

BRIEF COMMUNICATION

## Deviation from published guidelines in the management of primary spontaneous pneumothorax in Australia

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### Abstract

There are several published guidelines recommending treatment pathways for patients with primary spontaneous pneumothorax (PSP). Little is known about how these patients are actually treated in Australia. The aim of this study was to establish treatment patterns for Australian patients with PSP. This was a multicentre retrospective observational study conducted at 19 emergency departments across Australia of adult patients with PSP presenting in the calendar year 2005. In Australia, there is considerable deviation from published guidelines for the management of PSP. In light of the lack of high-quality evidence to assist in choosing treatment approaches, a randomized controlled trial of management strategies is recommended.

Primary spontaneous pneumothoraces (PSP) remain a significant global problem, occurring in healthy subjects with a reported incidence of 18–28/100 000 per year for men and 1.2–6/100 000 per year for women.<sup>1,2</sup> Many patients do not seek medical advice for several days, with 46% waiting more than 2 days despite symptoms.<sup>3</sup>

There are four published guidelines for the management of PSP. Unfortunately, they differ in important aspects of their recommended approach.

The guidelines of British Thoracic Society (BTS) choose to classify the size of a pneumothorax as ‘small’ or ‘large’ depending on the presence of a visible rim of < 2 cm between the lung margin and the chest wall, but do not define where this measurement should be taken. There is no distinction made for isolated apical pneumothoraces.<sup>4</sup> These guidelines recommend:

- Patients with small (< 2 cm) PSP not associated with breathlessness should be considered for discharge with early outpatient review. These patients should receive clear written advice to return in the event of worsening breathlessness (evidence level B)

- Simple aspiration is recommended as first-line treatment for all PSP requiring intervention (evidence level A)
- Repeated aspiration is reasonable for PSP when the first aspiration has been unsuccessful (i.e. patient still symptomatic) and a volume of < 2.5 L has been aspirated on the first attempt (evidence level B)
- If simple aspiration or catheter aspiration drainage of any pneumothorax is unsuccessful in controlling symptoms, then an intercostal tube should be inserted (evidence level B)
- There is no evidence that large tubes (20–24 Fr) are any better than small tubes (10–14 Fr) in the management of pneumothoraces. The initial use of large (20–24 Fr) intercostal tubes is not recommended (evidence level B)

The guidelines of American College of Chest Physicians (ACCP) were developed by literature review from 1967 to January 1999 and a Delphi questionnaire submitted in three iterations to a multidisciplinary physician panel. In this guideline, small pneumothoraces are defined as those with less than 3 cm apical distance.<sup>5</sup> They recommend that:

- Clinically stable patients with small pneumothoraces should be observed in the emergency department (ED) for 3–6 h and discharged home if a repeat chest radiograph excludes progression of the pneumothorax (good consensus)

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- Clinically stable patients with large pneumothoraces should undergo a procedure to re-expand the lung and should be hospitalized in most instances (very good consensus). The lung should be re-expanded by using a small-bore catheter (14 Fr) or placement of a 16–22 Fr chest tube (good consensus)
- Simple aspiration is appropriate rarely in any clinical circumstance

For the Belgian Society of Pneumology, a large pneumothorax is defined as one where there is a pleural gap along the entire length of the lateral chest wall on chest X-ray. They equate this with a minimum 20% size.<sup>6</sup>

- In the case of a small and minimally symptomatic PSP, observation and outpatient follow up are recommended (evidence level C)
- In the case of symptomatic and/or large PSP, initial treatment is evacuation of air either by simple aspiration or by the introduction of a small-bore catheter attached to a Heimlich valve or underwater seal (evidence level B)
- In the case of failure of simple manual aspiration, intercostal tube drainage using a small tube (maximum 16 Fr) is recommended (evidence level C).

Therapeutics Guidelines (Australia) also divide PSP into 'large' and 'small' based on the rim of air surrounding the lung similar to the BTS guidelines. A 2-cm rim is said to approximate a 50% collapse.<sup>7</sup>

These suggest that patients with small PSP without significant breathlessness can be observed, either at home or in hospital. They state that those with larger PSP without breathlessness can also be observed, but that evidence comparing observation with intervention is lacking. In patients with PSP requiring intervention (not defined, but assumed to be those with respiratory compromise and larger PSP), simple aspiration is recommended as initial therapy.

In summary, there is agreement regarding the management of small PSP, but there are different approaches to larger PSP.

Little is known about how these patients are actually treated in Australia. The aim of this study was to establish treatment patterns for Australian patients with PSP.

## Study parameters

This is a multicentre retrospective observational study conducted at 19 ED across Australia.

Participants were adult patients (aged 16 years and more) with PSP presenting to any of the study ED in the calendar year 2005. Patients were identified from existing databases. Patients with tension pneumothoraces were excluded.

Data were collected by explicit medical record review by a local investigator at each ED and included demographics, size of pneumothorax by Collins' formula<sup>8</sup> (pneumothorax size =  $4.2 + 4.7 \times$  (sum of interpleural distances

in cm at apex, midpoint of upper half of collapsed lung and midpoint of lower half of collapsed lung), primary treatment and outcome.

The primary outcome of interest was the management option used (conservative, aspiration, small-bore pleural catheter plus drainage and traditional intercostal catheter plus drainage). Secondary outcomes of interest were rates of surgical treatment and success rate of aspiration.

Data are presented as descriptive statistics for the overall group and the subgroups small and large subgroups, with the 2-cm rim measured at the midpoint of the upper half of the collapsed lung.  $\chi^2$ -analysis was used for comparison of proportions.

Two hundred and thirty-four patients were studied and 71% were men with a median age of 25 years (IQR 17). Fifty-six per cent of PSP were on the left side (128 of 230, four missing data), median size was 45% (95% confidence interval (CI) 35–59%, 203 cases with data available) and 62% were first episodes (134 of 217, 17 missing data).

Initial management strategy is shown in Table 1. Of note is that 63% of small PSP pneumothoraces and 10% of large pneumothoraces were treated conservatively. Aspiration was not commonly used (17%), but when used, aspiration was successful in 58% of cases (23 of 40). There was no difference in aspiration success rates between different pneumothorax sizes (small 56% success, large 53%), but the numbers were very small. Small-bore catheters are not commonly used. Intercostal catheter (ICC) remains the preferred treatment for large pneumothoraces (62%).

Surgery at index admission occurred in 16% of patients, the vast majority in the large pneumothorax group. Patients with large PSP were more likely to undergo surgery at index admission [ $P = 0.002$ ,  $\chi^2$ ].

## Discussion

With the exception of conservative management for small pneumothoraces that is a feature of all of the guidelines, our

**Table 1** Primary management strategy used

Primary management strategy	Overall ( <i>n</i> = 234) <i>n</i> (%)	Size: < 2 cm rim ( <i>n</i> = 105) <i>n</i> (%)	Size: > 2 cm rim ( <i>n</i> = 98) <i>n</i> (%)
Conservative	91 (39)	66 (63)	10 (10)
Aspiration	40 (17)	16 (15)	17 (17)
Small bore pleural catheter (plus UWSD/Heimlich valve)	18 (7.7)	3 (3)	10 (10)
ICC	96 (41)	20 (19)	61 (62)
Surgery at index admission	38 (16)	10 (10)	26 (27)

Thirty-one cases had no size data available for subgroup analysis; site of rim measurements is midpoint of upper half of collapsed lung. ICC, intercostal catheter; UWSD, under-water seal drain.

results show poor compliance with any of the published guidelines.<sup>4-7</sup> Conservative management was used for 10% of large pneumothoraces and aspiration was not commonly used, both of which are at odds with most of the guidelines.

The case for conservative management is interesting, but based on limited data. It was the mainstay of management of PSP until the 1940s when it was largely rejected in favour of ICC drainage because it was believed that the latter resulted in a more rapid re-expansion of the lung with the assumption that this yielded a better outcome for the patient.<sup>9</sup> This logic has been challenged.<sup>10,11</sup> There are very limited data about outcome for patients with larger PSP treated conservatively; however, success rates of the order 90% have been reported.<sup>10,12,13</sup> Recent studies estimate the rate of re-expansion of PSP at 2.2%/day.<sup>11</sup> Importantly, that study also found significant between and within patient variation in re-expansion rate, with a tendency for larger pneumothoraces to re-expand at a faster rate.

Deviation from published pneumothorax guidelines is an international phenomenon. Several studies of the BTS guidelines suggest poor compliance with the 1993 guidelines among non-respiratory and ED staff.<sup>14-17</sup> In particular, in comparison to the BTS guideline recommendations, aspiration is being under-utilized or used inappropriately.<sup>14,16,18</sup> Our findings support this observation. A survey of US chest physicians showed considerable variation in practice and were, in part, the impetus for the development of the 2001 guidelines.<sup>19</sup> Disappointingly, this survey with a response rate of only 3.6%, suggested that even for small PSP (< 20%) there was significant variation with approximately 57% opting for conservative management, 12% for aspiration and the remainder for intercostal catheter drainage. Survey data from Switzerland show agreement for conservative management of small PSP in most cases (small defined as being less than 3 cm apical interpleural gap).<sup>20</sup> They, however, found that ICC placement was strongly preferred for stable patients with large pneumothoraces and aspiration was not preferred. A retrospective study from Singapore reported that of all first episodes of PSP, 37% were managed conservatively, 18% with aspiration and 45% with ICC insertion and drainage. Eighty per cent of pneumothoraces of more than 40% of the hemithorax volume were treated with ICC insertion and drainage.<sup>21</sup> Data from Israel suggest that almost all patients with PSP >20% were treated with ICC insertion and drainage.<sup>22</sup> The only data from Australia are from a survey of members of the Australian Thoracic Society that found good consensus for the management of small and large PSP, but considerable variation in practice for intermediate pneumothoraces.<sup>23</sup>

Reasons for deviation from the guidelines might include lack of awareness of them, lack of confidence in their evidence base or habit/resistance to change. Given that

the guidelines vary in their recommendations, the evidence base is likely to be a significant issue. A recent review article concluded that based on current evidence, several treatment strategies seem to have similar success rates (although 'success' is variably defined), but there are few high-quality studies that robustly investigate success rate, adverse events, cost and patient acceptance.<sup>24</sup> It makes an appeal for randomized trials to answer outstanding questions. The BTS guidelines document also emphasizes several areas as needing research: conservative management versus aspiration  $\pm$  tube drainage for PSP larger than 2 cm on the chest radiograph; use of small catheter/Heimlich valve kits versus intercostal tube drainage following failed aspiration in PSP and small catheter aspiration versus conventional aspiration or tube drainage.<sup>4</sup>

A further confounding factor in this case is the varying definitions of 'small' and 'large' pneumothoraces. In this report, we have used the Australian/BTS definition that classified 52% of the sample as 'small'. If the ACCP definition had been applied only 27% of the sample would be defined as 'small'.<sup>5</sup> The Belgian Society of Pneumology definition would also classify 27% as 'small'; however, only 60% of the cases identified overlap with the ACCP group!<sup>6</sup> Without clear and agreed definitions, preferably based on simple, reproducible measures, it will be hard to collate the results of research to better inform our practice.

There are some limitations of our study that should be considered when interpreting the results. This was a retrospective medical record review with all its inherent weaknesses. The sample is drawn from the Australian population and so may not be generalizable to patients or health services in other countries. The Australian/ BTS definitions regarding PSP size were used. If other definitions had been used, different results would have been obtained. The Collins' method was used to estimate pneumothorax size. It has not been externally validated (neither have the alternative methods).

In Australia, there is considerable deviation from published guidelines for the management of PSP. In light of the lack of high-quality evidence to assist in choosing treatment approaches, a randomized controlled trial of management strategies is recommended.

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