ORIGINAL ARTICLE

Diagnostic Accuracy of Chest Ultrasonography for Pneumothorax in Post Traumatic Patient taking CT as a gold standard

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ABSTRACT

Background: It is vital to diagnose pneumothorax at early stage for treatment purpose. In trauma cases usually it is ignored and remains undiagnosed which can become cause of tension pneumothorax and cardiac arrest. Ultrasound has helped the trauma cases to diagnose pneumothorax by performing chest ultrasound and can manage the treatment plan and resuscitation.
Aim: To analyze the diagnostic accuracy of chest ultrasound in identifying the pneumothorax from trauma cases while CT remain as a gold standard.
Methodology: The trauma patients who were referred to Radiology Department of Lahore General Hospital from the period of January 2019 to January 2020 were included in the study. Total 152 patients were included in the study. The ultrasound chest was performed in suspected chest trauma patients . Scan was done in supine position by using high frequency linear probe by focusing on both lungs and identifying the parietal pleura, visceral pleura, comet tail artifact and lung sliding which shows normal lungs. The gold standard set was CT chest results.
Results: Total of 152 patients who have chest trauma were included and the mean age of the selected sample was 31.6±13.4 years (range: 5-68).Male patients were more in number (76%).Pneumothorax was found in 55 cases which counts 36.2% of the total cases. The sensitivity of the ultrasound was 83.6%. Specificity of the ultrasound was 97.9%. Positive predictive value of ultrasound was 95.8% and negative predictive value 91.3%.
Conclusion: Chest ultrasound is accurate, no exposure to radiation and quick technique to identify the pneumothorax in trauma patients presenting in emergency department.
Keywords: Chest Trauma, Pneumothorax, CT scan, Ultrasonography

INTRODUCTION

Trauma is caused by external factors which can result in injuries and damage to the patients in form of disability or loss of life in young and older population. Trauma is common cause of mortality in the world and it is reported that more than 6 million people deaths occurred in the world almost every year due to trauma[1]. Pneumothorax is common cause of death found in chest trauma if remain undiagnosed[2]. From the published reports it was observed that pneumothorax was found in 5-7% of the trauma patients[3]. The identification of pneumothorax which is done on the basis of signsuý and symptoms observed clinically in trauma patients can sometime mislead the diagnosis[5].Chest x-ray, chest ultrasound and CT scan are considered extensive diagnosis techniques in trauma cases. The sensitivity of chest x-ray may range from 30-75% and the specificity of chest X-ray is 100%[6].CT is a diagnostic test which is used as gold standard in chest trauma cases[7]. It is a time consuming test and for cases like pneumothorax the ultrasound is considered fast and easy test. The sensitivity and specificity of chest CT scan is 83% and 100% respectively. CT scan is expensive, not widely available in remote areas and sometimes it is difficult for the patient to hold breath during performing CT scan, which can cause delay in diagnosis and hence the condition can become life threatening. While ultrasound access is easy and is gaining popularity due to its affordability, time efficiency and diagnostic accuracy in rural and urban health care facilities. Sensitivity and specificity of ultrasounds in identifying the thoracic trauma was 53-

95%[8]. In other study the ultrasound specificity and sensitivity was found 97.2% and 86.2%[9].The purpose of the study is to find the diagnostic accuracy of ultrasound in early identification of pneumothorax among trauma patients for timely treatment and reducing the mortality rate. The results of diagnostic accuracy have helped to widely use the ultrasounds in areas where CT is not available and timely diagnosis can help to save the life of the patients.

METHODOLOGY

The present study was conducted in Radiology Department of Lahore General Hospital from time period of January 2019 to January 2020.In the study total 152 patients participated with polytrauma including those with intra thoracic injuries were referred to Emergency department. The purpose of the study was to diagnose pneumothorax accurately by ultrasound while taking CT as a gold standard. The inclusive criterion for the study was patients with all age group who were referred to emergency department with poly trauma and were also willing to participate in the study. Pregnant ladies, patients with hemodynamic instable, and those having pulmonary pathologies were excluded from the study.
The ultrasound was performed on chest trauma patients by using high frequency probe in supine position. Lung sliding is one of the most important sign seen in normal aerated lung. The doctor should identify hyperechoic pleural line moving back and forth between two ribs. Lung sliding sign can be detected on M- mode ultrasound. The cursor is placed along the pleural line. Motionless part of

the chest develops horizontal waves above the pleural line and below the pleural line is the sliding part which shows granular pattern. It looks like waves and the sand like pattern represent the normal lungs (5). Comet tail artifact is observed as hyper echoic vertical lines which appear from the pleura to the end of screen and do not fade. Absence of lung sliding and comet tail artefact is seen in Pneumothorax. Pneumothorax on CT scan is observed as air accumulation within the pleural cavity.

The ultrasound was performed in supine position and lungs field was scanned from 2nd to 4th anterior intercostals space and 6th to 9th intercostals space in mid axillary line. Transducer is placed longitudinally across the ribs. The pleural line was observed between the lower and upper ribs with hyper echoic horizontal line. The parietal and visceral lungs sliding can be differentiated with the help of high frequency probe .Comet tail artifact can be observed in normal lungs. The scan helps to find the absence or presence of comet tail artifact and lung sliding. Medison Sonoace Accuvix V20 with 7.5 MHz frequency transducer was used for all patients. Chest CT scan of all the patients were performed as a gold standard for confirming the diagnostic accuracy of ultrasound in identification of pneumothorax.

RESULTS

Wide range of age group was included in the study that came with chest trauma and was ranged from 5 years to 68 years and their mean age was 31.4±13.6. Table 1 below shows participants characteristics and from the table 1 it is clear that pneumothorax positive cases were 36%. Table 2 shows the performance of the ultrasonograhy and CT for identification of pneumothorax among chest trauma patients

Table 1

Gender	Frequency	Percentage
Male	117	0.76
Female	136	0.34
Total	152	100
Age		
Under 19	25	0.164
20-40 years	91	0.598
40-60 years	26	0.171
61 and above	10	0.657
Total	152	100%
Pneumothorax		
Yes	55	0.64
No	97	0.36

Table 2

Index	Ultrasound	CT
Sensitivity	83.6%	77.7%
Specificity	97.9%	96.5%
Positive Predictive value	95.8%	73.6%
Negative predictive value	91.3%	97.2%

DISCUSSION

From the results it is clear that diagnostic accuracy of ultrasound in detecting the pneumothorax in chest trauma was high. Other studies published show the same

sensitivity and specificity of the ultrasound and it is more accurate as compared to the X-ray results[19,20].

Heydari F et all in the study has drawn a conclusion that the ultrasound is best technique for initial screening of chest trauma patients[21].

The study of, Hyacinthe et al has also confirmed that the ultrasound diagnostic accuracy is more than the chest X-ray performed on the trauma patient. In his study the gold standard set was also CT. The sensitivity and specificity of chest x-ray was 37 % to 61% and the sensitivity, specificity of ultrasound was 61% and 96% respectively[22]

Wilkerson and Stone study has concluded ultrasound sensitivity as 85% and specificity as 100% in the thoracic trauma injuries[18]. Saucier S has identified the application of ultrasound technology as compared to the chest radiography for identification of pneumothorax in traumatic patient. Ultrasound is more accurate, time and cost efficient[23].

Roberts DJ et al in his study also concluded that ultrasound is more efficient and easily available mode of technology to detect pneumothorax in trauma patients[24].

Similar study was conducted by Liu Y et all has concluded in his study that ultrasound is more reliable, accurate and time saving technology as compared to the chest radiography[25].

CONCLUSION

From the study it can be concluded that ultrasound is reliable technique in the screening of trauma patients for pneumothorax .The results are also linked with the expertise of the radiologist and hence CT will remain as a gold standard for confirmation.

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