ROLE OF PERCUTANEOUS NEEDLE ASPIRATION IN THE MANAGEMENT OF PNEUMOTHORAX

Anila Basit, Zia Ullah, Arshad Javaid
Department of Pulmonology,
Postgraduate Medical Institute, Lady Reading Hospital Peshawar

ABSTRACT

Objective: To assess the effectiveness and safety of percutaneous needle aspirations in the management of pneumothorax and to see the difference in the outcome of needle aspirations as determined by size of pneumothorax.

Material and Methods: The study included 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-intervention 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. Needle aspiration was successful in 56% patients and failed in 44%. The impact of size of pneumothorax, on the success of needle aspirations was also studied. The success rate was 100% in 16 patients with small pneumothorax, 66% (n=32) in 48 patients with moderate pneumothorax and 22% (n=8) in 36 patients in complete pneumothorax. The complications of needle aspiration included re-expansion pulmonary oedema in 3.5% (n=2), surgical emphysema in 3.5% (n=2) and recurrence of pneumothorax in 21% (n=12) patients. The total cost of equipment of needle aspiration was Rs. 100 versus Rs. 1500 for ICDT.

Conclusion: Percutaneous needle aspiration is safe, effective and minimally invasive procedure. It can be used as a first line procedure in managing primary spontaneous pneumothorax. The outcome of the procedure is influenced by the size of pneumothorax; the smaller the pneumothorax better is the outcome of needle aspiration.

Key words: Spontaneous Pneumothorax, Needle Aspiration, Size of Pneumothorax.

INTRODUCTION

Pneumothorax is defined as the presence of air within the pleural cavity. It can be classified as traumatic and spontaneous which occur without a preceding event. Spontaneous pneumothorax (SP) can be further subdivided into primary spontaneous and secondary spontaneous pneumothorax. Primary spontaneous pneumothorax (PSP) occurs without preexisting respiratory disease. Secondary spontaneous pneumothorax (SSP) occurs in the presence of structural or functional abnormality in the lungs.

The aim of treatment of pneumothorax is to eliminate the collection of air from the pleural cavity. There is considerable variation in approach towards management of spontaneous pneumothorax, with physicians tending to be more conservative than the thoracic surgeons. Invasive techniques are required if the pneumothorax occupies greater than 15% of the involved hemothorax, it is progressive over time or if the patient is symptomatic. The common practice in this country is insertion of intercostal tube drainage (ICDT), but this procedure requires expertise and hospitalization. Supplemental oxygen accelerates the re-absorption of air by the pleura.

If the pneumothorax is more than 15% of the hemithorax, aspiration of air with a plastic intravenous catheter, No 7-14 French gauge or chest tube can be done. This technique is usually successful in around 70% of patients. Patient can be discharged if a follow up chest radiograph 6 hours after procedure shows resolution of pneumothorax.

Aspiration has been recommended as the first line of treatment for most patients with spontaneous pneumothorax. Despite the recommendations, needle aspiration for management of pneumothorax is hardly practiced by physicians in Pakistan. Even in United States,
this technique was utilized by approximately 14% of surveyed US physicians.

The objective of this study was to assess the effectiveness of this procedure in management of pneumothorax and to find out whether the size of pneumothorax influences the outcome of needle aspiration.

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. Clinical and demographic details were recorded for each patient and pneumothorax was confirmed by radiological examination. Size of the pneumothorax was determined according to the recommendations of British Thoracic Society guidelines for Pneumothorax i.e. Small Pneumothorax is defined as small rim of air around the lung, moderate is the one in which lung is collapsed half way towards heart border and complete pneumothorax is airless lung, separate from diaphragm with no mediastinal or tracheal shift. Tension pneumothorax is any pneumothorax with cardio respiratory collapse.

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 a 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.

The volume of air aspirated was recorded. A repeat chest radiograph was obtained soon after percutaneous needle aspiration was performed. Complication, if any, during and after the procedure was noted. The procedure was deemed successful if after aspiration, the lung expanded completely or symptoms were relieved but small pneumothorax of less than 15% was still there. In case of failed aspiration, ICTD was carried out.

The procedure was discontinued if, there was a feeling of resistance to aspiration or patient had severe cough, or air was still present in the pleural cavity after aspirating 2.5 liters.

The outcome parameters included the success rate of the procedure in all patients as defined earlier, as well as success rate according to the size of the pneumothorax.

RESULTS

This study extended over a period of 19 months from January 2002 to July 2003. Hundred patients were included in the study, out of which 60 were males and 40 females. Age range of the patients was as follows: 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 size of pneumothorax was small in 16 patients, moderate in 48 patients while it was complete in 36 patients.

In 56% of the patients the procedure was successful, while it failed in 44%.

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 1)

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

SUCCESS OF NEEDLE ASPIRATION AS DETERMINED BY SIZE OF PNEUMOTHORAX

<table>
<thead>
<tr>
<th>Size of pneumothorax</th>
<th>No. of patients</th>
<th>Successful</th>
<th>Unsuccessful</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Small size</td>
<td>16</td>
<td>100% (n=16)</td>
<td>0</td>
</tr>
<tr>
<td>2. Moderate size</td>
<td>48</td>
<td>67% (n=32)</td>
<td>33% (n=16)</td>
</tr>
<tr>
<td>3. Complete</td>
<td>36</td>
<td>22% (n=8)</td>
<td>78% (n=28)</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
<td>56% (n=56)</td>
<td>44% (n=44)</td>
</tr>
</tbody>
</table>

Table 1
COMPLICATIONS OF NEEDLE ASPIRATION IN PATIENTS WITH SUCCESSFUL EXPANSION

<table>
<thead>
<tr>
<th>Complication</th>
<th>No of patients</th>
<th>% age</th>
</tr>
</thead>
<tbody>
<tr>
<td>Re-expansion Pulmonary edema</td>
<td>2</td>
<td>3.5%</td>
</tr>
<tr>
<td>Surgical Emphysema</td>
<td>2</td>
<td>3.5%</td>
</tr>
<tr>
<td>Recurrence of Pneumothorax</td>
<td>12</td>
<td>21%</td>
</tr>
<tr>
<td>Total number of patients</td>
<td>16</td>
<td>28%</td>
</tr>
</tbody>
</table>

Table 2
Complications were encountered in only 16% (n=16) patients. Of which, 3.5% (n=2) patients developed surgical emphysema. 3.5% (n=2) patients had re-expansion pulmonary edema and in 21% (n=12) patients recurrence of pneumothorax was noted.

All patients required local analgesia during the procedure. None of the patients managed by simple aspiration required any further analgesia after procedure. The cost of the equipment needed for simple aspiration was approximately Rs 100 while that of ICTD is Rs 1200.

All patients required local analgesia during the procedure. None of the patients managed by simple aspiration required any further analgesia after procedure. The cost of the equipment needed for simple aspiration was approximately Rs 100 while that of ICTD is Rs 1200.

DISCUSSION

Role of simple needle aspiration in the management of pneumothorax has been debated for a long time.

In 1966, Ruckle and Mc Cormack condemned simple aspiration, while the same year Straddling and Poole strongly put forward their views favoring conservative management. Consensus seems to be elusive even forty years later.

We have observed a good outcome for simple aspiration in the present study. Recently, Moritimeto et al 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. Marked practice variation exists in clinician approaches to the management of spontaneous pneumothorax.

The initial treatment of spontaneous pneumothorax involves removing air from the sub pleural space. If the pneumothorax is more than 15 percent, aspiration of air with a plastic intravenous catheter is recommended.

Manual aspiration of air has been strongly proposed by British Thoracic Society, but lack of confidence has limited its use.

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. 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%, iatrogenic pneumothorax (IP) 67% to 100%. In the present study the corresponding success rates were 80%, 41.2% and 50%.

When the British thoracic society research committee first began the study in 1985 of simple aspiration versus intercostal tube drainage for spontaneous pneumothorax, some doctors declined to take part because they thought that all pneumothorax should be treated by simple aspiration. An equal number declined to take part because they thought that all pneumothoraces required intercostal tube drainage. Awareness has been increasing of the simplicity, effectiveness and acceptability to patients of simple aspiration and these advantages over tube drainage has been confirmed in a recent multicentre study. Aspiration is less painful than intercostal tube drainage and leads to a shorter admission and reduces the need for pleurectomy with no increase in recurrent rate at one year.

According to this study spontaneous pneumothorax was more in males (60%) than female (40%). These finding are similar to other studies. 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 the studies conducted at Peshawar.

Secondary spontaneous pneumothorax in our study was more common (70%) than the primary spontaneous pneumothorax. This is in contrast with situation from developed world, where primary spontaneous pneumothorax is cited as more common, but in line with local studies.

Percutaneous needle aspiration was successful in 56% of patients. A 43% success rate of simple aspiration was reported by Seaton et al and this has been exceeded in the recent randomized trials by Andrivet et al and Harvey and Prescott 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 Roggla M,11 J S Jones,11 Arch GJ et al,12 Hamilton AAD,12 Noppen M et al17 and Bradley G.13

The amount of air aspirated was different in successful and unsuccessful aspirations. (successful average 1.5 lit) Vs (failed average 3 liters). This is similar to the finding seen in Harvey and Prescott10 and J S Jones.11

Complications of the procedure were as follows; surgical emphysema: 3.5%, re-expansion pulmonary oedema: 3.5% and recurrence of pneumothorax: (21%). These are similar to the studies conducted by Andrivet P at al,29 and Noppen M et al,30

The cost incurred was less in those who responded to simple aspiration versus those who required ICTD. The hospital stay was on average one day. This is relevant in the context of our hospitals that are usually short of beds.

CONCLUSION
1. Percutaneous needle aspiration is safe, well-tolerated, effective, minimally invasive and cost effective procedure.
2. It should be used as a first line procedure in managing spontaneous pneumothorax as recommended in BTS guidelines.
3. Success of needle aspiration depends on the size of pneumothorax. Its outcome is good in small and moderate size as compared to large size pneumothorax.
4. In case of failed aspiration, patient should be managed with intercostal tube drainage.

Acknowledgment
Mr Akhter Ali, BSC
Technician Procedure room of Pulmonology ward PGMI LRH

REFERENCES
18. Roggla M, Wagner A, Brunner C, Roggla G. The management of pneumothorax with the thoracic vent versus conventional intercostal


25. Durrani YM. Short-term outcome of 50 admitted cases of intercostal tube drainage for pneumothorax in the department of Pulmonology PGMI LRH Peshawar.


Address for Correspondence:
Dr Anila Bashir
House No. 14 Street-3 Sector H-3
Phase-2, Hayatabad Peshawar.
Email: anila1@hotmail.com