



COMPARING DIAGNOSTIC ACCURACY OF LUNG ULTRASOUND AGAINST CHEST XRAY FOR DETECTION OF PNEUMOTHORAX USING HRCT AS GOLD STANDARD.

Emergency Medicine

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ABSTRACT

Thoracic trauma is one of the most common locations of injury with an overall mortality rate of up to 10% making its recognition a priority in chest trauma assessment. Imaging plays a key role in guiding interventions and management in patients with chest trauma. Conventional imaging in the form of chest radiographs, ultrasounds, and computed tomography (CT) are usually performed in the emergency settings with CT scan as the gold standard for this diagnosis. But high radiation dose in CT scan has made chest X-ray a popular initial diagnostic tool in these cases. Apart from various disadvantages of chest X ray, many studies suggest its poor sensitivity and specificity in identifying intrathoracic injuries culminating in lower diagnostic yield. Recently, chest ultrasonography has emerged as a portable, inexpensive, safe, and fast alternative for radiography in detection of traumatic intrathoracic injuries. So, the present study was undertaken to compare the diagnostic accuracy of this newly surfaced chest ultrasonography and the conventional chest radiography in identifying traumatic intrathoracic injuries. Objective: To evaluate and compare the accuracy, sensitivity and specificity of chest ultrasound and chest x ray as a diagnostic tool in detection of pneumothorax, in trauma patients using CT thorax as gold standard. Study design: Descriptive study. Place and duration of study :Department of General Surgery, Lala Lajpat Rai Hospital, GSVM Medical College, Kanpur, UP, India, between December 2020 to October 2022. Methodology : In the present descriptive study, patients with traumatic intrathoracic injuries, who were referred to the emergency department between December 2020 to October 2022, were assessed. The patients underwent bedside chest ultrasound (USG), x ray and computed tomography (CT) scan examinations based on ATLS recommendations. Results : Eighty five patients with mean age 41.13 ± 17.2 (range 7-87) were taken (68.24 % males).CT scan showed pneumothorax, in 94.12 % , cases Whereas chest ultrasonography in comparison to radiography detected pneumothorax in 69.41 % respectively. Comparison of sensitivity, specificity, positive predictive value and negative predictive value after taking CT thorax as gold standard gave accuracy of 76.27 % to USG thorax and 50.85 % to chest x ray ($p=0.0005$) for detecting pneumothorax , Conclusions : The results of the present study showed that ultrasonography is preferable to radiography in the initial evaluation of patients with traumatic injuries to the thoracic cavity.

KEYWORDS

Chest Injury, Thoracic Cavity, Pneumothorax, Haemothorax, Pulmonary Contusion.

INTRODUCTION

Thoracic trauma is one of the most common locations of injury (after head and extremities), and has an overall mortality rate of up to 10% making it imperative to recognize intrathoracic injuries in chest trauma assessment. Trauma is the fifth leading cause of death worldwide, predominantly in people younger than 40 years of age. Whether it is a life threatening condition that requires an emergent response, or a minor injury, imaging is a key tool that drives major clinical interventions and management decisions in patients with chest trauma. Conventional imaging in the form of chest radiographs, ultrasound, and computed tomography (CT) are the imaging techniques that are usually performed in the emergency settings.

Computed tomography (CT) scan is the gold standard for diagnosing chest trauma. Although CT scans are highly accurate in detecting intrathoracic injuries, patients undergoing CT scan examination receive a high dose of radiation. This makes chest radiography an approved initial diagnostic tool in these cases. Chest radiography seems inexpensive and non-invasive, but its application in all multiple trauma patients significantly increases the total cost and overall exposure to radiation. Many studies have recently reported poor sensitivity and specificity of chest radiography resulting in low diagnostic yield (6.3 12.4%) in identifying intrathoracic injuries¹¹.

During recent years, chest ultrasonography has surfaced as a portable, inexpensive, safe, and fast alternative for radiography in detection of traumatic intrathoracic injuries. Besides, it does not use radiation, and also allows real-time scanning and interpretation. However, as with chest radiography, the care of acute trauma patients imposes some obstacles to chest ultrasonography too. These patients are usually immobilised and are receiving other diagnostic and therapeutic interventions, which makes them unable to collaborate with the examination. Thus, evidence on non traumatic pneumothorax and pleural effusions cannot be totally applied to the trauma context. Moreover, USG is a subjective tool that is largely dependent on the experience and expertise of the operator and its results may not be very reliable in identifying parenchymal injuries and where no fluid is present. Based on the foretasted points, the present study was planned to compare the diagnostic accuracy of chest ultrasonography and radiography in identifying traumatic intrathoracic injuries.

METHODS :

Study design and setting

In the present prospective study, patients with traumatic chest injuries, who were referred to the Department of General surgery, LLR & Associated Hospitals, GSVM Medical College from December 2020 to October 2022 were assessed. The study was done to calculate the diagnostic accuracy of chest ultrasonography and radiography in the initial evaluation of patients with chest trauma. Thoracic CT scan was used as the gold standard. All patients in need for chest CT scan based on standard indications of advanced trauma life support (ATLS) guidelines were included in a consecutive manner. Exclusion criteria consisted of pregnancy, hemodynamic instability, tension pneumothorax, chest abnormalities due to medical reasons, tuberculosis, tumour and lack of interest in participating in the study. Chest ultrasonography and data collection were carried out by the radiologist posted in Emergency department where as Chest x-ray and CT scan were reported by two radiologists separately, who were blinded to the clinical findings of patients and aim of study. The protocol of the study was approved by the Ethics Committee of Ganesh Shankar Vidyarthi Memorial Medical (GSVM), Kanpur, Uttar Pradesh, India.

The protocol of the study did not interfere with the patient's therapeutic and diagnostic procedures and the patients were not exposed to any risks. The data collection forms were kept anonymous and a code was assigned to each patient. An informed consent was taken from all patients before being included in the study.

Observations

Demographic (age, gender, and mechanism of trauma) and clinical data, as well as imaging findings of each patient were recorded using a checklist. Immediately after collection of data, the patients underwent chest ultrasonography, which was carried out using a bedside ultrasonography unit (Fujifilm sonosite M-Turbo) and 3.5-7 mhz linear and curvilinear transducers. Examinations were carried out at 2-6 intercostal spaces on both sides of parasternal, mid-clavicular, anterior axillary and mid-axillary lines. Then, the patients underwent an anterior posterior (AP) chest x-ray examination using a portable x-ray machine (Allenger Mars 40-80 Kw) and chest CT scan (Siemens, Go now, 32 slice scanner with 1mm helical cuts, volume acquisition) in

supine position. Pneumothorax, was considered as traumatic intrathoracic injuries.

Statistical Analysis

The presentation of the Categorical variables was done in the form of number and percentage. The following statistical tests were applied for the results:

1. Sensitivity, specificity, positive predictive value and negative predictive value was assessed of USG thorax and CXR for predicting pneumothorax, after taking CT scan as gold standard. McNemar test was used for comparison of sensitivity and specificity.

RESULTS

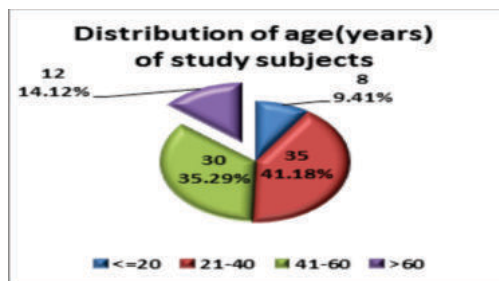


Figure 1

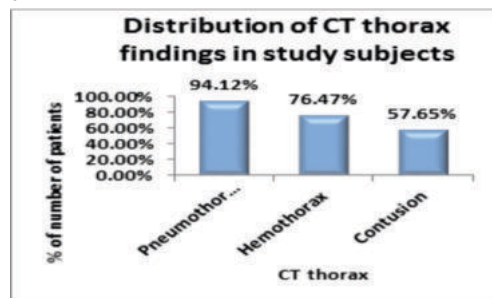


Figure 2

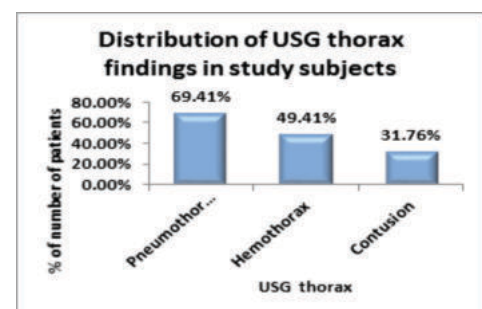


Figure 3

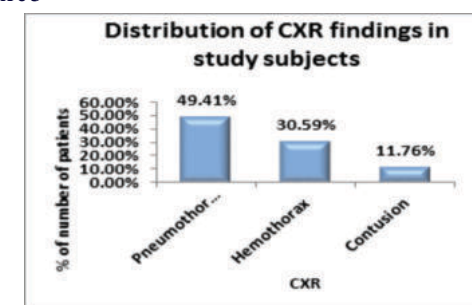


Figure 4

Eighty five patients with mean age 41.13 ± 17.2 (range 7-87) were included (68.24 % males) in the study (Figure 1). CT scan showed pneumothorax in 94.12 %, cases (Figure2). Chest ultrasonography findings showed pneumothorax in 69.41 %, cases respectively (Figure3). Chest Xray detected pneumothorax, in 49.41 %, cases respectively (Figure4). Comparison of sensitivity, specificity, positive predictive value and negative predictive value after taking CT thorax

as gold standard gave accuracy of 76.27 % to USG thorax and 50.85 % to chest xray ($p=0.0005$) for detecting pneumothorax (Figure 5),

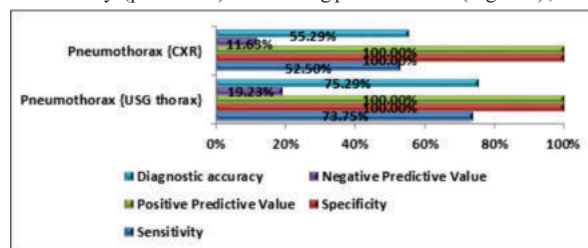


Figure 5: Sensitivity, specificity, positive predictive value and negative predictive value of USG thorax and CXR for predicting pneumothorax after taking CT as gold standard in total study subjects.

DISCUSSION

The results of the present study show that chest ultrasonography has a higher diagnostic value in detection of pneumothorax, as compared to radiography. Various studies have evaluated the diagnostic accuracy of ultrasonography in trauma patients . In this context, (Hyacinthe A-C n.d.) also found that the diagnostic accuracy of ultrasonography was higher than that of chest x-ray. The study showed that the sensitivity and specificity of ultrasonography, compared to CT scan as the gold standard, in diagnosis of thoracic cavity lesions were in the 37 61% and 61 96% ranges, respectively.. (Gentry Wilkerson R 2010) meta-analysis reported a sensitivity of 85 100% for ultrasonography in diagnosis of thoracic cavity injuries . Other studies, have also reported similar findings. The differences in the sensitivity and specificity might be attributed to inclusion and exclusion criteria in these studies. These studies did not include the patients with subcutaneous emphysema and intubated patients. Subcutaneous emphysema interferes with examination of the parietal pleura using ultrasonography, making it difficult to identify pneumothorax in these areas.

An attempt was made in the present study to evaluate the diagnostic accuracy of ultrasonography as an alternative to x-ray. Comparison of the results of these two techniques with those of CT scan showed that ultrasonography is superior to chest x-ray in initial evaluations.

CONCLUSIONS

The results of the present study showed that ultrasonography is preferable to radiography in the initial evaluation of patients with traumatic injuries to the thoracic cavity. However, the low sensitivity of the ultrasonography technique in comparison to CT scan and its reliance on operator skill, have made it valuable to be used only as an initial test, necessitating confirmation using other techniques.

Statement and Declaration :

All authors declare that they have no conflict of in

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