

Comparing the Interpretation of Traumatic Chest X-Ray by Emergency Medicine Specialists and Radiologists

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Background: Discrepancy between X-ray readings of emergency physicians (EPs) versus radiologists was reported between 0.95% and 16.8% in different studies. The discordance was even higher when specific studies such as chest X-rays (CXR) were probed.

Objectives: This prospective study was conducted to assess the discrepancies between emergency and radiology departments with respect to interpretation of the traumatic chest X-rays.

Patients and Methods: This prospective study was conducted in Shohadaye Tajrish Hospital, Tehran, Iran, from March to April 2014. Based on Advanced Trauma Life Support (ATLS) guidelines, plain chest radiography (CXR) was ordered for all patients in two standard views of posterior-anterior and lateral. All CXRs were interpreted by a corresponding emergency medicine specialist and a radiologist blind to the clinical findings of the patients. Finally, the results of two interpretations were compared. Accuracy, sensitivity, specificity, and predictive values of traumatic CXR interpretation were calculated by EPs with 95% of confidence interval (CI).

Results: The evaluation of EPs was identical to that of the radiologists in 89.5% of the cases. Ninety-eight percent (98%) indicated total agreement and 1.5 percent total disagreement.

Conclusions: There is a high agreement between EPs and radiologists in CXR interpretations in Shohadaye Tajrish Hospital. Thus, EPs can substitute radiologists in the emergency department. More improvements are recommended to achieve the standard level of agreement.

Keywords: Emergency Medicine; Advanced Trauma Life Support Care; Radiography, Thoracic; Radiographic Image Interpretation

1. Background

Emergency department (ED) is the critical ward in hospitals. Overcrowding and urgent nature of the patients makes EDs more crucial and turns them to a particularly challenging area. Therefore, the importance of accurate and fast diagnosis needed for a proper management is obvious (1, 2).

Traumatic patients make up the major bulk of emergency clients and almost always CXR is the most common investigation being used in their evaluation process. CXR usually requires to be interpreted by an emergency physician (EP) and management plans are initiated before the formal radiologist's interpretation (3). CXR is the most common type of radiograph that is misinterpreted by observers, especially in the ED, nevertheless not so much data are available regarding traumatic patients. Also, the considerable number of ED cases, including traumatic ones present in late evening, night, or weekend hours that access to the radiologist is nearly impossible. Thus, EPs may remain ignorant about the final read-

ing and finding their mistakes, which can have impact on patient's care (4, 5). The discrepancy rate between X-ray readings of EPs versus radiologists was reported between 0.95% and 16.8% in different studies. This discordance was even higher when some specific studies like CXR were probed (5, 6), but it did not assess well in traumatic patients. In addition, false radiologic interpretations were described differently in various studies. For instance, while some studies only take false negatives into account, in others both false negative and false positive cases were considered as misinterpretation. Thus, the reports of discrepancy vary between 14% and 33% in different studies (2, 6, 7).

Although CXR is a useful clinical imaging technique in ED, especially for the primary evaluation of traumatic patients, the diagnostic accuracy of CXRs still depends on the clinician's experience (8, 9). Advancement in techniques and equipment of diagnostic imaging (like digitalization) was made to improve the quality of CXR, but

it is too expensive to use in all health-care units. Since interpretation accuracy of traumatic CXR by EPs is vital, improvements in the diagnostic accuracy of CXR by developing the interpretation's technique could be more beneficial than technical improvements in the quality of CXRs (8,10).

2. Objectives

We conducted a prospective study to assess the discrepancies between emergency and radiology departments in the interpretation of CXRs.

3. Patients and Methods

This prospective study was conducted in the ED of Shohadaye Tajrish Hospital, Tehran, Iran, from March to April 2014. The study population comprised of patients referred to the trauma unit following multiple traumas. The study protocol was approved by Ethics Committee of Shahid Beheshti University of Medical Sciences and the informed consent form was fulfilled by the participants. Based on the advanced trauma life support (ATLS) guidelines, CXR was ordered for all patients in two standard views of posterior-anterior and lateral. Based on this method, we wanted to compare the mentioned skill by interpretation of posterior-anterior (PA) and lateral views, however, it is impossible or useless to obtain these views in patients who are hemodynamically unstable, have depressed level of consciousness, or flail chest. In these patients, an anterior-posterior (AP) portable chest was the alternative choice and sometimes chest CT may substitute PA and lateral views during their management process. Consequently, patients with hemodynamic instability, depressed level of consciousness, and flail chest were excluded.

All CXRs were interpreted by a corresponding emergency medicine specialist and the results were submitted in a specific data gathering form. Positive CXRs were considered as ones with any of the following findings: pneumothorax; hemothorax; dislocation rib; sternum, scapular, or clavicle fracture; wide mediastinum lung contusion;

and subcutaneous emphysema. All CXRs were interpreted again by a radiologist blind to the clinical findings of patients. Finally, the two interpretations were compared. Accuracy, sensitivity, specificity, and predictive values of traumatic CXR interpretation were calculated by an EP with 95% confidence interval (CI).

3.1. Statistical Method

The data were entered into the Microsoft Excel sheet. Statistical analysis was performed using MedCalc software. Descriptive statistics was generated using chi-square test to assay the difference in evaluation proportions. The proportion of agreement (po) in each diagnostic item was calculated as the percentage between the sum of correct evaluations and the total evaluations. Bland-Altman plot was used to indicate the upper and lower limits of agreement. P value ≤ 0.05 was considered statistically significant.

4. Results

Of 105 patients, 82 were male and 23 female. Their ages ranged from 1 to 75 years (33.1 ± 14.1). The most common physical examination findings were as follows: destructive injury (92.4%), abnormal chest exam (21%), local chest pain (17.1%), and shoulder tenderness (8.6%).

The EP evaluation was identical to that of the radiologist in 89.5% of the cases. The total proportion of agreement was 98.5% and disagreement was 1.5%. The proportion of agreement in each item is shown in Table 1 and Figure 1.

The upper marker indicates the least agreement, 92.4%, achieved in normal chest and the lower marker shows the highest agreement, 100%, in cases with cardiomegaly, wide mediastinum, sternal fracture, and dislocation. Sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) of EP in traumatic CXR interpretation were 100% (95% CI: 62.91-100.00), 100 (95% CI: 96.23-100), 100% (95% CI: 62.91-100), and 100 % (95% CI: 96.23-100), respectively.

Table 1. Details of Agreement Proportion

Cases/With	χ^2	P value	Agreement, %	Disagreement, %
Normal cases	91.273	P < 0.0001	92.4	7.6
Hemothorax	25.748	P < 0.0001	99.0	1.0
Pneumothorax	58.300	P < 0.0001	98.1	1.9
Lung contusion	58.300	P < 0.0001	98.1	1.9
Scapular fracture	25.748	P < 0.0001	99.0	1.0
Clavicle fracture	58.300	P < 0.0001	98.1	1.9
One-rib fracture	25.748	P < 0.0001	99.0	1.0
Two-rib fracture	72.061	P < 0.0001	97.1	2.9
Sternal fracture	identical	-	100	0
Wide mediastinum	identical	-	100	0

ical factor of preparedness in EPs interpreting the radiographs that could be eliminated if the study was designed to compare EPs vs. radiologists. A proof supporting of this factor is that the degree of agreement was least in the normal CXRs (92.4%). EPs tend to give attention to any possible findings, which make false positive interpretations.

5.1. The Possible Solutions

Lucas et al. (14) suggested enhancing the part of radiology in the residency curriculum of emergency medicine, which would enable radiologists to interpret radiographic images perfectly.

Maryland University had a leading experience (15) in developing a network system that allows radiologists to interpret the radiographic findings without a physical presence in the ED. It is also a rapid system that allows radiologists to overlook the preliminary interpretations and comments of Eps, which will supply the missing parts regarding the historical information of the patient and the impression of EPs towards the patient.

Continuous training and weekly courses for EPs are recommended solutions that will enhance their CXR interpretative skills and minimize the possible errors till a solo interpretation, independent from radiologists, can be achieved with less than 0.3% discordance.

In case of urgent cases, when EPs' interpretation is needed, it is recommended to interpret those CXR images by a senior EP, not a house officer, resident, or nurse. According to Guly, the educational degree was associated with the percentage of misdiagnosis errors (16).

Ghane et al. (8) described a new interpretation method for CXR to detect small size pneumothorax; this method increased the accuracy of EPs interpretations. Indeed, such low cost methods are recommended.

5.2. Limitations of the Study

The study did not reveal the effect of the experience or academic degree on the accuracy of CXR interpretations.

There is a high agreement between EPs and radiologists in CXR interpretations in Shohadaye Tajrish Hospital, Tehran, Iran. EPs can substitute radiologists in the ED. Of course, more improvements are needed to achieve the standard level of agreement.

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