Management of spontaneous pneumothorax: are British Thoracic Society guidelines being followed?

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ORIGINAL ARTICLE

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In 1993, the British Thoracic Society (BTS) issued guidelines for the management of spontaneous pneumothorax. The aim of this study was to determine the level of adherence to and awareness of these guidelines at a London teaching hospital. A retrospective case note audit of 59 episodes of acute spontaneous pneumothorax was performed. In patients undergoing intervention, the initial procedure was simple aspiration in 32 (73%) and chest tube insertion in 12 (27%) cases, contrasting with the BTS recommendation that aspiration should be attempted first in all such patients. Simple aspiration was successful on 34% of occasions. Successful aspiration was associated with a significantly shorter hospital stay (median 3, range 1–11 days) than either failed aspiration (7, 3–66 days; p=0.003) or chest tube insertion without aspiration (9, 3–16 days; p=0.005). Other areas where practice differed from the BTS guidelines were clamping of chest tubes and use of a pursestring suture for wound closure. A follow up questionnaire survey suggested a lack of familiarity with the guidelines. These findings indicate that current management of spontaneous pneumothorax deviates from the BTS guidelines in a number of potentially important respects. Attention should be directed to improving awareness of and access to clinical guidelines.

Pneumothorax is a common clinical problem, with an estimated incidence of 11.1 per 100 000 each year for emergency hospital admissions in a recent survey.[1] Spontaneous pneumothorax, in contrast to iatrogenic and traumatic pneumothorax, occurs without any precipitating event. Primary spontaneous pneumothorax, seen in otherwise healthy individuals, is rarely life threatening but does have significant economic impact. Secondary spontaneous pneumothorax, in patients with underlying lung disease and limited pulmonary reserve, is a more serious condition that can be associated with substantial mortality.[2 3]

Therapeutic options available for the management of spontaneous pneumothorax include observation without intervention, supplemental oxygen, simple aspiration, intercostal tube drainage, and various surgical procedures. Controversy exists regarding the most appropriate choice of management in a given clinical situation.[4 5] In 1993, the British Thoracic Society (BTS) issued national guidelines for the management of spontaneous pneumothorax.[6] A conservative approach was strongly favoured, with emphasis on observation without intervention in selected patients, and on aspiration as a technique that is simple, effective, and acceptable to patients. Aspiration was recommended as an initial procedure in all cases of spontaneous pneumothorax where intervention is considered necessary, irrespective of the size of pneumothorax, number of previous episodes, or whether the condition is considered primary or secondary.

In this study, we asked how closely the BTS guidelines were being followed at a London teaching hospital. To address this, we identified a group of patients who had received a diagnostic coding for acute spontaneous pneumothorax, and retrospectively compared their actual management with that recommended in the BTS guidelines. We also conducted a questionnaire survey among medical staff with responsibility for acute medical admissions to assess their awareness of the guidelines.

METHODS

Case note review

Patients seen at Guy's Hospital between 1995 and 1998 with acute spontaneous pneumothorax were identified from ward discharges using the Casemix program and the *International Classification of Diseases*, 10th revision, diagnostic code J93.8, and from accident and emergency (A&E) department computer records via a "pneumothorax" word search. The case notes (but not chest radiographs) of these patients were retrieved. Information was collected regarding their clinical characteristics, presentation, management, length of hospital stay, and follow up arrangements. Cases were rejected if the notes could not be located despite searching on two occasions, or when inspection of the notes revealed a diagnosis other then acute spontaneous pneumothorax (for example, patients electively admitted for surgical procedures or transferred from other hospitals).

Questionnaire survey

A questionnaire was sent to all consultant physicians, A&E consultants, and senior and specialist registrars in A&E and general medicine at Guy's Hospital with responsibility for emergency medical admissions. They were first asked to state whether or not they were aware that the BTS had produced guidelines on the management of spontaneous pneumothorax. They were then presented with three clinical scenarios concerning patients with acute spontaneous pneumothorax and breathlessness, and asked what initial management they would advise. The cases were: a 20 year old man with a small spontaneous pneumothorax; a 20 year old man with a large spontaneous pneumothorax; and a 60 year old man with a moderate sized spontaneous pneumothorax and associated chronic obstructive pulmonary disease (COPD). Finally, they were asked for any additional comments or suggestions. Replies were accepted if received within four weeks. Non-responders were not contacted.

Statistical analysis

Data are shown as median (range). Contingency table analysis was performed with the χ^2 and Fisher's exact tests, and

Abbreviations: A&E, accident and emergency; BTS, British Thoracic Society; COPD, chronic obstructive pulmonary disease

Table 1 Patient characteristics

	Primary spontaneous pneumothorax	Secondary spontaneous pneumothorax
No of episodes	45	14
No of patients	42	12
Median (range) age (years)	28 (14–59)	*57 (23–75)
Male/female	38/7	9/5
History of cigarette smoking		
Yes (current/ex)	29	10
No	9	1
NR	7	3
Symptoms (%)		
Breathlessness	33 (73)	11 (79)
Chest pain	44 (98)	*10 (71)
Cough	8 (18)	*7 (50)
Duration of symptoms (%)		
≤24 hours	24 (53)	6 (43)
>24 hours	7 (16)	3 (21)
NR	14 (31)	5 (36)
History of previous spontaneous pneumothorax (%)	21 (47)	8 (57)
†Ipsilateral	14	7
†Contralateral	5	1
NR	4	0

Data are expressed per episode.
*p<0.05 compared to primary spontaneous pneumothorax; see text for details.
†In two patients with primary spontaneous pneumothorax, there was a history of a previous ipsilateral and previous contralateral episode.
NR: information not recorded.

Table 2 Initial management of spontaneous pneumothorax

	Outpatient observation	Inpatient observation	Simple aspiration	Chest tube
Primary (%) (n=45)	12 (27)	1 (2)	25 (56)	7 (16)
Secondary (%) (n=14)	0	2 (14)	7 (50)	5 (36)
Total (%) (n=59)	12 (20)	3 (5)	32 (54)	12 (20)

between group comparisons with the Kruskal-Wallis and Mann-Whitney U tests. Data were analysed using StatView 4.02 for Macintosh (Abacus Concepts, Berkeley, CA, USA). A p value <0.05 was regarded as statistically significant.

RESULTS

Case note review

Patients

Forty five episodes of spontaneous pneumothorax occurred in 42 patients (35 male) without known underlying lung disease, and were therefore categorised as primary disease. Four of these patients were current smokers aged >50 years and so may have had COPD, but no formal diagnosis had been made. A further 14 episodes of spontaneous pneumothorax were identified in 12 patients (eight male) who did have underlying lung disease. The relevant diagnoses were: COPD (n = 8), asthma (n = 1), sarcoidosis (n = 1), lung cancer and associated pulmonary fibrosis (n = 1), and uncharacterised bullous disease (n = 1). Clinical details of the patients in the two groups are summarised in table 1. Patients with secondary spontaneous pneumothorax were significantly older than those with primary disease (p<0.001). Chest pain was significantly less common (p<0.01) and cough significantly more common (p=0.03) in secondary than primary spontaneous pneumothorax.

Initial management

Thirteen cases of primary spontaneous pneumothorax, all with either small (n = 12) or medium (n = 1) pneumothoraces, were managed by observation without specific intervention (table 2). No patient with secondary disease was managed by outpatient observation, but two patients, both with small pneumothoraces, were observed as inpatients. Overall, simple aspiration was the initial procedure in 73% of cases undergoing therapeutic intervention. The frequency of aspiration was higher in primary (78%) than secondary (58%), but this difference did not reach statistical significance (p=0.26).

The relation between initial intervention and size of pneumothorax is shown in table 3. For primary spontaneous pneumothorax, the frequency of simple aspiration was slightly higher in patients with small (86%) rather than medium (75%) or large (75%) pneumothoraces, but the difference between groups was not significant (χ^2 = 0.34, p=0.84). The number of cases of secondary spontaneous pneumothorax was too small to allow statistical analysis.

Information regarding the grade and specialty of the persons performing therapeutic interventions, and whether these procedures were supervised, was rarely recorded and is therefore not presented.

Success of simple aspiration

Aspiration was considered successful when a repeat chest radiograph showed no or minimal residual air in the pleural space. Repeated attempts at aspiration were recorded on nine occasions. When aspiration was unsuccessful, patients were managed by subsequent chest tube insertion.

The success of aspiration, and its relation to size of pneumothorax, is shown in table 4. The overall success rate was 34%, with no significant difference between primary and secondary spontaneous pneumothorax (p = 0.67). In primary spontaneous pneumothorax, there was a progressive increase

Table 3 Relationship between size of pneumothorax and initial intervention

Size of pneumothorax	Primary		Secondary		All	
	Aspiration	Chest tube	Aspiration	Chest tube	Aspiration	Chest tube
All (%)	25 (78)	7 (22)	7 (58)	5 (42)	32 (73)	12 (27)
Small (%)	6 (86)	1 (14)	2 (67)	1 (33)	8 (80)	2 (20)
Medium (%)	3 (75)	1 (25)	1 (100)	0	4 (80)	1 (20)
Large (%)	12 (75)	4 (25)	3 (50)	3 (50)	15 (68)	7 (32)
*Not known	4	1	1	1	5	2

*Cases where the size of the pneumothorax could not be reliably established from the case notes.

Table 4 Success of simple aspiration, and relation to size of pneumothorax

Size of pneumothorax	Primary		Secondary		All	
	Success	Failure	Success	Failure	Success	Failure
All (%)	8 (32)	17 (68)	3 (43)	4 (57)	11 (34)	21 (66)
Small (%)	4 (67)	2 (33)	1 (50)	1 (50)	5 (63)	3 (38)
Medium (%)	1 (33)	2 (67)	0	1 (100)	1 (25)	3 (75)
Large (%)	3 (25)	9 (75)	1 (33)	2 (67)	4 (27)	11 (73)

Size of pneumothorax could not be established in four cases of primary and one of secondary spontaneous pneumothorax.

in the failure rate of aspiration in cases of small (33%), medium (67%), and large (75%) pneumothorax, but the differences between groups were not significant ($\chi^2 = 2.98$, $p = 0.23$). There were too few cases of secondary spontaneous pneumothorax to allow statistical analysis. For all cases together, there was a trend for aspiration to be more successful with small compared with medium plus large pneumothoraces ($p = 0.10$).

Further management

Tube thoracostomy was unsuccessful on 11 of 33 (33%) occasions, six performed for treatment of primary and five for secondary spontaneous pneumothorax. These patients were referred to the thoracic surgeons, and underwent pleural procedures of various sorts during the same admission. Seven of the cases in which intercostal drainage failed had been managed initially by simple aspiration that had also been unsuccessful. Documented complications relating to chest tubes included infection (n = 2), bleeding (n = 1), and pain (n = 4). Clamping of chest tubes appeared infrequent, as this was recorded on only three occasions. A pursestring suture was used in 13 of the 33 cases where a chest drain was inserted; in the remainder, the method of wound closure was not specified.

Considering all patients with spontaneous pneumothorax together, successful aspiration was associated with a significantly shorter hospital stay (median 3, range 1–11 days) than either failed aspiration (7, 3–66 days; p=0.003) or chest tube insertion without aspiration (9, 3–16 days; p=0.005). Follow up arrangements were recorded for all patients managed by outpatient observation and >90% of those admitted, but appointments were frequently later than the recommended 7–10 day interval.

Questionnaire survey

The response rates were 43% (six of 14 questionnaires returned) for consultants, and nearly 77% (10 of 13) for the specialist and senior registrar group.

All consultants, and all but two of the specialist/senior registrars, stated that they were aware of the existence of the BTS guidelines. Responses to the questions involving clinical cases are shown in table 5. For the 20 year old male with a small spontaneous pneumothorax, replies were evenly divided between aspiration and observation alone as the initial management of choice. No respondent suggested immediate chest tube insertion for this patient. For both the other cases—the 20 year old man with a large pneumothorax and the 60 year old man with COPD—a majority of the replies (63% and 67%, respectively) recommended that the initial management should be chest tube insertion. The overall pattern of responses to all three questions was similar between consultants and registrars. Observation rather than aspiration was recommended more frequently by doctors in the A&E department than general physicians for the first patient with the small pneumothorax, although the number of replies was too small to draw definite conclusions.

Many respondents, mostly from the senior and specialist registrar group, indicated that they would welcome further information. Specific suggestions for improving their knowledge included ensuring that guidelines were available on the hospital "intranet", included in the junior doctors' handbook,

Table 5 Results of questionnaire survey. Data shown are number of responses (%)

	Observation	Simple aspiration	Chest tube insertion
Q1. A 20 year old man with a small pneumothorax			
All	7 (47)	8 (53)	0
Consultants	2 (40)	3 (60)	0
SRs/SpRs	5 (50)	5 (50)	0
†General medicine	2 (20)	8 (80)	0
†A&E	3 (100)	0	0
Q2. A 20 year old man with a large pneumothorax			
All	0	6 (38)	10 (63)
Consultants	0	2 (33)	4 (67)
SRs/SpRs	0	4 (40)	6 (60)
†General medicine	0	4 (40)	6 (60)
†A&E	0	1 (33)	2 (67)
Q3. A 60 year old man with a moderate pneumothorax and COPD			
All	0	5 (33)	10 (67)
Consultants	0	2 (33)	4 (67)
*SRs/SpRs	0	3 (33)	6 (67)
†General medicine	0	3 (30)	7 (70)
†A&E	0	1 (50)	1 (50)

SR/SpR: senior and specialist registrars.
*One reply in these two groups was excluded from analysis as the response was ambiguous with regard to preferred choice of management.
†Three respondents did not state their specialty (but did indicate their grade), and were therefore excluded from analysis.

and clearly displayed in the A&E department. The specialist registrar training programmes were mentioned as valuable opportunities to disseminate guidelines and audit findings.

DISCUSSION

In this study, we compared current management of spontaneous pneumothorax with that recommended in the 1993 BTS guidelines. We were particularly interested in the relative use of simple aspiration and chest tube insertion as initial interventions. Overall, aspiration was performed in 73% of episodes judged to require intervention, contrasting with the BTS recommendation that aspiration should be the initial management for all such patients. Use of a pursestring suture for wound closure appeared to be widespread, although it is recognised that this can lead to a poor cosmetic outcome. Finally, clamping of drains occurred, albeit in a minority of cases, despite the frequently stated advice that this practice is potentially hazardous.[7–9]

We could not establish a clear relation between either the presence of underlying lung disease or the size of pneumothorax and the choice of aspiration or chest tube insertion. However, the size of the study sample, particularly in the case of secondary spontaneous pneumothorax, means that such a relationship cannot be excluded. The frequency of successful aspiration in this study (34% for all cases of spontaneous pneumothorax) was lower than in previous prospective studies, which have reported figures in the range 44%–80%.[10–19] The reason for this lower success rate is uncertain. Possible factors include differences in the study populations, particularly with regard to the proportion of patients with chronic lung disease, and the relatively infrequent use of repeated aspiration in the present study.

Our findings are of relevance when considering the impact of spontaneous pneumothorax on healthcare resources. Twelve patients—27% of the total number who were considered to require intervention—received chest tube insertion without prior attempt at aspiration. It is likely that a proportion of these cases (perhaps 35%–40% based on the success rates of simple aspiration in primary and secondary spontaneous pneumothorax) could have been managed adequately by aspiration alone. This would have reduced occupancy of inpatient beds, and would also have avoided the trauma and complications that are associated with intercostal tube insertion.

Several previous reports have analysed the management of spontaneous pneumothorax in the UK. In an audit of spontaneous pneumothorax management at an Edinburgh teaching hospital between 1990 and 1991, Selby and Sudlow identified a number of deficiencies, including over-reliance on intercostal tube drainage, drain clamping, and incomplete follow up.[20] That study was performed before publication of the BTS guidelines, but more recent reports have produced similar findings. Courtney and McKane, for example, audited spontaneous pneumothorax management in a district general hospital in Northern Ireland between 1994 and 1996.[21] Aspiration was attempted in only seven of 65 (11%) cases and was successful in just two. Soulsby recorded a higher rate of aspiration (37%) in a survey of patients with spontaneous pneumothorax attending an A&E department in Liverpool during the period 1993–98, although overall only about 20% of episodes were treated correctly according to BTS guidelines.[22] Compared with these earlier studies, the use of simple aspiration was substantially greater in our study, perhaps reflecting the longer interval since publication of the guidelines and the teaching hospital setting.

The questionnaire survey revealed a greater level of divergence from the BTS guidelines than the case note review. In particular, only a minority of respondents suggested aspiration as the initial management of either the young man with a large pneumothorax or the older patient with COPD. Consistent findings have been reported by other investigators. Yeoh *et al* conducted a postal survey among consultant physicians and A&E consultants in Wales, and reported a lack of confidence in simple aspiration as a treatment for a secondary or large primary spontaneous pneumothorax.[23] Another survey of respiratory physicians and thoracic surgeons in the United States identified wide variation in many aspects of pneumothorax treatment, with aspiration favoured by a minority of respondents for both primary and secondary spontaneous pneumothorax.[24] We did not collect information from doctors more junior than registrars, although these are probably responsible for decision making in a proportion of cases.

Several factors might explain the deviation from the BTS guidelines in addition to simple lack of awareness of or access to them. Some doctors may be unfamiliar with the technique of simple aspiration, or may prefer chest tube insertion as they wish to gain experience in performing this procedure. There may also be a perception that aspiration is futile, particularly for patients with large or secondary pneumothoraces. Another possibility is that doctors are aware of the BTS recommendations, but choose not to follow them. Appropriate management of patients with spontaneous pneumothorax is a subject of continuing debate, and a particular criticism of the BTS guidelines was their failure to document the diversity of opinion.[25] The questionnaire did not directly inquire about disagreement with the BTS guidelines, however, and no respondent specifically mentioned this issue.

In conclusion, this study has identified several areas where current management of spontaneous pneumothorax deviates from the BTS guidelines, and shown that this is associated with an apparent lack of familiarity with these guidelines. Taken together, these findings emphasise the need to improve access to information. There has been a steady rise in the number of clinical guidelines in recent years, a trend that seems likely to continue, and a revised version of the BTS pneumothorax guidelines is now in preparation. For guidelines to be widely adopted, they must be simple and pragmatic, but also authoritative and evidence based.[26] The number of randomised controlled trials evaluating different management options for spontaneous pneumothorax is surprisingly small. More prospective studies are required to formulate best practice recommendations.

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REFERENCES

1 **Gupta D**, Hansell A, Nichols T, *et al*. Epidemiology of pneumothorax in England. *Thorax* 2000;**55**:666–71.
2 **Shields TW**, Oilschlager GA. Spontaneous pneumothorax in patients 40 years of age and older. *Ann Thorac Surg* 1966;**2**:377–83.
3 **Dines DE**, Clagett OT, Payne WS. Spontaneous pneumothorax in emphysema. *Mayo Clin Proc* 1970;**45**:481–7.
4 **Light RW**. Management of spontaneous pneumothorax. *Am Rev Respir Dis* 1993;**148**:245–8.
5 **Baumann MH**, Strange C. Treatment of spontaneous pneumothorax: a more aggressive approach? *Chest* 1997;**112**:789–804.
6 **Miller AC**, Harvey JE. Guidelines for the management of spontaneous pneumothorax. *BMJ* 1993;**307**:114–6.
7 **Harriss DR**, Graham TR. Management of intercostal drains. *Br J Hosp Med* 1991;**45**:383–6.
8 **Hyde J**, Sykes T, Graham T. Reducing morbidity from chest drains. *BMJ* 1997;**314**:914–5.
9 **Tomlinson MA**, Treasure T. Insertion of a chest drain: how to do it. *Br J Hosp Med* 1997;**58**:248–52.
10 **Raja OG**, Lalor AJ. Simple aspiration of spontaneous pneumothorax. *Br J Dis Chest* 1981;**75**:207–8.
11 **Bevelaqua FA**, Aranda C. Management of spontaneous pneumothorax with small lumen catheter manual aspiration. *Chest* 1982;**81**:693–4.

12 **Hamilton AAD**, Archer GJ. Treatment of pneumothorax by simple aspiration. *Thorax* 1983;**38**:934–6.
13 **Archer GJ**, Hamilton AAD, Upadhyay R, *et al*. Results of simple aspiration of pneumothoraces. *Br J Dis Chest* 1985;**79**:177–82.
14 **Vallee P**, Sullivan M, Richardson H, *et al*. Sequential treatment of a simple pneumothorax. *Ann Emerg Med* 1988;**17**:936–42.
15 **Delius RE**, Obeid FN, Horst HM, *et al*. Catheter aspiration for simple pneumothorax: experience with 114 patients. *Arch Surg* 1989;**124**:833–6.
16 **Markos J**, McGonigle P, Phillips MJ. Pneumothorax: treatment by small-lumen catheter aspiration. *Aust N Z J Med* 1990;**20**:775–81.
17 **Seaton D**, Yoganathan K, Coady T, *et al*. Spontaneous pneumothorax: marker gas technique for predicting outcome of manual aspiration. *BMJ* 1991;**302**:262–5.
18 **Harvey J**, Prescott RJ. Simple aspiration versus intercostal tube drainage for spontaneous pneumothorax in patients with normal lungs. *BMJ* 1994;**309**:1338–9.
19 **Ng AWK**, Chan KW, Lee SK. Simple aspiration of pneumothorax. *Singapore Med J* 1994;**35**:50–2.
20 **Selby CD**, Sudlow MF. Deficiencies of management of spontaneous pneumothorax. *Scott Med J* 1994;**39**:75–6.
21 **Courtney PA**, McKane WR. Audit of the management of spontaneous pneumothorax. *Ulster Med J* 1998;**67**:41–3.
22 **Soulsby T**. British Thoracic Society guidelines for the management of spontaneous pneumothorax: do we comply with them and do they work? *J Accid Emerg Med* 1998;**15**:317–21.
23 **Yeoh JH**, Ansari S, Campbell IA. Management of spontaneous pneumothorax—a Welsh survey. *Postgrad Med J* 2000;**76**:496–500.
24 **Baumann MH**, Strange C. The clinician's perspective on pneumothorax management. *Chest* 1997;**112**:822–8.
25 **Baumann MH**, Strange C. [Communications to the editor]. *Chest* 1998;**113**:1424–5.
26 **Jackson R**, Feder G. Guidelines for clinical guidelines. *BMJ* 1998;**317**:427–8.