Biological and Clinical Sciences Research Journal
eISSN: 2708-2261; pISSN: 2958-4728
www.bcsrj.com
DOI: https://doi.org/10.54112/bcsrj.v2023i1.508
*Biol. Clin. Sci. Res. J., Volume, **2023**: 508*
Original Research Article

FREQUENCY OF PNEUMOTHORAX AMONG PATIENTS PRESENTED WITH LARGE VOLUME THORACENTESIS

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(Received, 25th July 2023, Revised 19th October 2023, Published 1st November 2023)

Abstract: *This study aimed to determine the frequency of pneumothorax among patients who underwent large-volume thoracentesis. A cross-sectional study was conducted at the Department of Pulmonology, Pak Red Crescent Medical College & Teaching Hospital, Lahore, from January 2023 to June 2023. The study included 110 patients, aged between 50 and 75 years, of both genders, who presented with a large volume of thoracentesis. The frequency of pneumothorax was determined. The mean age of the patients was 62.04±7.04 years, with male patients accounting for 62.7% and female patients accounting for 37.3%. The frequency of pneumothorax was found to be 13.6%. No significant statistical association was observed between pneumothorax and gender. The study found that the frequency of pneumothorax among patients who underwent large-volume thoracentesis was 13.6%.*

Keywords: Pneumothorax, Thoracentesis, Pleural Effusion, Frequency

Introduction

Thoracentesis, a fundamental medical procedure, has long been essential in diagnosing and managing pleural effusions, a common manifestation of various underlying medical conditions such as heart failure, pneumonia, malignancies, and liver cirrhosis (Kamio et al., 2022). This minimally invasive technique, which involves the aspiration of pleural fluid from the pleural space, not only aids in diagnostic accuracy but also offers therapeutic relief to patients experiencing pleural effusion-related symptoms. While thoracentesis is generally considered a safe procedure, it is not without risks (Gottumukkala et al., 2019). Among the potential complications, pneumothorax—a condition characterized by air within the pleural space; holds a prominent and concerning place. Pneumothorax, when it occurs in the context of large-volume thoracentesis, becomes an issue of critical clinical significance, raising questions about its frequency, risk factors, clinical implications, and the optimal strategies for prevention and management (Huan et al., 2021; Imran and Eastman, 2017).

Large-volume thoracentesis, an advanced variant of the standard thoracentesis procedure, becomes necessary when pleural effusions reach a significant volume, typically exceeding 1.5 liters. The primary goal of this procedure is to provide immediate symptomatic relief to patients by removing a substantial amount of pleural fluid, thereby improving their respiratory function and overall well-being. However, the magnitude of the pleural fluid evacuation in large-volume thoracentesis poses unique challenges and augments the risk of complications, with pneumothorax being a prominent concern (Fawad et al., 2020; Lentz et al., 2019).

Pneumothorax in large-volume thoracentesis occurs when air is inadvertently introduced into the pleural space during the procedure. This can result from several factors, including the penetration of the pleura during needle insertion, the rapid evacuation of pleural fluid, and the release of pleural pressure (Zhou et al., 2021). The consequences of pneumothorax can range from mild respiratory distress to severe respiratory compromise, necessitating immediate intervention.

Above all, the safety and well-being of patients undergoing large-volume thoracentesis are of utmost concern (Ciriaco, 2022; Gilday et al., 2021). Recognizing the frequency of pneumothorax allows healthcare providers to educate patients about potential risks, enabling them to make informed decisions regarding the procedure. An accurate assessment of pneumothorax frequency in large-volume thoracentesis can inform the development of refined procedural guidelines and best practices. This can mitigate the risk of complications, enhancing the overall safety and effectiveness of the procedure (Dahmarde et al., 2019; Schnell et al., 2017).

This study sets the stage for a comprehensive exploration of pneumothorax frequency among patients with large-volume thoracentesis. By delving into the relevant literature, examining risk factors, discussing preventive measures, and considering the broader implications for clinical practice, this investigation seeks to contribute to the ongoing efforts

[Citation: Naeem, O.M., Ahmad, M., Abbasi, W.Z., Zaman, M.H., Ahmad, A., Shamshad, S. (2023). Frequency of pneumothorax among patients presented with large volume thoracentesis. *Biol. Clin. Sci. Res. J.*, **2023***: 508*. doi: https://doi.org/10.54112/bcsrj.v2023i1.508]

to improve the safety and efficacy of large-volume thoracentesis procedures.

Methodology

We conducted a cross-sectional study at the Department of Pulmonology, Pak Red Crescent Medical College & Teaching Hospital, Lahore, from January 2023 to June 2023. We enrolled 110 patients using a non-probability consecutive sampling technique. Patients aged 50 to 75 of either gender presented with pleural effusion (> 1 L fluid) were enrolled in the study. Basic demographics were noted down on a predesigned proforma. Pneumothorax was confirmed on chest X-ray, and every patient was subjected to radiological examination.
Data analysis was performed using IBM SPSS 24. Variables like age and BMI were presented as mean and standard deviation, while for gender, diabetes, hypertension, and pneumothorax, frequencies and percentages were used. Pneumothorax was stratified with gender using the Chi-Square test, keeping $P < 0.05$ as significant.

Results

We carried out this research on 110 patients presenting with large-volume thoracentesis. Regarding gender distribution, the frequency of male patients was 62.7%, and the frequency of female patients was 37.3%. The mean age of the patients was 62.04±7.04 years. The mean BMI recorded was 26.03±1.96 kg/m2. Regarding the comorbid, we observed that 26.4% of patients had diabetes while 38.2% of patients had depression (Table, Figure 1). The frequency of pneumothorax in our study was 13.6%. In our study, we observed that the frequency of pneumothorax was higher in the male gender than the female gender, but we did not observe a statistical significance ($P > 0.05$) (Table, Figure 2).

Table 1 Baseline characteristics

Variables	Statistics
Age (Years)	62.04±7.04
BMI (Kg/m^2)	26.03±1.96
Diabetes	29 (26.4%)
Hypertension	42 (38.2%)

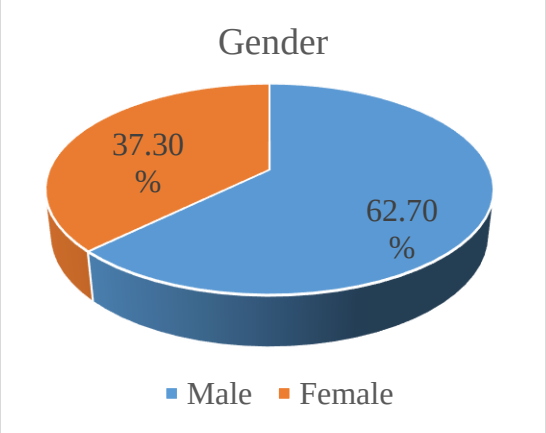

Figure 1

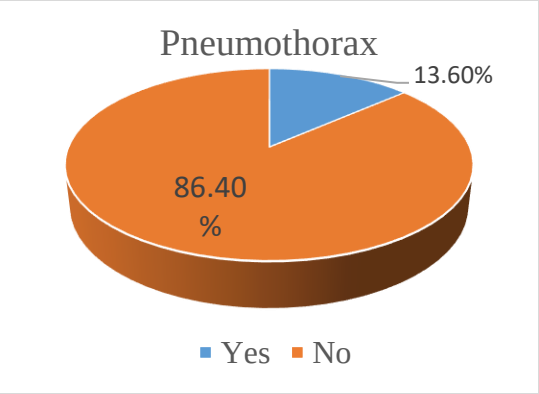

Figure 2 Frequency of pneumothorax

Table 2 Association of pneumothorax with gender

		Gender		Total	P value
		Male	Female		
PNEUMOTHORAX	Yes	11	4	15	0.36
		73.3%	26.7%	100.0%	
	No	58	37	95	
		61.1%	38.9%	100.0%	
Total		69	41	110	
		62.7%	37.3%	100.0%	

Discussion

Thoracentesis is a frequently employed medical technique that serves diagnostic and therapeutic functions. The prevailing consensus is that it is commonly seen as a low-risk and secure option. Nevertheless, the occurrence of pneumothorax after thoracentesis can result in heightened health issues, elevated fatality rates, and prolonged durations of hospitalization. In nearly 50% of instances involving pneumothorax, implementing a chest tube becomes imperative, prolonging the duration of hospital stay and imposing a substantial financial strain (Hibbert et al., 2013). Prior research has documented the prevalence of pneumothorax associated with thoracentesis. A comprehensive evaluation was conducted on 9,230 thoracentesis procedures, revealing an incidence rate of pneumothorax at 0.61% (Ault et al., 2015).
Pneumothorax is a commonly observed consequence of thoracentesis, historically reported to have incidence rates as high as 19%. The occurrence of iatrogenic pneumothorax

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significantly affects the overall results of patients (Cavanna et al., 2014). According to a recent meta-analysis, it has been found that chest tube drainage is required in around one-third of patients. Moreover, there is a correlation between iatrogenic pneumothorax and elevated healthcare expenditures, as well as higher rates of mortality. In a particular investigation, a solitary instance of pneumothorax occurred as a consequence of unintentional penetration of the lung within a sample size of 367 procedures. Nevertheless, it is crucial to acknowledge that current research conducted within the last three years has documented different prevalence rates of iatrogenic pneumothorax, from 0% to 3%. Two recent meta-analyses have documented an average pneumothorax rate of 6% (Perazzo et al., 2014).

It is vital to comprehend that detecting air in the pleural space on chest radiography after thoracentesis does not invariably signify a genuine procedural issue involving harm to the visceral pleura (Zanforlin et al., 2013). In the process of pleural space drainage, there is a possibility of inadvertent introduction of ambient air, resulting in a minor pneumothorax that does not necessitate intervention. Pneumothorax ex vacuo is an additional form of pneumothorax that can arise when there is an excessive generation of negative pleural pressures. This occurs in situations where the lung cannot fully re-expand, such as in cases of endobronchial blockage, atelectasis, and thickening of the visceral pleura. The augmented intrapleural pressure gradient has the potential to induce the influx of air into the pleural space, leading to the development of pneumothorax at the identical location as the extracted pleural fluid. The necessity for aggressive therapy in cases of pneumothorax ex vacuo is infrequent. Hence, it should not be regarded as a procedural consequence of thoracentesis (Levitov et al., 2016).

The utilization of ultrasonography has emerged as the key contributing factor to the decreased incidence of pneumothorax in thoracentesis procedures. Using ultrasound technology allows the operator to effectively observe and analyze several attributes of a pleural effusion. This includes the ability to find the optimal location for fluid extraction that is easily accessible, accurately determine the appropriate depth for needle insertion into the pleural effusion, prevent potential harm to nearby vital structures, and locate intercostal vessels. There exists a substantial body of evidence that substantiates the utilization of preprocedural ultrasound to demarcate the precise site of fluid, hence significantly mitigating the incidence of problems associated with thoracentesis (Patel et al., 2012)

We conducted our study on 110 patients presented with large-volume thoracentesis. We included patients aged between 50 and 75 years. We observed that the frequency of pneumothorax in our study was 15 (13.6%). A similar frequency has been reported in a study that showed that the frequency of pneumothorax in their patients was 12% (Shechtman et al., 2020). Another study reported that the prevalence of pneumothorax in their study was 18.3% (Khan et al., 2022).

Conclusion

Our study concluded that the frequency of pneumothorax among patients with large-volume thoracentesis was 15 (13.6%). The occurrence of pneumothorax is prevalent as a complication of thoracentesis, although the utilization of ultrasound guidance and a focus on the proficiency of the operator can substantially reduce the incidence of complications.

Declarations

Data Availability statement

All data generated or analyzed during the study are included in the manuscript.

Ethics approval and consent to participate

Approved by the department Concerned.

Consent for publication

Approved

Funding

Not applicable

Conflict of interest

The authors declared absence of conflict of interest.

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