ORIGINAL ARTICLE

A Survey on the Initial Management of Spontaneous Pneumothorax

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SUMMARY

Spontaneous pneumothorax (SP) is a common medical condition but continues to be a frequent management problem among doctors. Despite the availability of guidelines on management of SP, studies have shown that the compliance with the guidelines is low. The various treatment options available in treating this condition further confuse doctors on the right approach in managing SP. The objective of this study is to investigate the awareness of the availability of these existing guidelines and to investigate how the doctors involved in the initial management of SP would manage this condition. A self completed questionnaire which included three case scenarios were distributed among doctors in two teaching university hospitals and two large Ministry of Health hospitals. This study showed that there is a lack of awareness of the existing guidelines even among the senior doctors and there is a variation in the initial management of SP. Therefore a locally produced guideline may be beneficial to standardise and improve the management of SP.

KEY WORDS:
Spontaneous pneumothorax, Management, Guideline, Aspiration

INTRODUCTION

Spontaneous pneumothorax (SP) is a common clinical condition which requires immediate evaluation and management. The estimate incidence is 18-28/100,000 for males and 1.2-6 per 100,000 for females in the western countries. A district general hospital in United Kingdom serving a population of 200,000 would expect to treat 25 pneumothoraces a year [1,2]. However the data on the prevalence of SP in Malaysia and the Asian Pacific region is lacking.

The immediate management of this condition depends on several factors including the degree of symptoms, the presence of underlying lung pathology and the size of the pneumothorax. Primary spontaneous pneumothorax (PSP) occurs in otherwise healthy young adults who may present with a large pneumothorax but experience minimal symptoms. The mortality rate is low in PSP where the mortality rate was reported to be 0.09% for men and 0.06% or women in patients aged 15-34 years[1]. In contrast, secondary spontaneous pneumothorax (SSP) occurs in older population with coexisting chronic lung disease like chronic obstructive pulmonary disease (COPD), where even a small pneumothorax can be life threatening in view of the underlying significant airflow obstruction and air trapping[3]. Mortality in SSP patients aged 55 years or older is 1.8% in men and 3.3% in women[1]. COPD related SSP reported mortality rates vary from 1% to 17% [4,5].

The goal of treatment in SP is to eliminate the intrapleural air collection, thus allowing re-expansion of the collapsed lung and improvement of symptoms. The therapeutic options available in the initial management of spontaneous pneumothorax include (1) observation without intervention (2) simple aspiration and (3) insertion of chest tube into the pleural cavity.

Several guidelines have been developed to assist doctors in the management of pneumothorax. The two most widely available are from the British Thoracic Society (BTS) Guidelines [6,7] and the American College of Chest Physicians Delphi Consensus Statement (ACCPDCS) [8]. Despite the availability of these guidelines, studies have shown that compliance with the guidelines remains low [9-12].

In Malaysia, SP are primarily managed by physicians and doctors in the emergency department. At present, there are no current national guidelines on the management of SP. The adoption of these international guidelines such as the BTS and ACCP guidelines into the local practice have to be done cautiously as there are differences in the facilities available in the health centers, the availability of cardiothoracic surgeons and the distance to the nearest health centre. The patients' expectations and understanding may also differ.

The objectives of this study are to investigate the awareness of doctors of the availability of existing international guidelines and treatment choices adopted in the initial management of SP in various hospitals in Malaysia.

MATERIALS AND METHODS

A self completed questionnaire was distributed among doctors in two teaching university hospitals and two large Ministry of Health hospitals namely Hospital Selayang, Universiti Kebangsaan Malaysia Medical Centre, Hospital Tengku Ampuan Afzan, Kuantan and Hospital Universiti Sains Malaysia. The doctors invited to participate included

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medical officers, non respiratory specialists and consultants who are actively involved in the management of spontaneous pneumothoraces between 2007-2009. Housemen were excluded from the study. The respondents were asked on their medical grades, awareness of existing pneumothorax guidelines, method used to describe or estimate the size of pneumothorax and three common case scenarios to assess their management strategies based on their current knowledge. Only questionnaires that were returned within one week of distribution were included in this study. It was emphasized to the participants that reference to texts and persons were not allowed at time of completion of questionnaire.

The three case scenarios were:
1. A 40-year-old gentleman with a large primary spontaneous pneumothorax with symptoms on exertion.
2. A 28-year-old gentleman with a small primary spontaneous pneumothorax without symptoms.
3. A 73 year-old gentleman with underlying COPD with a tension spontaneous pneumothorax.

For each case scenario, several management options were given-
a) Send the patient home with advice and return for repeat CXR
b) Needle aspiration (simple aspiration)
c) Insert branula at the 2nd intercostal space before chest tube drainage
d) Chest tube drainage

The original questionnaire is available on request from the author.

RESULTS

A total of 177 questionnaires were distributed among the doctors in the four hospitals who managed spontaneous pneumothoraces on a regular basis. 148 questionnaires were returned within a week giving a response rate of 83.6%. 21 questionnaires answered by housemen were excluded giving a total of 127 questionnaires included in this study. Based on the respondents medical grades, 125 (85%) were medical officers and 22 (15%) were non respiratory specialists and consultants.

Awareness of existing guidelines

Table I shows the awareness of existing guidelines in the management of SP. Only 61% of medical officers and 72.7% of specialists/consultants were aware of any existing guidelines in the management of SP.

Estimation of size of pneumothorax

Forty nine (39%) subjects described the size of pneumothorax by percentages, 39 (31%) by small/medium/large, 22 (17%) gave mixed or other descriptions, 11(9%) by centimeters, 2 (1%) by fraction e.g. 1/3, and there was no answer in 4 (3%) in each of the 3 case scenarios (Fig 1).

Initial management of pneumothoraces

Case scenario 1

This case scenario described a 40-year-old gentleman with a PSP and exertional breathlessness. Table II shows the majority of medical officers (60.9%) and specialists/consultants (59%) opted for a chest drain insertion with or without prior insertion of branula into the 2nd intercostal space. Only 38.1% of medical officers and 40.9% of specialists would perform a needle aspiration for the initial management for this case scenario. Overall the majority of respondents (60.6%) chose to put a chest drain with 18.1% would insert a branula first before putting a chest drain and only 38.6% would perform needle aspiration as the initial management in this case.

According to the British Thoracic Society (BTS) guidelines[7], simple aspiration is recommended for all PSP requiring intervention as the success rate in re-expansion of the lung in PSP has been shown to be between 59-83%[13,14]. However, the ACCPDCS[8] found simple aspiration to be rarely appropriate in the management of stable PSP.

Case scenario 2

This case scenario described a 28-year-old gentleman with asymptomatic small PSP. Table III shows that the majority of medical officers (65.3%) and specialists/consultants (61.9%) were happy to send the patient home. Overall 64.8% of the respondents would have discharged the patient home with advice and return for a repeat CXR. The remaining respondents felt that action was required to resolve the pneumothorax with 34 respondents (27.2%) opted for attempted needle aspiration and the remaining 10 respondents (8%) opted for insertion of a chest drain with or without inserting a branula first.

Both the BTS and the ACCPDCS guidelines recommend observation as the treatment of choice for small asymptomatic PSP where patients may be discharged with careful instructions and early clinic review.

Case scenario 3

This case scenario described an elderly 73 year old patient with COPD with a tension pneumothorax. Table IV shows that the majority of respondents (97.6%) would have inserted a chest drain as the first line treatment strategy. Sixty four (50.4%) of the respondents would have inserted a branula in the 2nd intercostal space prior to insertion of functioning chest drain.

Tension pneumothorax in a patient with underlying chronic lung disease requires urgent action as it may lead to a life threatening situation. The BTS guidelines recommends prompt insertion of a cannula of adequate length into the 2nd intercostal space in the mid clavicular line of the affected site until a functioning chest drain can be placed in. The ACCPDCS guidelines suggest immediate chest drain insertion in all unstable secondary pneumothoraces.

Table I: Awareness of existing guidelines on the management of pneumothorax

	Yes	No
Medical officer n=105	64 (61.0%)	41 (39.0%)
Specialist/Consultants n=22	16 (72.7%)	6 (27.3%)
Total n=127	80 (63.0%)	47 (37.0%)

Table II: Initial management of 40-year-old gentleman with symptomatic large primary spontaneous pneumothorax according to status of respondents

	Send patient home with advice and return for repeat CXR (%)	Needle aspiration (%)	Insert branula at the 2nd ICS before chest tube drainage (%)	Chest tube drainage (%)
Medical Officers n=105	1 (1.0)	40 (38.1)	18 (17.1)	46 (43.8)
Specialists/Consultants n=22	0 (0.0)	9 (40.9)	5(22.7)	8 (36.3)
Total n=127	1 (0.8)	49 (38.6)	23 (18.1)	54 (42.5)

Table III: Initial management of 28-year-old gentleman with asymptomatic small primary spontaneous pneumothorax according to status of respondents

	Send patient home with advice and return for repeat CXR (%)	Needle aspiration (%)	Insert branula at the 2nd ICS before chest tube drainage (%)	Chest tube drainage (%)
Medical Officers n=104*	68 (65.3)	27 (26.0)	3 (2.9)	6 (5.8)
Specialists/Consultants n=21*	13 (61.9)	7 (33.3)	0 (0.0)	1 (4.8)
Total n= 125	81 (64.8)	34 (27.2)	3 (2.4)	(5.6)

*1 missing answer

Table IV: Initial management of 73 year-old gentleman with COPD with a tension spontaneous pneumothorax

	Needle aspiration (%)	Insert branula at the 2nd ICS before chest tube	Chest tube drainage (%)
Medical Officers n= 105	3 (2.9)	53 (50.4)	49 (46.7)
Specialists/Consultants n=22	0 (0.0)	11 (50.0)	11 (50.0)
Total n= 127	3 (2.4)	64 (50.4)	60 (47.2)

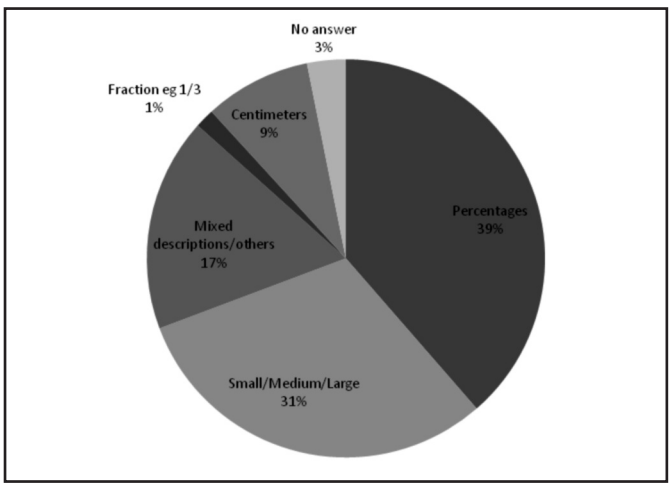

Fig. 1: Description of the size of pneumothorax.

DISCUSSION

This study showed there was a variation in the knowledge of existing international guidelines and management of SP among doctors in the four hospitals surveyed. Many of the doctors were still unaware of the existing guidelines in the management of SP despite being a common condition encountered in the hospital setting. This may reflect poor adoption of evidence based practice or issues regarding the lack of dissemination and education of the guidelines.

The diagnosis of pneumothorax is often established by CXR. There were obvious discrepancies in describing the size of the pneumothorax which could have clinical implications in the management of the patient. With a standard chest radiograph, various ways were used to describe the size of pneumothorax which can lead to confusion in interpretation among doctors managing the same patient. The estimation of the size of pneumothorax is frequently inaccurate and usually underestimates the true size[15,16]. This would in turn, have clinical implications on the management of this condition. The volume of the pneumothorax approximates to the ratio of the cube of the lung diameter to the hemithorax diameter. For example, if the lung marking is 2.5cm from the lateral chest wall on the PA chest radiograph, it will occupy about 50% of the hemithorax volume if the lung is 9.5cm in diameter and the hemithorax is 12cm in diameter: $(12^3 - 9.5^3)/12^3 = 50\%$.

Both the ACCPDCS and BTS guidelines use the combination of patient's clinical status and size of pneumothorax to direct

management options. The BTS guidelines suggests a practical approach and divides the size of pneumothorax into "small" when the lung surface to the chest wall is < 2cm and "large" if the lung surface to the chest wall is ≥ 2 cm. The ACCPDCS however uses the apex to cupola distance: a small pneumothorax is less than 3 cm in collapse and a large pneumothorax ≥ 3cm in collapse. Both guidelines do not use percentages of collapse to describe the size or pneumothorax or to direct therapy.

Computed tomography of the thorax will provide a more accurate estimation of the size of the collapsed lung but the routine use of CT scanning is not recommended because it does not change the clinical management of the patient unless in difficult cases such as to differentiate pneumothorax from a suspected bulla, difficulty in inserting chest drain in loculated pneumothorax or if the lungs are obscured from significant subcutaneous emphysema [17-19].

The management of pneumothorax depends on severity of symptoms, the size of pneumothorax, type of pneumothorax and whether an air leak is likely to be present. The choice of method for the initial treatment of a PSP remains controversial [20,21]. Only 38.6% of respondents would attempt simple aspiration to treat the pneumothorax in an otherwise fit middle- aged patient who is only symptomatic on exertion. This is out of line with the BTS guidelines which recommends simple aspiration as the first line treatment for all PSP requiring intervention. The ACCPDCS however found simple aspiration to be rarely appropriate in the management of stable PSP and chest drain insertion was recommended as the preferred intervention. The ACCPDCS only recommends simple aspiration in PSP patients who have failed observation (initially stable with a small pneumothorax).

There is a lack of randomised controlled trials in this area and the studies had limitations because they were underpowered [22]. However the current available evidence suggests that simple aspiration provides certain advantages in the initial management of PSP compared to chest drain insertion because of the potential to immediately discharge patients, a shorter duration of hospitalisation which has cost saving benefits, less invasive with lower complication rate in inexperienced hands and patients requiring less analgesics [11,22-26].

The success rates with simple aspiration have been shown to be high although a larger size of pneumothorax seems to be associated with increased likelihood of failure. Studies have also shown no difference in recurrence rates at two years compared to chest tube drainage [14,22]. Therefore doctors should be encouraged to attempt simple aspiration as the initial management of all PSP. However, simple aspiration is less likely to be successful in SSP (33-67%) compared to PSP (59-83%) [13,14] and in the BTS guidelines it is only recommended as an initial treatment in small < 2cm pneumothoraces in minimally breathless patients under the age of 50 years old. The BTS recommends that patients with SPS treated successfully with simple aspiration should be observed at least 24 hours in hospital before discharged.

The majority of respondents (64.8%) would discharge an asymptomatic young adult with a small spontaneous pneumothorax. Given the low mortality rate with PSP, observation is a reasonable option because pleural air absorption occurs with time. Both guidelines recommend observation as the treatment of choice in small PSP without significant breathlessness and the patient can be considered to be discharged with advice and early outpatient review. The patients must be advised on what symptoms to look for and have rapid access to medical care if required [27,28]. With the usual bed constraints in most hospitals this policy would be helpful and may be preferable to the patients. Both the ACCPDCS and BTS guidelines recommend that clinically stable SSP patients with small pneumothorax should be admitted to hospital if observation is the choice of management.

If a patient with a pneumothorax is admitted overnight for observation, supplemental high flow oxygen (10 litres/min)[7] should be given to increase the pressure gradient between the pleural capillaries and the pleural cavity. This gradient increases the absorption of pleural nitrogen preferentially followed by other gases in the space. The rate of pleural air absorption without oxygen supplementation is about 1.25% per day of the involved hemithorax, therefore a 25% pneumothorax takes about three weeks to reabsorb and supplementary oxygen has been shown to result in a three to four fold increase in the rate of reabsorption of air from the pleural cavity[29]. Nevertheless, this should be done cautiously in patients with COPD who may be sensitive to higher concentrations of oxygen.

Tension pneumothorax requires immediate intervention with a functioning chest tube as it is a life threatening condition and the BTS guidelines recommends a cannula of adequate length to be inserted into the second intercostal space in the mid clavicular line prior to the insertion of chest tube.

Both ACCPDCS and BTS guidelines recommend small sized chest tubes in the management of SP. The ACCPDCS recommends 14F to 22F size or smaller chest tubes in PSP patients with large pneumothorax and stable SSP without risk for large air leaks. In clinically unstable SSP and unstable PSP patients with large pneumothoraces at risk of large bronchopleural fistula with large air leak or requires positive pressure ventilation, a larger 24F-28F chest tube may be used. The BTS does not recommend the use of large (20F to 24F) chest tubes as there is no evidence that larger tubes are better than small tubes (10F to 14F) in the management of SP[30-32]. However, the replacement of a smaller chest tube to a larger chest tube may be necessary if there is a persistent air leak which exceeds the capacity of the smaller tubes.

There are limitations in our study. Our study was performed in four major healthcare centres with adequate facilities and expertise to manage SP and the approach to managing these conditions may be different in smaller or district hospitals. Therefore, the results may not represent other centres in Malaysia. We also did not explore the background experience of individual doctors treating SP which may have an impact on the results. Nevertheless, due to limitation of data available on management of pneumothorax in Malaysia and the rest of Asia Pacific, the results can be utilized as a stepping stone for further studies.

In conclusion, despite the availability of international guidelines, there is a variation in the management of spontaneous pneumothorax. There is variation in awareness of the existence of such guidelines, resulting in inconsistency of management of common pneumothorax presentations. Therefore a locally produced guideline that takes into account local factors such as the accessibility to the nearest hospital, facilities available in the health centers and the availability of experienced staff would be necessary to guide doctors as SP continues to be a frequent management problem.

REFERENCES

1. Gupta D, Hansell A, Nichols T, *et al*. Epidemiology of pneumothorax in England. Thorax 2000; 55: 666-71.
2. Melton LJ, Hepper NCG, Offord KP. Incidence of spontaneous pneumothorax in Olmsted County, Minnesota: 1950–1974. Am Rev Respir Dis 1979; 29: 1379-82.
3. Light RW. Management of spontaneous pneumothorax. Am Rev Resp Dis 1993; 148: 245-8.
4. Shields TW, Oilschlager GA. Spontaneous pneumothorax in patients 40 years of age and older. Ann Thorac Surg 1966; 2: 377-83.
5. Dines DE, Clagett OT, Payne WS. Spontaneous pneumothorax in emphysema. Mayo Clin Proc 1970; 45: 481-7.
6. Miller AC, Harvey JE. Guidelines for the management of spontaneous pneumothorax. BMJ 1993; 307: 114-6.
7. Henry H, Arnold T, Harvey J. BTS guidelines for the management of spontaneous pneumothorax. Thorax 2003; 58: Suppl. 2 ii39–ii58.
8. Baumann MH, Strange C, Heffner JE, *et al*. Management of spontaneous pneumothorax: an American College of Chest Physicians Delphi consensus statement. Chest 2001; 119: 590-602.
9. 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.
10. Mendis D, El-Shanawany T, Mathur A, Redington AE. Management of spontaneous pneumothorax: are British Thoracic Society guidelines being followed? Postgrad Med J 2002; 78: 80-84.
11. Packham S, Jaiswal P. Spontaneous pneumothorax: use of aspiration and outcomes of management by respiratory and general physicians. Postgrad Med J 2003; 79: 345-47.
12. Yeoh JH, Ansari S, Campbell IA. Management of spontaneous pneumothorax : a Welsh survey. Postgrad Med J 2000; 76: 496–9.
13. Ng AWK, Chan KW, Lee SK. Simple aspiration of pneumothorax. Singapore Med J 1994; 35: 50–52.
14. Noppen M, Alexander P, Driesen P, *et al*. Manual aspiration versus chest tube drainage in first episodes of primary spontaneous pneumothorax. Am J Respir Crit Care Med 2002; 165: 1240-4.
15. Engdahl O, Toft T, Boe J. Chest radiograph: a poor method for determining the size of a pneumothorax. Chest 1993; 103: 26-29.
16. O'Connor AR, Morgan WE. Radiological review of pneumothorax. BMJ 2005; 330: 1493-97.
17. Carr JJ, Reed JC, Choplin RH, *et al*. Plain and computed radiography for detecting experimentally induced pneumothorax in cadavers: implications for detection in patients. Radiololgy 1992; 183: 193–9.
18. Bourgouin P, Cousineau G, Lemire P, *et al*. Computed tomography used to exclude pneumothorax in bullous lung disease. J Can Ass Radiol 1985; 36: 341-42.
19. Collins CD, Lopez A, Mathie A, *et al*. Quantification of pneumothorax size on chest radiographs using intrapleural distances: regression analysis based on volume measurements from helical CT. AJR 1995; 165: 1127–30.
20. Baumann MH. Management of spontaneous pneumothorax. Clin Chest Med 2006; 27: 369-81.
21. Miller AC, Harvey J. Pneumothorax: What's wrong with simple aspiration? Chest 2001; 120: 1041.
22. Ayed AK, Chandrasekaran C, Sukumar M. Aspiration versus tube drainage in primary spontaneous pneumothorax: a randomised study. Eur Respir J 2006; 27: 477-82.
23. Harvey J, Prescott RJ. Simple aspiration versus intercostal tube drainage for spontaneous pneumothorax in patients with normal lungs. BMJ 1994; 309: 1338–39.
24. Andrivet P, Djedaini K, Teboul JL, *et al*. Spontaneous pneumothorax: comparison of thoracic drainage vs. immediate or delayed needle aspiration. Chest 1995; 108: 335-9.
25. Luketich JD, Kiss MD, Hershey J, *et al*. Chest tube insertion: a prospective evaluation of pain management. Clin J Pain 1998; 14: 152–4.
26. Devanand A, Koh MS, Ong TH, *et al*. Simple aspiration versus chest-tube insertion in the management of primary spontaneous pneumothorax: a systematic review. Respir Med 2004; 98: 579-90.
27. Flint K, Al-Hillawi AH, Johnson NM. Conservative management of spontaneous pneumothorax. Lancet 1984; 687-8.
28. O'Rourke JP, Yee ES. Civilian spontaneous pneumothorax: treatment options and long term results. Chest 1989; 96: 1302-6.
29. Northfield TC. Oxygen therapy for spontaneous pneumothorax. BMJ 1971; 4: 86-88.
30. Conces Jr DJ, Tarrer RD, Cory Gray W, *et al*. Treatment of pneumothoraces utilising small calibre chest tubes. Chest 1988; 94: 55–7.
31. Minami H, Saka H, Senda K, *et al*. Small calibre catheter drainage for spontaneous pneumothorax. Am J Med Sci 1992; 304: 345–7.
32. Tattersall DJ, Traill ZC, Gleeson FV. Chest drains: Does Size Matter? Clin Radiol 2000; 55: 415–21.