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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

Summary of aspiration studies to date detailing possible paediatric patients

Study	Number of paediatric patients (defined as age < 18 years) and age of subjects
Archer et al 1985[77]	0/18
Hayes et al 1988[78]	At least 1 of 17 Age range 17–71 years
Markos et al 1990[79]	Unclear/40 28.3 ± 12.4 years for the successful group suggests some paediatric
Delius et al 1989[80]	0/114*
Harvey 1994[81]	Unclear/35 Mean age 34 SD 15, no lower age limit stated
Ng et al 1994[82]	Unclear/34 Age range 16–82
Andrivet et al 1995[83]	0/68 Entry criteria included those > 18 years
Soulsby et al 1998[84]	11 patients in second decade/115
Mendis et al 2002[85]	Some/45 PSP Age range 14–59
Noppen et al 2002[86]	3/60* Aged 16,16 and 17 years All in the manual aspiration group
Packham et al 2003[87]	Unclear/89 Mean (SD) for the two groups were 40.6 (18.0) and 38.9 (21.4)
Faruqi et al 2004[88]	5/59* 3 PSP (all aged 16 years) 2 secondary SP (aged 15 and 16 years, both secondary to TB)
Chan et al 2005[89]	17/91* Aged 14–17 years, mean 15.8 years
Kelly et al 2008[90]	0/203 Entry criteria included those > 18 years
Kelly et al 2008[32]	23/234* Aged 15–17 years

* 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.

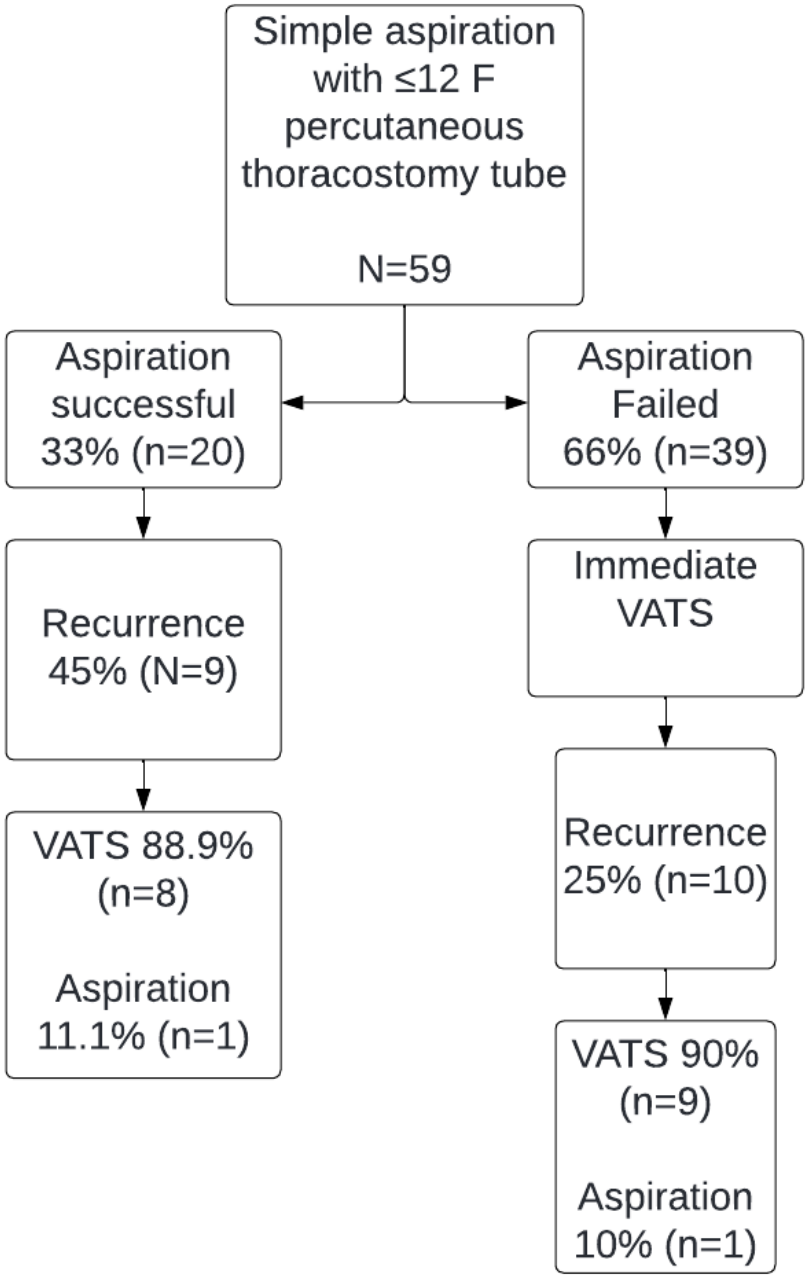
Exclusion Criteria

- 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]

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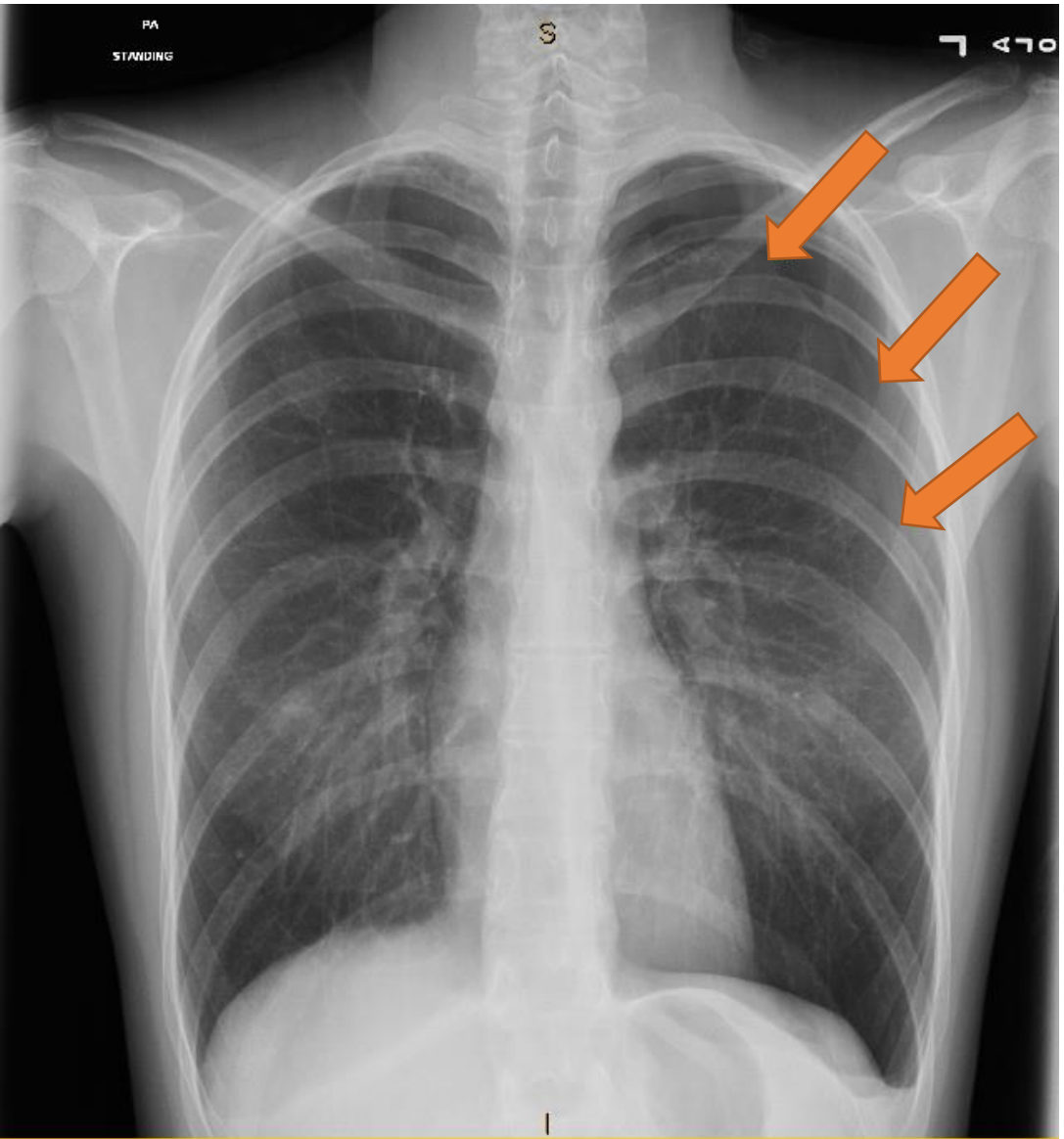
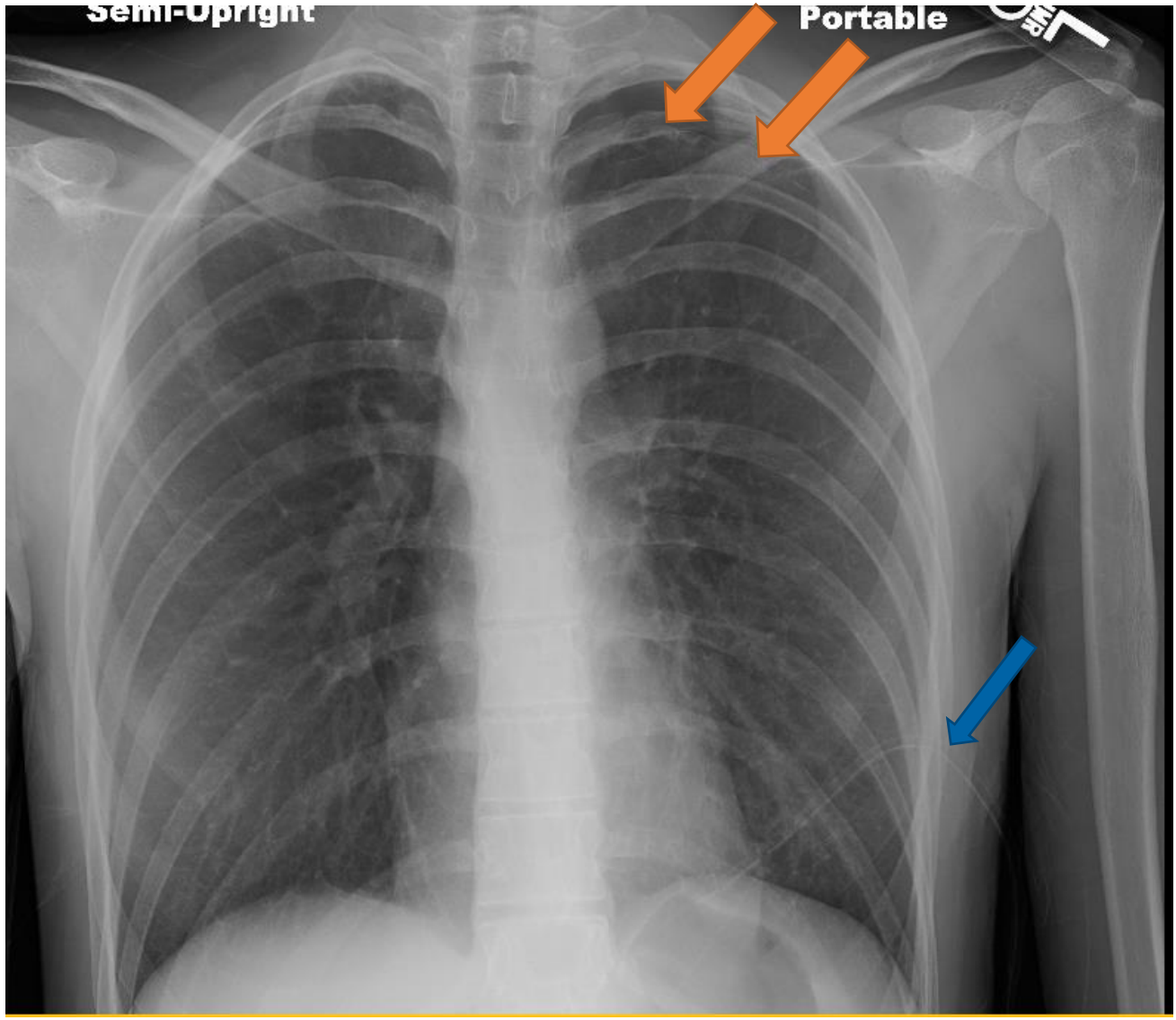
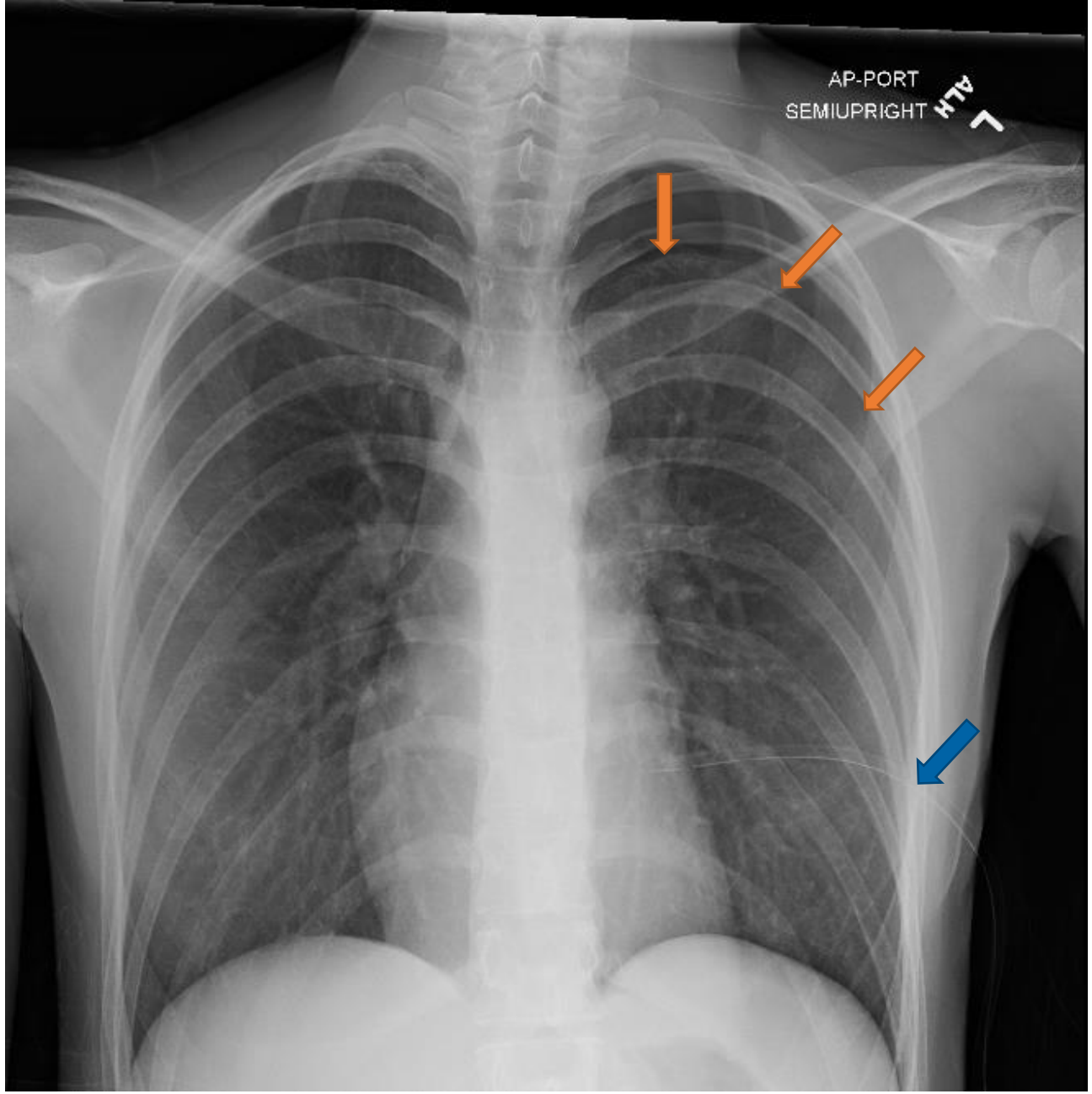
Let’s see this in action





This is what failure looks like – air continues to leak



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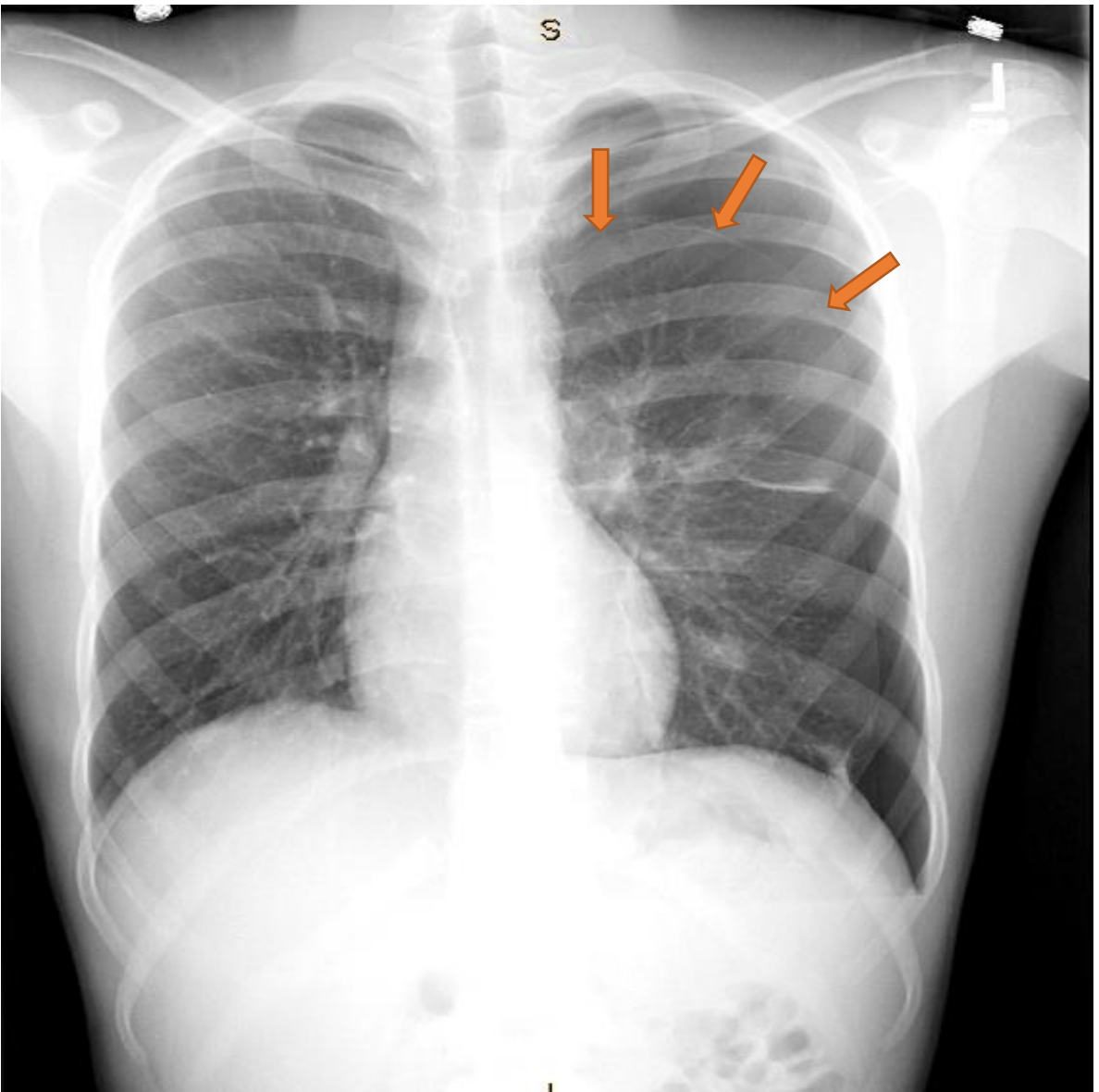
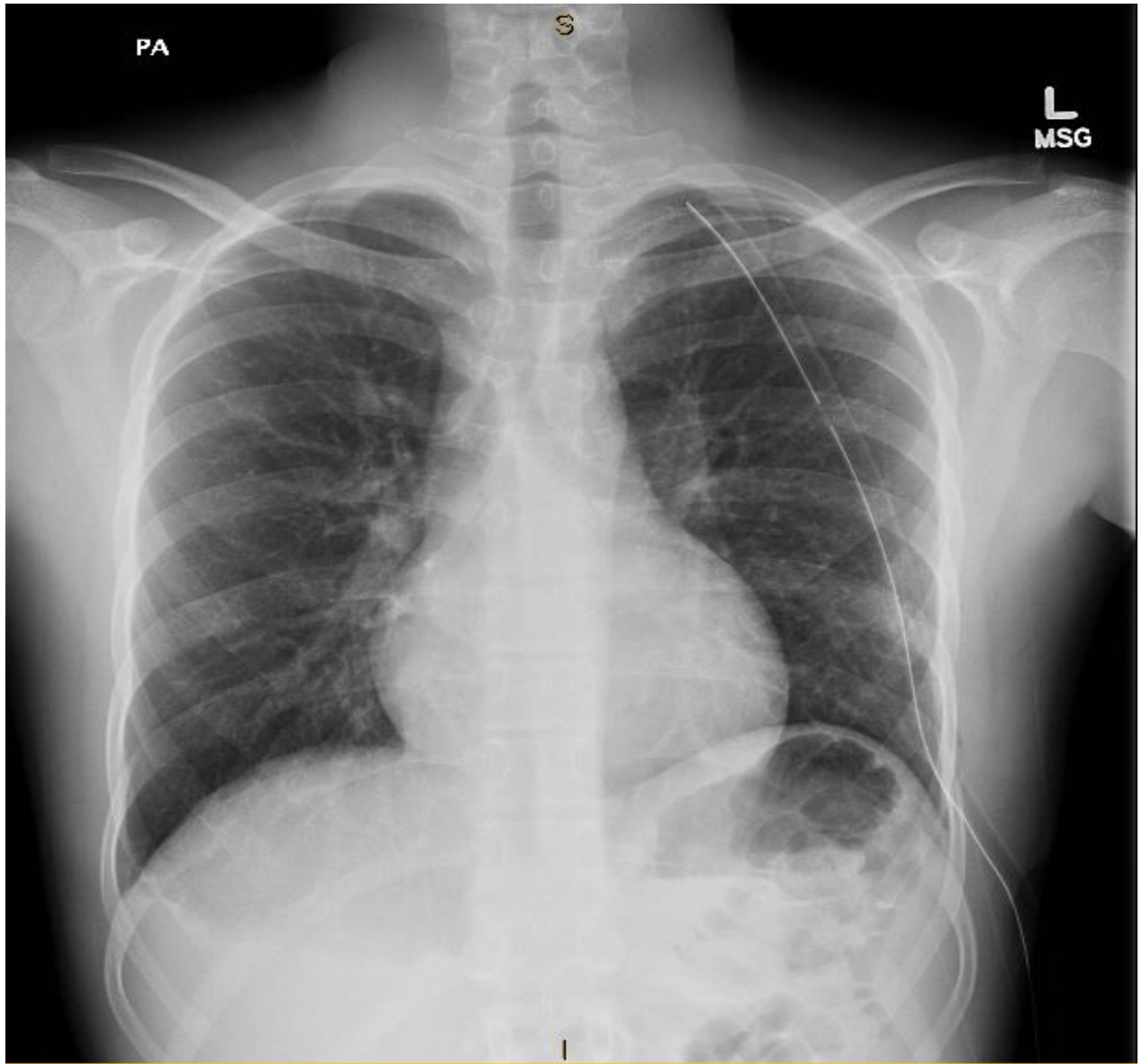
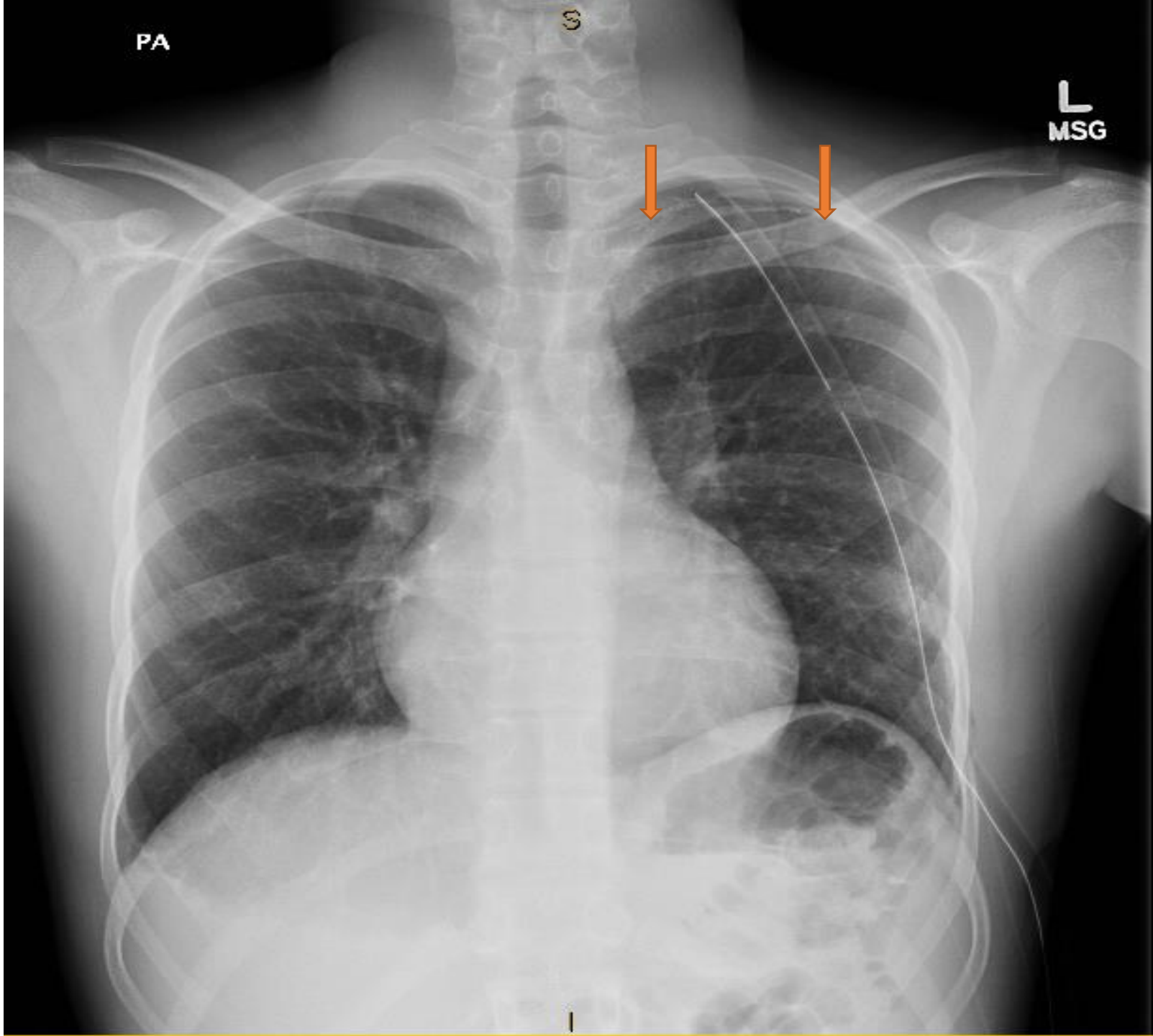
Another one





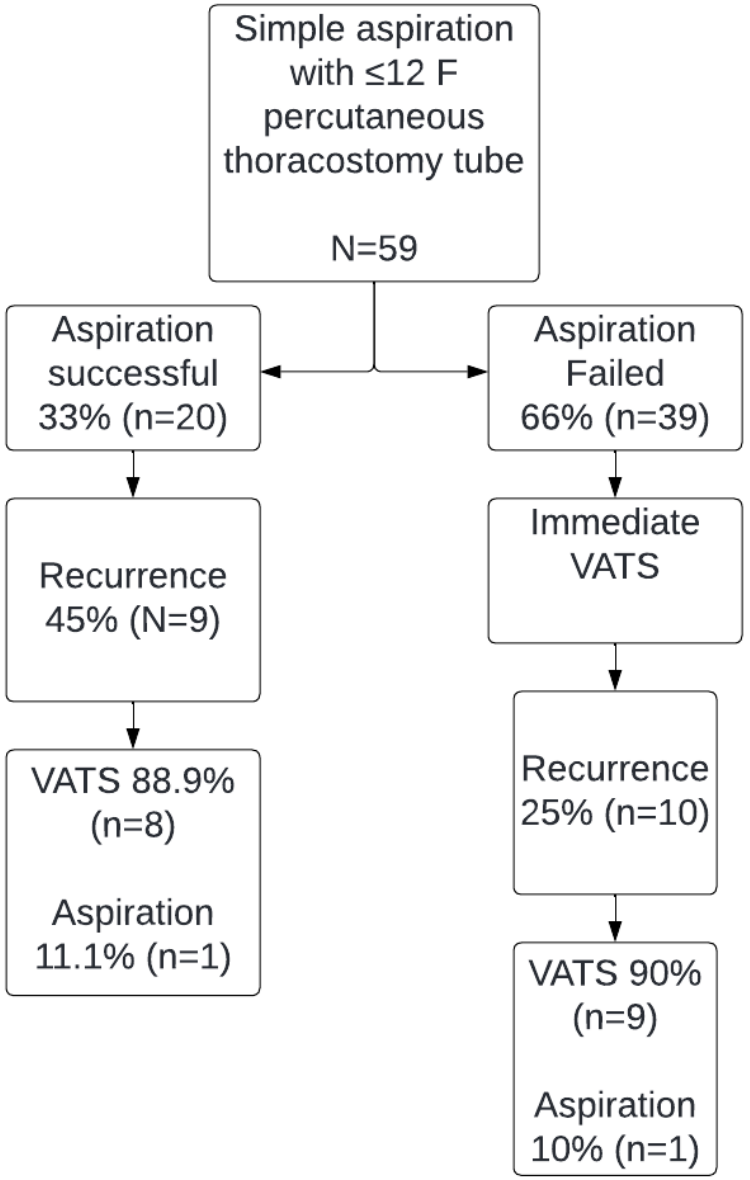
This is what success looks like – no pneumothorax



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



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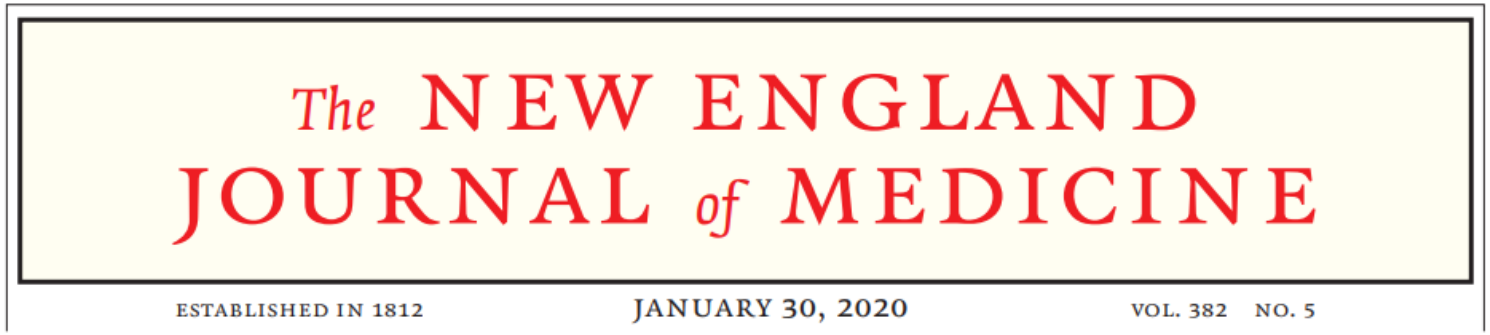
- The primary clinical feature that must be distinguished is which patients are not still leaking air into their pleural space after the initial bleb rupture, and which ones are (and hence warrant operative intervention).
- More updated data suggests an initial trial of observation is possible to discern between these two patient populations, with results demonstrating a decrease in the overall need for any intervention.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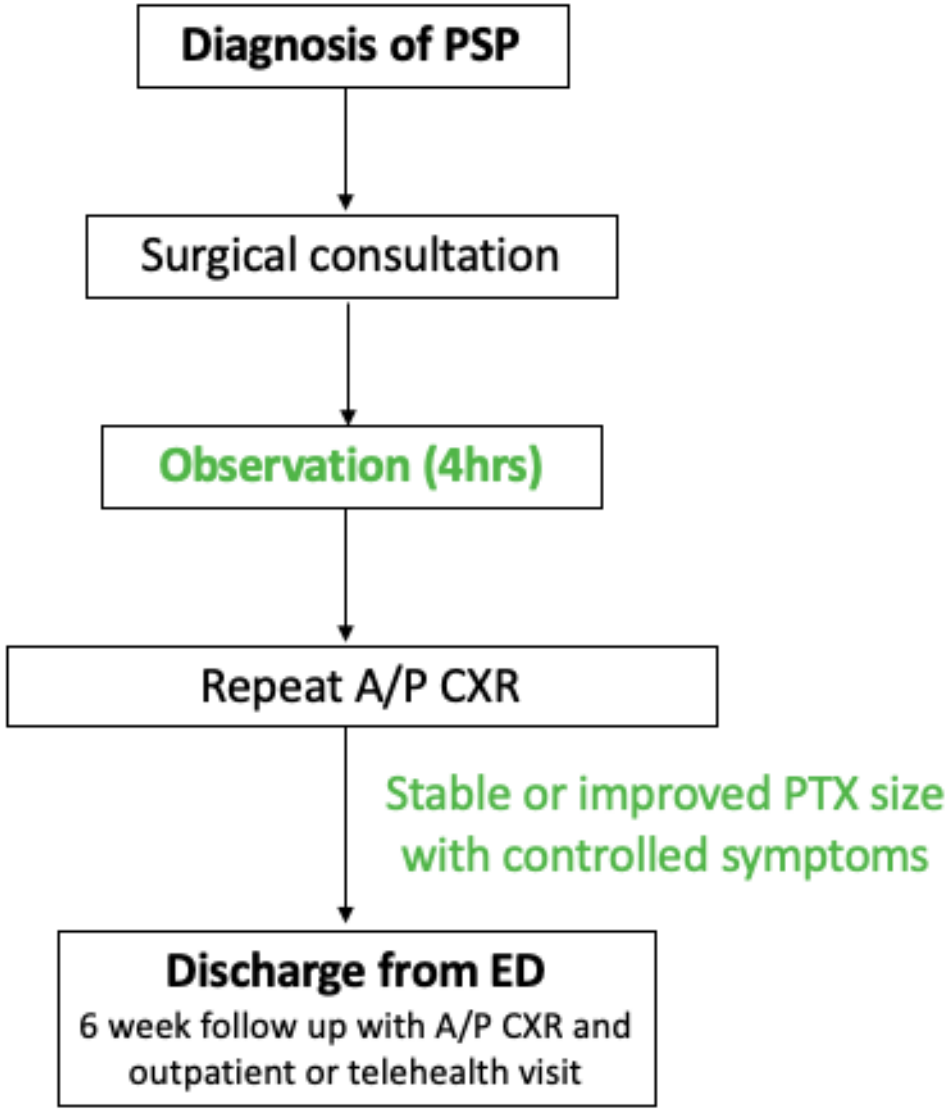
Conservative versus Interventional Treatment for Spontaneous Pneumothorax

S.G.A. Brown, E.L. Ball, K. Perrin, S.E. Asha, I. Braithwaite, D. Egerton-Warburton, P.G. Jones, G. Keijzers, F.B. Kinnear, B.C.H. Kwan, K.V. Lam, Y.C.G. Lee, M. Nowitz, C.A. Read, G. Simpson, J.A. Smith, Q.A. Summers, M. Weatherall, and R. Beasley, for the PSP Investigators*

Current Protocol

Figure 2.



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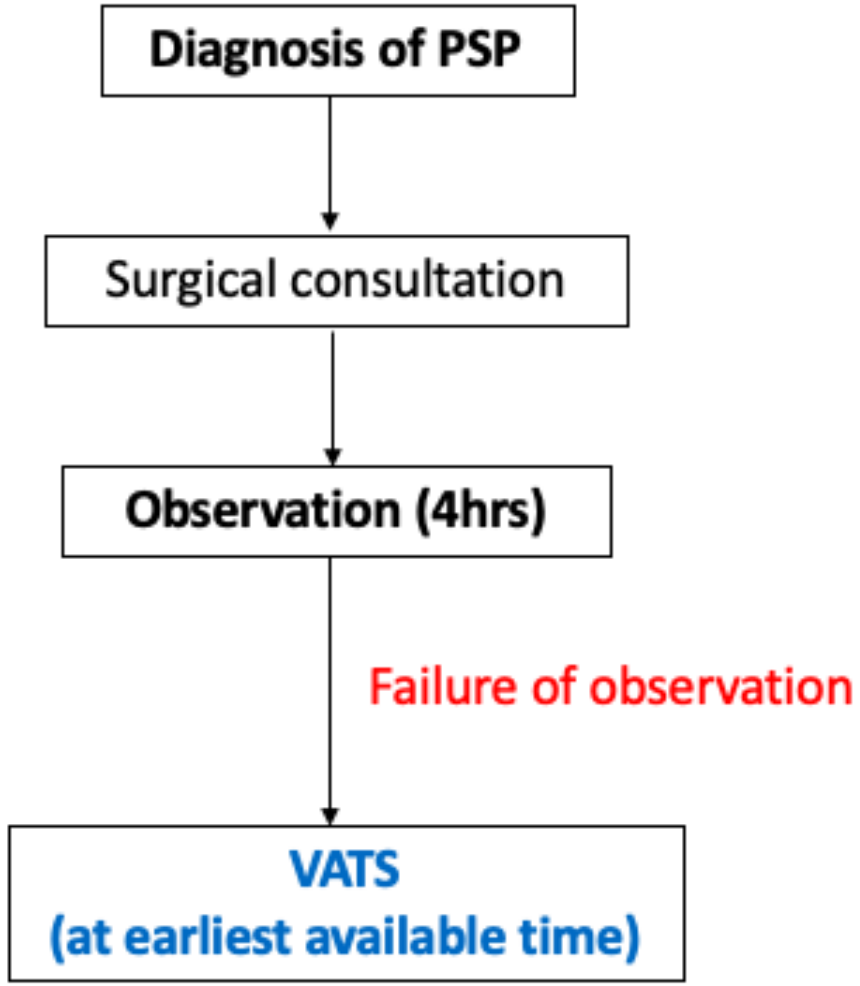
Current Protocol

Figure 3.



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