3. Observation (4hrs)
4. Failure of observation
5. VATS (at earliest available time)