Emergency Medicine Investigations

Research Article

Assessing Radiologic Findings of Chest Radiographs in Patients with Trauma Admitted to the Emergency Room

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Abstract

Background: According to Advanced Trauma Life Support, chest radiography must be performed during the initial evaluation of patients with trauma. We studied the CXR performed in the emergency room of Rajaie Hospital to determine its usefulness.

Methods: In this prospective study, patients who referred with high-energy trauma from December 2013 until April 2014 were recruited. Their demographic characteristics, including age, gender, and cause of trauma were recorded. Meticulous medical history was taken from all patients and they were examined by emergency medicine specialist. Simple radiographic CXR was performed for selective patients and image findings and their mediastinal width were recorded. All statistical analysis was performed using SPSS software version 20.0 and P-value less than 0.05 was considered significant.

Results: Of the total 790 patients assessed, 137 patients were female (17.3%) and 655 were male (82.7%). Mean age of patients was 35.13±17.01 (ranging from 12 to 91); Mean mediastinal width was 80.9±11.45 mm (range: 49.2-142.29). The most common causes of trauma included car-to-patient accident in 131 patients (16.5%), motor-to-car accident in 128 patients (16.2%), car turnover in 103 (13%), falling down in 93 (11.7%), and stab wound 88 (11.1%). The most common pathologic finding included rib fractures (42.7%), pneumothorax (11.6%), abnormal diaphragmatic findings (10.3%), and hemothorax (8.3%).

Conclusion: The results of the current study, in accordance to previous studies, suggest rib fractures, pneumothorax, abnormal diaphragmatic findings, and hemothorax as the most frequent findings in CXR that need to be assessed meticulously. Moreover, the majority of patients were young males and the most frequent causes of trauma included car accidents, falling down, and stab wound. Therefore, paying attention to their diagnosis and treatment may increase the survival of this important group of patients.

Keywords: Chest X-Ray; Multiple Trauma; Radiologic Findings

Introduction

Multiple trauma is an important cause of death worldwide [1], which is also a leading cause of mortality and morbidity in Iran after cardiovascular injuries [2]. Although it is estimated that a number of cases pass away before reaching medical centers, it is essential to diagnose and manage the patients referring to trauma centers rapidly and properly to increase their survival rate [3]. Among various traumas the multiple traumas that a patient might experience, chest trauma is ranked third and requires careful assessment [4].

Performing Chest X-Ray (CXR) in patients with multiple trauma is recommended by Advanced Trauma Life Support (ATLS) since 1992 [5] and is performed in many countries as the standard trauma care [6]. It is also an easy and fast imaging technique with low radiation dose [7] and can be interpreted rapidly. Studies have

also demonstrated that routine CXR performed in the emergency room reduces further costs of patients [8].

Beside the advantages of chest radiography, some studies have determined that reading the result of CXR once by the emergency medicine specialist might be associated with errors and a second assessment by a radiologist increases the accuracy of diagnosis [9]. Some have proposed that assessing the indication of CXR by a trauma surgeon is safe and efficacious and reduces total costs [10]. Others have demonstrated that routine CXR is unnecessary in stable patients with normal physical examination under 60 years [11-13] and some have indicated normal physical examination parameters sufficient to eliminate some radiographs [14]. Some others have compared other imaging methods to CXR, such as thoracic Computed Tomography (CT) [15-17], and ultrasound [18,19]. Yet, the gold standard imaging method stays a dilemma for detecting some pathologies like diaphragmatic rupture [20].

As there is still no consensus on the indications and necessity of CXR in multiple traumatized patients referring to emergency ward, this study aimed to review the CXRs performed in the emergency room of Rajaie Hospital to determine its usefulness.

Materials and Methods

In this prospective study, patients who referred with high-energy trauma from December 2013 to April 2014 were recruited based on convenient sampling. All patients gave consent for participation in the research. CXR was performed for the patients by the following criteria: decreased level of consciousness (GCS<13), subjective respiratory and chest discomfort in any form (chest pain, chest compression, dyspnea, etc), positive physical examination of the neck, chest or abdomen, and unrevealing or unreliable chest physical examination for any reason [8]. The exclusion criteria included any patient with a history of chest surgery or thoracic drainage at arrival. The research protocol was approved by the Ethics committee of Rajaie hospital.

Their demographic characteristics, including age, gender, and cause of trauma were recorded. All patients were examined by emergency medicine specialist after history taking. Simple radiographic CXR was performed for all patients, which were read by a trained doctor and suspicious graphies were reviewed by radiology specialist, and the image findings and their mediastinal width were measured.

Categorical variables were described by numbers and percentages and mean ± standard deviation was reported to describe continuous variables. The comparison of mediastinal width among gender and age group was performed by independent sample T test. All statistical analysis was performed using SPSS software version 20.0 and P-value less than 0.05 was considered significant.

Results

During the study period, considering the inclusion/exclusion criteria, 795 patients referred to the emergency of Shahid Rajaie hospital with high-energy trauma and the data of 790 cases were ultimately analyzed, as three patients did not give consent to use their data in the study and the data of two patients were incorrectly recorded.

Mean age of patients was 35.13±17.01 (ranging from 12 to 91); Regarding gender, 137 patients were female (17.3%) and 655 were male (82.7%); the male-to-female ratio was 4.78:1. Mean age of female patients was 41.32±19.87 (14-85) and 33.83±16.07 (12-91) in men, which was significantly different (P<0.001).

The most frequent causes of trauma included car-to-patient accident in 131 patients (16.5%), motor-to-car accident in 128 cases (16.2%), car turnover in 103 cases (13%), falling down in 93 (11.7%), and stab wound in 88 (11.1%). The complete causes of trauma are demonstrated in Figure 1.
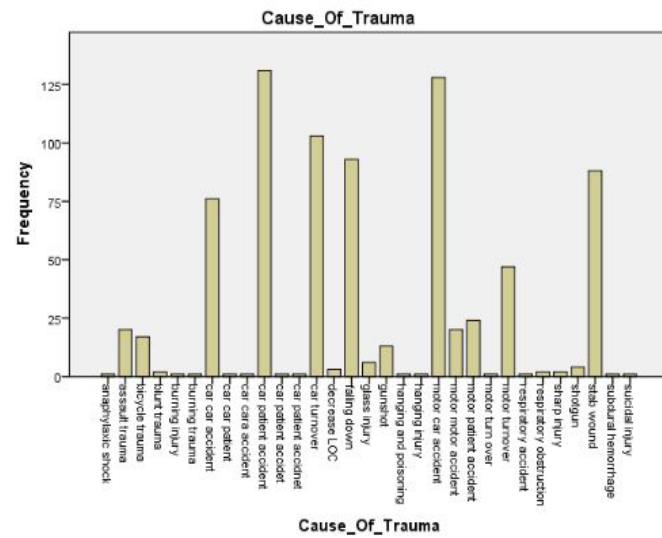

Figure 1: Frequency of Causes of Trauma in the Studied Patients.

The most frequent pathologic finding included rib fractures (42.7%), pneumothorax (11.6%), abnormal diaphragmatic findings (10.3%), and hemothorax (8.3%). The frequency of all radiologic findings is demonstrated in Table 1.

RIGHT	No.	%	LEFT	No.	%	Total percentage
Pneumothorax	38	4.8	**Pneumothorax**	54	6.8	11.6
Hemothorax	65	8.2	**Hemothorax**	1	0.1	8.3
Diaphragm Abnormalities	25	3.2	**Diaphragm Abnormalities**	56	7.1	10.3
Clavicle Fx	28	3.5	**Clavicle Fx**	25	3.2	6.7
1st Rib Fx	5	0.6	**1st Rib Fx**	4	0.5	1.1
2nd Rib Fx	16	2.0	**2nd Rib Fx**	13	1.6	3.6
3rd Rib Fx	21	2.7	**3rd Rib Fx**	24	2.7	5.4
4th Rib Fx	24	3.0	**4th Rib Fx**	24	3.0	6.0
5th Rib Fx	27	3.4	**5th Rib Fx**	20	2.5	6.9
6th Rib Fx	25	3.2	**6th Rib Fx**	20	2.5	5.7
7th Rib Fx	19	2.4	**7th Rib Fx**	22	2.8	5.2
8th Rib Fx	15	1.9	**8th Rib Fx**	18	2.3	4.2
9th Rib Fx	13	1.6	**9th Rib Fx**	7	0.9	2.5
10th Rib Fx	8	1.0	**10th Rib Fx**	4	0.5	1.5
11th Rib Fx	1	0.1	**11th Rib Fx**	3	0.4	0.5
12th Rib Fx	1	0.1	**12th Rib Fx**	0	0	0.1

Table 1: Frequency of Radiologic Findings of the Studied Patients.

Mean mediastinal width of patients was 80.9±11.45 (49.2-142.29) mm with a median of 79.43 mm. Mediastinal width was not significantly different by gender (P=0.36), but was significantly associated with age (P<0.001).

Pearson chi square test showed the association of cause of trauma with pathologies as follows: right and left pneumothorax (P=0.873 and 0.023), right and left hemothorax (P=0.115 and 0.998), diaphragm and clavicle problems (P=0.273 and 0.677, respectively), and rib fractures were not associated with cause of trauma, except right rib fracture (P<0.001). Right 9th and 2nd rib fracture was associated with sex (P=0.058 and 0.043, respectively), but other pathologies were not significantly correlated with patients' sex. Among cases with left pneumothorax 4 cases had car-car accident, 7 had motor-car accident, 16 stab wound, 8 cases car turnover, 6 falling down, 8 car-patient accident, 3 motor-patient accident, and 1 bicycle trauma, and 1 gunshot.

Regarding co-occurrence of pathologies, 7 cases (0.88%) had both right and left pneumothorax, 18 cases (2.27%) had both right and left hemothorax. 2 cases had right pneumothorax and right clavicle fracture, 1 case had right pneumothorax and left clavicle fracture, 12 cases had left pneumothorax and left clavicle fracture, 3 cases had right hemothorax and right clavicle fracture, and 7 cases had left hemothorax and left clavicle fracture.

4 cases had both right pneumothorax and right diaphragmatic abnormalities and 20 cases had both right hemothorax and right diaphragmatic abnormalities cases and 1 patient had both left pneumothorax and right diaphragmatic abnormalities, 3 patients had both left hemothorax and right diaphragmatic abnormalities. Right diaphragmatic abnormalities co-occurred with right clavicle fracture in 3 patients and none cases of left clavicle fracture.

Left diaphragmatic abnormalities co-occurred with right hemothorax in 11 cases, right pneumothorax in 2 cases, left pneumothorax in 11 cases, left hemothorax in 1 case, right clavicle fracture in 4 and left clavicle fracture in 1 patient.

Discussion

As the results of the current study, consistent to other studies [21-23], have demonstrated, most traumatized patients are young men who are considered the productive group in the society and performing CXR routinely for all traumatized patients entering the emergency room exposes them to a high radiation rate and increases health costs. Therefore, we have performed CXR selectively for indicated patients.

Traumatic injuries has scarcely been studied in Iran. A recent study in Shiraz declared a mean age of 26.6 years including 75.8% men and have reported 22.9% car accident as the commonest cause of injury [21]. Although they have not excluded chest trauma, their results are comparable to the current study. Another study in Zahedan assessed 768 traumatic patients with a mean age of 23 including 80% men and have similarly reported road traffic accidents as the most frequent cause (about 60%) [22]. The studied patients in the two above-mentioned studies were apparently younger and they have not separated the forms of car accidents to be comparable with our results. A wide-scaled study has evaluated 58013 traumatic patients in Tehran (48173 blunt trauma) and has reported a mean age of 27 years with a male-to-female ratio of 4:1 and have reported the most common causes of injuries as gunshot, traffic accidents involving pedestrians, and falling in hospitalized patients [23], which was also in accordance with our results, as we also had a 4.78:1 male-to-female ratio. Although they have also not reported different statistics by body regions, they have reported

thorax as the third rank in most severe injuries. A population-based study in 2003 also reported road traffics in 1071 million males as the highest cause of disability premature deaths in Iran [24]. Parallel to the results of the current study, the most traumatized patients are young male who are considered the productive group in the society. Thus, paying attention to their initial care is necessary to provide the best approach for diagnosis and treatment and increase their survival.

Considering the radiologic findings, the commonest pathologies in the current study included rib fractures (42.7%), pneumothorax (11.6%), abnormal diaphragmatic findings (10.3%), and hemothorax (8.3%). Similarly have other studies reported different rates of abnormal CXR findings [9,17,25]. The rate of pneumothorax in the current study was lower than the mentioned studies, but as they also confirmed, pneumothorax can become a dangerous entity for the patient and its early diagnosis is essential in traumatic patients and studies have introduced different imaging methods as the most proper, accurate, and rapid imaging technique for its diagnosis; some have suggested CT [15], while others have concluded similar results reported by CXR and ultrasound [18]. As long as CT scan has a high cost, radiation rate, and long duration of imaging time and may be unavailable in all centers of our country, the trauma guideline of Rajaie hospital has considered CXR as the initial assessment of traumatic patients.

As studies have confirmed, selective CXR, as performed in the present study, reduces the health costs and radiation amount and is a safe and efficacious policy that prevents further investigations [8,10], compared to routinely performed CXR for all patients that has low clinical value [12], especially in stable conscious trauma patients with normal physical examination [13]. As long as there is no consensus on the gold standard imaging method, the trauma guideline of Rajaie hospital has considered selective CXR as the initial assessment of traumatic patients.

To the best of our knowledge, this study is the first study that evaluated the details about the cause of trauma in chest traumas and the comprehensive causes of road accidents and trauma in the current study help the decision-makers to have a better view.

The present study had some strengths including controlling errors of the study, for instance the emergency medicine specialist who read the radiographs initially in the emergency ward was blind to the case.

Beside the advantages of this study, it also faced some limitations, including not considering other socio-economic, psychologic, and other demographic details of the patients. As far as the study was performed in the emergency ward and there was limited time for gathering further details of the patient, as the patient should have been diagnosed and treated rapidly. It would also be greater, if we could compare the results of radiographies with CT scans and ultrasonography that were not performed as

they are not included in the trauma guideline of Rajaie hospital. We also did not have the choice to follow the patients, to observe if they required repeating the imaging or what further interventions they needed. Future studies are needed to give the emergency medicine specialists a better view in diagnosis and management of multiple traumatic patients.

The results of the current study, in accordance to previous studies, suggest rib fractures, pneumothorax, abnormal diaphragmatic findings, and hemothorax as the most frequent findings in CXR that need to be assessed meticulously. Moreover, the majority of patients were young males and the most frequent causes of trauma included car accidents, falling down, and stab wound. Therefore, paying attention to their diagnosis and treatment may increase the survival of this important group of patients.

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