



PNEUMOTHORAX; INCIDENCE AND OUTCOMES OF PNEUMOTHORAX IN CRITICALLY ILL PATIENTS

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INTRODUCTION

Pneumothorax is a devastating complication in patients admitted in intensive care units and is associated with very high rate of mortality and morbidity.^{1,2} It is caused by accumulation of air in extra-pulmonary spaces within the chest cavity caused due to leakage of air from the lungs within the chest wall.³ Pneumothorax can be spontaneous or iatrogenic, which is the most common. Incidence of spontaneous pneumothorax varies from 4% to 15% in patients admitted in intensive care units (ICU).^{4,5} In United States (US) nearly 7.4-18/100,000 patients suffer from spontaneous pneumothorax.⁶

Mechanical ventilation is one of the major causes of pneumothorax in ICU patients. It is responsible for 30% to 97% of all causes of

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ABSTRACT... Objectives: To determine the incidence and outcomes of pneumothorax in critically ill patients admitted in intensive care unit (ICU). **Study Design:** Retrospective study. **Setting:** Intensive care unit of Nishtar Hospital Multan. Period: 1 July, 2016 to 31 Dec, 2016. **Methods:** Included analysis of 300 patients. Patients of all age groups and gender were included in this analysis. We reviewed their clinical records regarding age, gender, incidence and type of pneumothorax, pneumothorax episodes and its causes. Diagnosis of pneumothorax was based on clinical examination and plain chest X-rays of patients. **Results:** Pneumothorax occurred only in 26 (8.7%) patients. Out of these 26 patients, there were 3 (1.0%) patients in whom spontaneous pneumothorax occurred and in remaining 23 (7.7%) patients pneumothorax was iatrogenic in nature. There was significantly higher rate of mortality in patients who developed pneumothorax 38.46% versus 3.2% in patients without pneumothorax (p-value <0.001). Duration of ICU stay was also significantly prolonged in pneumothorax patients 11.4 days versus only 6.2 days in patients without pneumothorax (p-value <0.001). Patients with iatrogenic pneumothorax, mortality occurred in 5 (83.3%) patients in whom pneumothorax occurred due to mechanical ventilation, 1 (33.3%) in patients with central venous catheter insertion, 2 (22.3%) in patients with pericardiocentesis and 2 (40.0%) in patients with thoracentesis. **Conclusion:** Pneumothorax is associated with a very high mortality and increased length of ICU stay. Mortality rate is higher in pneumothorax due to mechanical ventilation (barotrauma) as compared to other procedure related pneumothoraxes.

Key words: Pneumothorax, Mechanical Ventilation, Mortality.

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pneumothorax.⁷ Incidence of pneumothorax is lower in patients with normal lungs and it mostly occurs in patients with underlying lung pathology such as adult respiratory distress syndrome, pneumonia and obstructive lung diseases such as asthmatic patients.^{8,9}

Pneumothorax significantly adds up in morbidity like prolonged mechanical ventilation, increased length of hospital stay and mortality of ICU patients.¹⁰⁻¹² The purpose of this study is to determine the incidence of pneumothorax in critically ill patients admitted in intensive care unit (ICU) of Nishtar Hospital Multan and its impact on their outcome.

METHODOLOGY

This retrospective study included analysis of 300

patients who were admitted in intensive care unit of Nishtar Hospital Multan. Patients of all age groups and gender were included in this analysis. We reviewed their clinical records regarding age, gender, incidence and type of pneumothorax, pneumothorax episodes and its causes.

Patients were then divided into two groups on the basis of type of pneumothorax. Group I: included patients with spontaneous pneumothorax, Group II: included patients with iatrogenic pneumothorax. Spontaneous pneumothorax was defined as rupture of visceral pleura or lung parenchyma with no definitive cause. And occurrence of pneumothorax after some medical procedure was defined as iatrogenic pneumothorax. Diagnosis of pneumothorax was based on clinical examination and plain chest X-rays of patients. Clinical symptoms of pneumothorax included; Presence of chest pain associated with respiratory distress, tachypnea, and absence of breath sounds and chest movement on the affected side. This was further confirmed by PA view of plain chest X-rays.

Data analysis was done using SPSS v23 software for Windows. Frequency and percentages were used to represent incidence, causes and types of pneumothorax. Chi-square test was used to compare mortality between spontaneous and iatrogenic pneumothorax, and mortality in patients with versus without pneumothorax. Independent sample t-test was used to compare length of ICU stay in patients with pneumothorax and without pneumothorax. P-value <0.05 was considered significant difference.

RESULTS

Out of three hundred patients, 71.6% patients were male. The mean age of study patients was 55.4 ± 12.7 years. The main reasons for admission to intensive care unit was hemodynamic instability, pulmonary edema, severe pneumonia, and acute exacerbation of COPD (Table-I).

Invasive procedures were performed in 199 (66.3%) patients whereas 101 (33.7%) patients were kept under monitoring. Out of these 199 patients, 84 (42.3%) patients underwent

mechanical ventilation, central venous catheter (CVP) was inserted in 77 (38.7%) patients, thoracentesis was done in 23 (11.5%) patients and pericardiocentesis was done in 15 (7.5%) patients (Figure-1).

Spontaneous pneumothorax occurred only in 26 (8.7%) patients. Out of these 26 patients, there were 3 (1.0%) patients in whom spontaneous pneumothorax occurred and in remaining 23 (7.7%) patients pneumothorax was iatrogenic in nature. Pericardiocentesis and mechanical ventilation were the commonest causes of iatrogenic pneumothorax (Table-II).

There was significantly higher rate of mortality in patients who developed pneumothorax as compared to the patients who did not. Mortality rate was 38.46% in patients who developed pneumothorax as compared to only 3.2% in patients who did not develop pneumothorax (p-value <0.001) (Figure-2). Duration of stay of patients in ICU was also significantly prolonged in pneumothorax patients 11 days versus only 6 days in patients without pneumothorax (p-value <0.001).

Regarding mortality rate in pneumothorax patients, there was no mortality in patients with spontaneous pneumothorax. Regarding mortality rate in patients with iatrogenic pneumothorax, mortality occurred in 5 (83.3%) patients in whom pneumothorax occurred due to mechanical ventilation, 1 (33.3%) in patients with central venous catheter insertion, 2 (22.3%) in patients with pericardiocentesis and 2 (40.0%) in patients with thoracentesis. But this difference in mortality was not statistically significant (p-value 0.12).

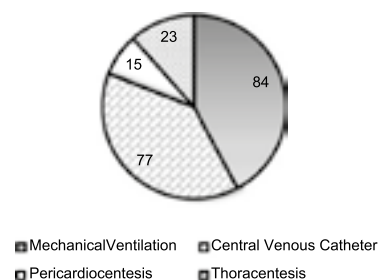


Figure-1. Types of Procedures performed in Intensive care unit.

Characteristics	Results
Age	55.4±12.7
Male gender (%)	215 (71.6)
Female gender (%)	85 (28.4)
Cause of Admission to ICU (%)	
Hemodynamic instability	155 (51.6)
Pneumonia	33 (11.0)
Pulmonary edema	37 (12.3)
Pleural effusion	23 (7.6)
Acute Exacerbation of COPD	34 (11.3)
Asthmatic attack	18 (6.0)

Table-I. Demographic characteristics of study participants. ICU= intensive care unit, COPD= chronic obstructive pulmonary disease

Pneumothorax	Incidence
Total Incidence	26 (8.7)
Spontaneous pneumothorax (%)	3 (1.0)
Iatrogenic pneumothorax (%)	23 (7.7)
Mechanical ventilation (%)	6 (2.0)
Central venous catheter (%)	3 (1.0)
Pericardiocentesis (%)	9 (3.0)
Thoracentesis (%)	5 (1.7)

Table-II. Incidence of pneumothorax with respect to etiological factors.

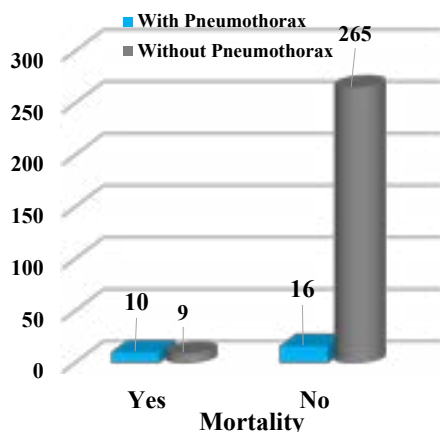


Figure-2. Incidence of Mortality in patients with pneumothorax and without pneumothorax.

Type of Procedure	No-Mortality (%)	Mortality (%)	P-value
Mechanical ventilation	1 (16.7)	5 (83.3)	0.12
Central venous catheter	2 (66.7)	1 (33.3)	
Pericardiocentesis	7 (77.7)	2 (22.3)	
Thoracentesis	3 (60.0)	2 (40.0)	

Table-III. Mortality rate of iatrogenic pneumothorax according to the types of procedures.

DISCUSSION

In this study, we evaluated the incidence of pneumothorax in patients admitted in intensive care unit, length of intensive care unit (ICU) stay and mortality rate in pneumothorax patients and effect of invasive procedures on mortality in patients with pneumothorax. In our study, incidence of pneumothorax was 26 (8.7%), with 35 episodes of pneumothorax. In our study spontaneous pneumothorax occurred only in 1.0% of total ICU admissions whereas as iatrogenic pneumothorax occurred in 23 (7.7%) of all ICU admission. In the study by El-Nawawy et al. incidence of pneumothorax in patients admitted in ICU was 10.4%.¹³ Incidence of spontaneous pneumothorax in their study was 0.6%. Kao et al. found 12% incidence of pneumothorax in their study.¹⁴

In our study, duration of ICU stay was significantly prolonged in patients who developed pneumothorax, 11 days versus only 6 days in patients without pneumothorax. Mortality in our study was also significantly high in pneumothorax patients, 38.46% versus only 3.2% in patients without pneumothorax. Several other studies have also found similar results. Zhan et al. concluded that ICU stay in patients with pneumothorax is increased on an average of 4.4 days, resulting in about 18 thousands dollar extra hospital charges per patient.¹⁵ These authors also found 6.0% higher mortality rate in pneumothorax patients. El-Nawawy et al. concluded that duration of ICU stay is increased to 7 days in patients with pneumothorax as compared to the patients without pneumothorax.¹³ In their study, mortality rate was 59.25% in pneumothorax patients and 10.3% in patients without pneumothorax. Hsu et al also found similar results.¹¹

Most of the pneumothoraxes that occur in ICU are iatrogenic in nature. Iatrogenic pneumothorax is further divided into two groups; occurring either due to barotrauma or due to thoracic procedures. In our study, pneumothorax in ventilated patients due to barotrauma was accountable for 26.0% of all cases of iatrogenic pneumothorax. And thoracic procedures such as CVP insertion, thoracentesis

and pericardiocentesis were responsible for remaining 74.0% pneumothorax cases and pericardiocentesis was the most common procedure responsible for pneumothorax. In the study of Chen et al. thoracic procedures were responsible for 58.0% cases for pneumothorax.¹⁶ In their study thoracentesis was highly associated with pneumothorax and pericardiocentesis was responsible for 10.0% cases of pneumothorax. Despairs et al in a singlecenter study found 28.0% incidence of pneumothorax after thoracentesis.¹⁷ Some studies have reported that incidence of pneumothorax after thoracentesis is reduced to only 3.0% if thoracentesis is done under ultrasonography guidance.^{18,19}

In our study, mortality rate of mechanically ventilated patients after pneumothorax was 83.3%. Hsu et al found 77.4% mortality rate in these patients.¹¹ da Silva et also found a very high mortality rate in mechanically ventilated children who develop pneumothorax.¹² In our study, we did not found any significant difference in mortality rate in pneumothorax patients who were on mechanical ventilation and in other patients who developed iatrogenic pneumothorax.

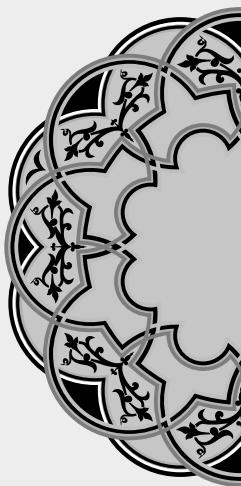
The main limitation of our study is its small sample size and furthermore this study is conducted only in a single center. We recommend that a large scale study should be conducted in our country to get the exact estimations of spontaneous and iatrogenic pneumothorax in patients admitted to intensive care units.

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“Those who follow the crowd usually get lost in it.”

Unknown

AUTHORSHIP AND CONTRIBUTION DECLARATION

Sr. #	Author-s Full Name	Contribution to the paper	Author=s Signature
1	Syed Aftab Haider	Conceived, designed the methodology	<i>Syed Aftab Haider</i>
2	Atqua Sultan	Did data collection and helped in statistical analysis	<i>Atqua Sultan</i>
3	Zaira Salman	Did data collection and manuscript writing	<i>Zaira Salman</i>
4	Salman Waris	Supervised the research project and gave final approval for publication	<i>Salman Waris</i>
5	Muhammad Yousaf	Supervised the research project and gave final approval for publication	<i>Muhammad Yousaf</i>