

Does needle aspiration respond same in Primary and Secondary Spontaneous Pneumothorax?

Anila Basit, Zia Ullah, Arshad Javaid

Department of Pulmonology

Postgraduate Medical Institute, Lady Reading Hospital Peshawar.

Abstract

Objectives:

To assess the effectiveness of percutaneous needle aspirations in the management of pneumothorax and compare its effectiveness in the treatment of primary spontaneous and secondary spontaneous pneumothorax. A secondary objective was to find the out come of patients in whom needle aspiration failed.

Material and Methods:

The study included all patients presenting with pneumothorax admitted to Chest unit from Jan 2002 to July 2003. Patients with tension pneumothorax, hydro-pneumothorax and recurrent pneumothorax were excluded from the study. It was a non-interventional descriptive study. The procedure was deemed successful if after aspiration, the lung expansion was normal or near normal.

Results:

During this period, 100 patients (60 males and 40 females) were studied. 30% (n=30) patients had PSP and 70% had SSP. The underlying cause of SSP was PTB in 57% (n=40) patients, COPD in 30% (n=21) and asthma in 13% (n=9) patients. Needle aspiration was successful in 54% patients and failed in 46%. Needle aspiration had good results in PSP (80%). In secondary pneumothorax it was successful in 43 % cases. The success rate of needle aspiration in pneumothorax due to COPD (62%) and Asthma (55%) was significantly better than pneumothorax due to PTB 30%.

Conclusion:

Needle aspiration can be used as a first line procedure in managing primary spontaneous pneumothorax. Its effectiveness in SSP due to asthma and COPD is comparable to that of PSP hence can be utilized as a first line procedure. The results are not as good in SSP with underlying diseased lung like Pulmonary TB.

INTRODUCTION

A pneumothorax is the collection of air with in the pleural cavity ¹.

A spontaneous pneumothorax (SP) occurs in the absence of preceding event like trauma or other intervention. Primary spontaneous pneumothorax (PSP) occurs in the absence of any clinically discernible lung pathology, where as Secondary spontaneous pneumothorax (SSP) is related to the presence of underlying lung disease ^{2,3}.

The aim of treatment of pneumothorax is to eliminate air from the pleural space. For a small pneumothorax, supplemental oxygen accelerates the re-absorption of air by the

pleura⁴, but invasive techniques are required if the pneumothorax occupies greater than 15 % of the involved hemithorax, is progressive over time or if the patient is symptomatic⁵. The common practice is insertion of an intercostal drainage tube (ICTD), but this requires significant expertise and hospitalization⁶. Aspiration with a plastic intravenous catheter No. 7-14 French gauge has been recommended as the initial treatment for most patients with spontaneous pneumothorax⁷. It is less painful, and reduces the stay in the hospital⁸. This technique is usually successful in 70 % of patients⁹. Despite the recommendations, needle aspiration for management of pneumothorax is hardly practiced by physicians in Pakistan. A survey in the United States showed that even there this technique was utilized by hardly 14% of surveyed US physicians¹⁰.

The objective of this study was to assess the effectiveness of percutaneous needle aspiration in the management of pneumothorax and to find out whether there is a difference in the outcome of needle aspiration in primary spontaneous and secondary spontaneous pneumothorax. A secondary objective was to find the out come of patients in whom needle aspiration failed.

MATERIAL AND METHODS

All patients presenting with pneumothorax to the Pulmonology Department of PGMI Lady Reading Hospital during the period of Jan 2002 to July 2003 were included in the study. Patients with tension pneumothorax, hydro-pneumothorax and recurrent pneumothorax were excluded from the study and they were intubated. Clinical and demographic details were recorded for each patient and pneumothorax was confirmed by radiological examination. All possible attempts were made to find out the cause. Relevant investigations like sputum microscopy for acid-fast bacilli (AFB), spirometry, full blood count and other relevant investigations were performed where necessary.

All the patients were managed with simple needle aspiration as the initial treatment modality irrespective of the etiology of pneumothorax.

The procedure of needle aspiration was performed using strict aseptic precautions with the patient lying down in supine position. The skin was infiltrated down to the pleura by 10 to 15 ml of lignocaine at the site of 2nd intercostal space in midclavicular line. An intravenous cannula (16 or larger and at least 3cm long) was inserted in the pleural cavity. The needle was withdrawn and three-way stopcock was connected to the intravenous cannula. A 50 cc syringe and intravenous tubing with its end under water seal were connected to the cannula through the three-way stopcock. Air was aspirated and expelled by means of intravenous tubing. A repeat chest radiograph was obtained soon after percutaneous needle aspiration was performed. The procedure was deemed successful if the post-aspiration chest radiograph showed no pneumothorax or a negligible small amount of air in the pleural cavity.

In case simple aspiration failed, the patient was managed with intercostal tube drainage (ICTD).

Outcome parameters were compared between PSP and SSP.

Results

This study extended over a period of 19 months from January 2002 to July 2003. Hundred consecutive patients were included in the study, out of which 60 were males and 40 females. Age wise, 53% of patients were between 10–29 years, 29% were 30–49 and

22% were 50-70 years of age. 30 % of the patients had primary spontaneous pneumothorax while 70 % had secondary spontaneous pneumothorax.

The cause of secondary pneumothorax was PTB in 57% (n=40) patients, COPD in 30% (n=21) patients and Asthma in 13% (n=9) patients.

The size of pneumothorax was small in 16 patients, moderate in 48 patients, while it was complete in 36 patients. Needle aspiration was successful in 80% of patients with PSP (24 of 30 patients), while it failed to expand the lung in 20% (6 of 30) patients. Overall, success rate of needle aspiration in SSP was 43%, while it failed in 57% of patients.

The success rate varied according to the etiology of pneumothorax. The procedure was successful in 30% (n=12) cases of pneumothorax due to PTB, 62% (n= 13) of COPD and 55% (n=5) of cases due to asthma. (Table 1)

The role of size of pneumothorax in the success of pneumothorax was also studied. In 16 patients with small size pneumothorax, the procedure was 100 % successful. In 48 moderate size pneumothorax patients, it was successful in 66 %, whereas among 36 patients with complete pneumothorax, the success rate was 22 %. (Table 2)

The volume of air aspirated was different in successful and unsuccessful aspiration. Successful average 1.5 liters vs. failed average 3 liters.

Chest intubation was done in whom the procedure failed: Among them 32 (72.7%) patients were successfully extubated in 2 weeks. 8 (18.18%) patients were successfully extubated in 3 weeks. Only 4 (9 %) patients needed surgery.

DISCUSSION

Marked practice variation exists in clinician approaches to the management of spontaneous Pneumothorax ¹¹⁻¹³, with physicians tending to be more conservative than the thoracic surgeons. Manual aspiration of air with percutaneous needle has been strongly proposed by British Thoracic Society, ¹⁴⁻¹⁶ but lack of confidence has limited its use.¹⁷

We have observed a good outcome for simple aspiration in cases of primary spontaneous pneumothorax in the present study where it was found effective in expanding the lungs in 80% of cases. Moritimoto et al ¹⁸ advocated thoracoscopic surgery for the first episode of PSP in young men where as others recommended simple aspiration as the initial treatment modality of choice for PSP ¹⁰.

Various studies have compared the outcome of needle aspiration with simple observation and intercostal tube drainage. Chan SS ¹⁹, in his study, found faster resolution of pneumothorax with needle aspiration compared with observation (time to full expansion: 1.6 weeks in 8 people successfully treated with needle aspiration v 3.2 weeks in 10 people treated conservatively. Study by Harvey J ²⁰ compared needle aspiration with intercostals tube drainage and found that on average, people receiving needle aspiration spent significantly fewer days in hospital than people receiving chest tube drainage (3.2 days with needle aspiration v 5.3 days with chest tube drainage; P = 0.005). However in another study, Andrivet P et al ²¹ found that, at 24 hours, pneumothorax resolved in significantly fewer people with needle aspiration compared

with chest tube drainage (22/33 [67%] with needle aspiration v 26/28 [93%] with chest tube drainage.

Simple aspiration has been described using several techniques such as catheters and Heimlich flutter valves. A simple I / V cannula has been used by various authors^{15, 17, 22-23}. The success rate for simple aspiration using an I/V cannula in these studies for the different types of pneumothoraces are: PSP 55% to 100%; SSP 35% to 63% IP 67% to 100%. In the present study the corresponding success rates were 80%, 41.2% and 50%. In our cohort spontaneous pneumothorax was more in males (60%) than female (40%). These findings are similar to other studies²⁴⁻²⁵.

Spontaneous pneumothorax was more common in younger age group. 53% of patients with spontaneous pneumothorax were in the age range of 10-29 years whereas 25% of patient in 30-49 years and 22% in 50-70 years range. These findings are consistent with earlier studies conducted at Peshawar^{1, 24}.

Secondary spontaneous pneumothorax in our study was more common (70 %, [n=70 out of 100]) than the primary spontaneous pneumothorax. The most common underlying disease in our series of patients with SSP was tuberculosis (57 %, n=40 out of 70) followed by COPD in 30% (n=21) and Asthma in 13 % (n=9) patients. This is in contrast with situation from developed world, where primary spontaneous pneumothorax is cited as more common,²⁶ but in line with local studies¹.

Percutaneous needle aspiration was successful in 80% of patients having PSP in our study, whereas the success rate for SSP was 43 %. The outcome of the procedure varied according to the etiology of SSP. It had reasonably good results in COPD (62 %) and Asthma (55 %), compared with PTB, where the success rate was only 30 %. A 43% success rate of simple aspiration was reported by Seaton et al,²⁷ and this has been exceeded in the recent randomized trials by Andrivet et al²¹ and Harvey and Prescott²⁰ which show success rate of 68% and 80% respectively. When success of needle aspiration was determined by size of pneumothorax it was found that procedure was more successful in small (100%) and moderate size (66%) as compared to large size pneumothorax (22%). These findings are similar to studies by FA Bevalaqua et al,¹⁸ Js Jones et al,³¹ Arch GJ,^{23,32} Noppen M et al¹⁷ and Bradley G.³³

Needle aspiration was successful in 80% of patients with PSP (24 of 32 patients), while it failed to expand the lung in 20% (6 of 30) patients. Similarly needle aspiration was successful in 43 % patients with SSP, while it failed in 57% of patients. The success rate varied according to the etiology of pneumothorax. The procedure was successful in 30 % cases of pneumothorax due to PTB, 62 % of COPD and 55 % of cases due to asthma. It failed to expand the lungs in 70 % of cases due to PTB, 38 % of cases due to COPD and 45 % of cases due to asthma. Chest intubation was done in whom the procedure was failed: Among them 32(72.7%) patients were successfully extubated in 2 weeks. 8 (18.18%) patients were successfully extubated in 3 weeks. Only 4(9 %) patients needed surgery. Among them 32 (72.7%) patients were successfully extubated in 2 weeks. 8 (18.18%) patients were successfully extubated in 3 weeks. Only 4(9 %) patients needed surgery.

CONCLUSIONS

- Percutaneous needle aspiration can be used as a first line procedure in managing primary Spontaneous Pneumothorax as recommended in BTS guidelines; however its outcome in Secondary Spontaneous Pneumothorax is inferior to that in Primary Spontaneous pneumothorax
- On the whole, needle aspiration had good results in COPD and Asthma, but has rather poor results in PTB.

References

1. Javaid A, Amjad M, Khan W, Sadiq M, Khan MH, Wazir AS. Pneumothorax: Aetiology, complications and outcome. J Coll physicians Surg Pak 1998; 8: 14-16.
2. Sasoon CS. The etiology and treatment of Spontaneous Pneumothorax. Curr Opin Pulm Med 1995; 1: 331
3. Buamann MH, Strange C. Treatment of spontaneous pneumothorax: a more aggressive approach? Chest 1997; 112:789-804.
4. Seaton D. Pneumothorax. In Crofton and Douglas's (eds) Respiratory Diseases (vol 2). 5th edition. Blackwell Science publications UK 2000; 1182-1204
5. Javaid A, Amjad M, Khan W, Wazir AS, Khan Mu, Sadiq M, et al. Pneumothorax. Is it a different disease in the East? J Coll physicians Surg Pak 1997; 11 (2): 157-61.
6. Baumann MH, Strange C, Hefner JE, et al. Management of spontaneous pneumothorax :An American College of Chest Physicians Delphi Consensus Statement .Chest 2001;119:590-602
7. Light RW. Pneumothorax. In Murray JF, Nadel JA, eds. Textbook of respiratory medicine.2nd edition. Philadelphia, PA: WB Saunders, 2000; 2193-2210
8. Henry M, Arnol T, Harvey J. BTS guidelines for the management of spontaneous pneumothorax. Thorax 2003; 58 (90002): 39-52.
9. Shan S, Hefner JE. Spontaneous pneumothorax. N Eng J Med 2000; 342: 868-3
10. Baumann MH, Strange C. The clinician's perspective on pneumothorax management Chest 1997; 112: 822-8.
11. Soulshy 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.
12. Management of Spontaneous pneumothorax. The expert speaks. J Watch Emerg Med 2001; 416: 6-10
13. Yeoh JH, Ansari S, Cambell IA. Management of spontaneous pneumothorax- a Welsh Survey. Post grad Med J 2000; 76: 496-9.

14. Miller AC, Harrey J, Bauman MH, Strange C, Heffner JE. Pneumothorax what's wrong with simple aspiration? *Chest* 2001; 120: 1041-2.
15. Miller AC, Harvey JE. Guidelines for the management of spontaneous pneumothorax. Standards of care committee, British Thoracic Society. *Br Med J* 1993; 307:144-6.
16. Henry M, Arnold T, Harvey J. BTS guidelines for the management of spontaneous pneumothorax. *Thorax* 2003; 58:39-52.
17. Noppen M, Alexander P, Driesen P, Slabbynck H, Verstreuten A. Manual aspiration versus chest tube drainage in first episodes of primary spontaneous pneumothorax: A multicentre, prospective, randomized pilot study. *Am J Respir Crit Care Med*, 2002; 165:1240-4.
18. Morimoto T, Fukai T, Kpyama H, Noguchi Y, Shimob T. Optimal strategy for first episode of primary spontaneous pneumothorax in young men. A decision analysis. *J Gen Intern Med* 2002; 17: 193-202.
19. Chan SS,(2000).Current opinions and practices in the treatment of Spontaneous Pneumothorax .*Accid Emerg Med*, 2000;17:165-9
20. Harvey JE, Prescott RJ. British Thoracic Society. Simple aspiration versus intercostals drainage for spontaneous pneumothorax in patients with normal lung. *BR Med J* 1994; 309:1338-45
21. Andrivet P, Djedaini K, Teboul. JL, et al spontaneous pneumothorax: Comparison of thoracic drainage vs immediate or delayed needle aspiration. *Chest* 1995; 108: 335-39.
22. Roggla M, Wagner A, Brunner C, Roggla G. The management of pneumothorax with the thoracic vent versus conventional intercostal tube drainage. *Wien Klin Wochenschr* 1996; 108: 330-3
23. Kelly DG, Ansari S, Davey WA, Mahadevan V, Tayler GJ, Seaton D. Bedside Tracer gas technique accurately predicts outcome in aspiration of Pneumothorax. *Thorax* 2001; 56:617-21.
24. Durrani YM. Short-term outcome of 50 admitted cases of intercostal tube drainage for pneumothorax in the department of pulmonology PGMI LRH Peshawar. (Dissertation) Karachi CPSP, 2002:110.
25. Ahangar AG, Shah HS, Mir I, Dar A, Bhat M, Lone G et al. Spontaneous pneumothorax. *Indian J Surg* 2003; 65: 423-6
26. Light RW. *Pleural Diseases*. 4th Edn Philadelphia, Lippincott Williams and Wilkins, 2001; pp. 284–319.
27. Ansari S, Highcock M, Seaton D. Spontaneous Pneumothorax: predicting early safe discharge following aspiration. *Eur Respir J* 1995; 8 (Suppl 19): 11-5

Table 1. Outcome of needle aspiration in Pneumothorax

Outcome of needle aspiration	Primary spontaneous pneumothorax (30)	Secondary spontaneous pneumothorax		
		COPD (21)	Asthma (9)	PTB (40)
Successful	24 (80%)	13 (62 %)	5 (55 %)	12 (30 %)
Failed	6 (20%)	8 (38 %)	4 (45 %)	28 (70 %)

Table 2: Success of needle aspiration as determined by size of pneumothorax

Size of pneumothorax	No. of patients	Outcome of needle aspiration	
		Successful	Unsuccessful
1. Small size	16	100% (n=16)	-
2. Moderate size	48	67% (n=32)	33% (n=16)
3. Complete	36	22% (n= 8)	78% (n=28)
Total	100	56%	44%