

# How Effective is Chest X-Ray Request in Patients Admitted to the Emergency Department in Clinical Decision Making?

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## ABSTRACT

Chest X-ray is known as a useful, standard, non-invasive, and available method of imaging to check the respiratory tract, Parenchyma and pulmonary arteries, Mediastinum, pleura, and chest wall. However, the practical value of CXR in decision making during treatment in emergency departments is not exact yet. This study was performed to investigate the correspondence of requested CXRs with an indication as cross-sectional research and among patients aging from 9 to 90 years and admitted at the emergency department of an educational hospital. Accordingly, the effect of mentioned radiographs. Employing SPSS-23 software, all statistical analysis was performed. By checking radiographs, it was revealed that 49% were according to indication, and 51 % were not according to indication. Generally, 58.2 % of radiographs did not affect treatment, and 32.3 % were verifying treatment, and 9.5 % lead to a change in treatment. The maximum conformity with indication was for shortness of breath (91%), and the minimum conformity was related to abdominal pain (65.5%). For low-quality radiographs, 56.39% of them had an indication. Not regarding indications for CXR, not only cannot make any change in diagnosis and treatment but also cause personnel exhaustion, equipment depreciation, human resource waste, and cost in care. Despite the low cost of one unit of CXR, the aggregate number of chest radiographs obviously imposes a considerable cost to a health care system annually. Accordingly, CXR should not take place merely because of admission to a hospital.

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## Introduction

Chest X-ray is a standard, non-invasive, and available imaging method to check the respiratory tract, Parenchyma and pulmonary arteries, Mediastinum, pleura, and chest wall without requiring intricate equipment and with convenient and fast interpretation [1-3]. This type of radiography is the most prevalent imaging method conducted in hospitals worldwide and consists of between one-third to half of all performed radiographies [4].

Despite what has been mentioned, the practical value of CXR in decision making during treatment in emergency departments is not exact yet. Several studies have been conducted, which led to different results concerning different settings. Studies revealed that chest radiography does not impress clinical decision-making by physicians as a usual way [5-7]. Some researchers have reported using CXR to help patients referred to an emergency department [8-10], where other groups of researchers have reported it to be futile [11-13]. Several studies have introduced and examined new criteria to limit CXR requests for chest pain [14,15].

Regarding the mission of emergency medicine objectives, prioritizing patients' complaints by considering disorders and threatening incidence, conducting any unnecessary measure leading to delay on diagnosis and treatment process is against the intrinsic values of this area of science which may prolong patients stay in emergency department and false decrease in capacity for reception of patients. We aimed to investigate the conformity of requested chest radiographs among patients and inpatients admitted to the emergency department of an educational hospital and evaluate its effect on clinical decision-making and medical treatment costs.

Despite the low cost of a CXR unit, the total number of chest radiographs per year imposes a high cost on the health care system. Based on this, we decided to examine the chest X-rays performed in a hospital's emergency department in a specific period.

## Methods and Materials Study design

This study was performed to investigate the correspondence of requested CXRs with an indication as cross-sectional research among patients admitted to the emergency department of an educational hospital. All legal permits from the University Ethics Committee have been reviewed for this study, and ethical codes have been recorded. The researcher remained committed to the Helsinki Declaration at all stages of the study.

## Definition

The correspondence of requested CXRs with indications were performed according to Rosen's Emergency Medicine (2018) as an educational reference in the emergency medicine area of study. To investigate the correspondence of CXR with an indication, two emergency medicine specialists studied clinical examinations and descriptions, differential diagnoses, and prescriptions. In case of disagreement, calling for a third specialist opinion was

established. To explore the effect of CXR on a treatment plan, they studied prescriptions, history of disease, and summary of medical documents and files.

## Statistical population

A population of 400 patients of the emergency department aged from 9 to 90 years was studied. In these patients' treatment, chest radiography, including poster anterior view, lateral view, lateral decubitus, and portable, was obtained.

## Data Collection

Information was gathered by random checking of patient's files who were admitted by the emergency department. Selecting 100 files of each section after randomization by www.random.org website, desirable information was gathered and registered according to checklists.

## Statistical analysis

Statistical analysis was conducted by SPSS-23 software. Normality of data distribution was examined through One-Sample Kolmogorov-Smirnov Test. For descriptive analysis, normal quantitative variables were described by mean value, and standard deviation and quantitative non-normal variables were stated through the median (range between 25-75 percentiles) where qualitative variables were presented through percentage amount. The chi-square test was used to compare qualitative variables and frequency percentages, and for quantitative variables, the T-test was established. Kappa statistic was employed to demonstrate the correspondence between CXR request and indication. 0.05 was considered a significance level for all performed analyses.

## Findings

Among 400 patients, 43.8 % were women, and 56.3% were men. The mean value of their age was 52.25 years. Second work shift (11 AM-3 PM) with 24.8 % of frequency and sixth work shift (3 AM- 7 AM) with 4.8% of frequency were hosting most and least number of patients, respectively. Abdominal pain (21.7 %), shortness of breath (11.3 %), and trauma (10.3 %) were the leading causes of referring to the emergency department. By checking radiographs, it was revealed that 49% of them were according to indication, and 51 % were not in accordance with indication.

Generally, 58.2 % of radiographs did not affect treatment, 32.3 % were verifying treatment, and 9.5 % led to a change in treatment. For radiographs inconsistency with indication, 62.4% of associated treatment was verified radiography. In 24.7% of cases, there was no effect on treatment by corresponding radiography, and only 12.6% of cases led to a change in treatment. For radiographs in nonconformity with an indication, 6.8% of conducted radiographs led to a change in treatment, 90% without any effect, and 3% confirmed the therapy. According to the results of this study, there was a significant relationship between indication and the effect of CXR on the treatment plan. (P-value<0.0001)

According to indications, the radiographs that took place coincided with the conclusion that this group of patients is significantly older than those with radiographs nonconforming indication ( $P < 0.05$ ). The maximum accordance of radiographs and indications was for the morning shift (7 AM-11 AM), and the minimum frequency was for the late-night working shift (3 AM-7 AM).

Results revealed that 66.8% of radiographs had appropriate quality, and 33.2% were not good. 45.3% of high-quality radiographs had indication, and 54.6% of those were without indication. For low-quality radiographs, 56.39% indicated, and 43.6% were done without indication. In 9.7% of low-quality radiographs, radiologists could not provide an interpretation.

The cost of performing a chest x-ray in 1995 in public centers was 136752 Rials and in private centers was 262200 Rials. Due to the average number of 50 chest x-rays per day in the emergency department, the annual cost of performing graphs without indication (51%) is a considerable amount of 1277810688 Rials.

## Discussion

The current study revealed that more than half of the chest radiographs are performed in an educational hospital's emergency department without precise indication. Among 400 patients, 205 cases were done without indication (51.2%). On the other hand, 74 cases (37.9%) of requests (out of 195 requests) could not satisfy desirable quality. If the radiology department had not been overwhelmed with radiographic requests without indication, then it would have been possible to guarantee optimal quality radiological films in all cases with benefits in establishing appropriate treatment.

Some research has reported routine CXR beneficial, and some have not counted it as a beneficial approach. Depending on the country's situation, the amount of treatment and per capita health may have different policies, but in the middle- and lower-income countries, it would be better to have stricter policies to protect the barriers. In a study, Speets et al., have explored the influence of CXR on treatment decision in the Netherland. This study suggested that CXR can help physicians in 60% of clinical decision-making cases, and hence that would be necessary and economic [16]. A study by Hubble et al. examined routinely captured CXRs in internal wards for patients who were among highly contagious cardiopulmonary diseases. 4% of radiographs led to a change in treatment. According to the mentioned study results, request routine CXR has subtle effects on patient care even among a population of positively affected cardiovascular disease [17].

Another study by Malnik in 2010 studied CXR performing for patients. CXR was not conducted for 19.6 % of patients, and 80.4 % of patients went under CXR. 23.5% of radiographs have considerably helped recognize, diagnose, and treat such that it had a

positive contribution in 11.2% and negative contribution in 28.1%. Also, it did not affect diagnosis and management in 33.8 %. The author found that CXR is useful for patients who had significant findings in examination and indication [18]. Emerman's study on COPD exacerbation patients of the emergency department has reported unpredictable radiographic findings in 25% of patients. This study's ultimate inference was the necessity of CXR for diagnosis of complications and correct treatment [19]. Tsai has also studied patients that have reported COPD exacerbation, and their symptoms had not been controlled and needed to be hospitalized. The author found that patients who had not complication signs despite their severe and abiding symptoms cannot benefit from CXR [20]. Moreover, Poku reported the lack of benefits of chest radiography results. Patients with chest pain as the main complaint and attending to the emergency department were studied. The author concluded that radiography is not useful for clinical decision-making in CHF absence, smoking, and abnormal respiratory sounds [21].

As mentioned, even in patients with shortness of breath, routine chest X-rays may not be very useful in treatment. Verma (2011) investigated medical records of non-surgical inpatients. Chest radiography took place in 43.6% of cases merely because of patients' complaints. Also, this kind of screening routinely took place in 56.3% of cases to limit hidden results. For 129 (43.4%) patients, chest wall deformity was reported. It was not helpful for 51 patients among 56. Findings suggested a need for changes in treatment for 5 cases of 129 patients (3.87%). It was concluded that chest screening could scarcely demonstrate unrecognizable clinical findings [22]. In Sagar studied 435 patients diagnosed with myocardial infarction, and 86% had chest radiography. 77.5% of radiographs were not technically satisfactory. Abnormal radiographs were found for 61 patients (16.4 %). Clinical management changed only in 14 (3.8%) individuals (among 61 patients). They concluded that CXR is not useful for myocardial infarction in patients with no clinical indication [23]. Birkemeier studied the necessity of CXR for patients complaining of consciousness level changes and referring to ED. The researcher found that CXR influences 17% of clinical decision making; hence, CXR helps this category of patients [24]. In another study on 100 patients with routine chest radiographs for acute changes in mental status, 17 results led to a change in treatment where 15 patients had no apparent symptoms, confirming the necessity of chest radiography for them [25].

Gleadhill reached identical results in studying CXRs for injured patients referred to the hospital by EMS. This study suggested that both can take advantage of traumatic patients and the treatment system by determining a limited protocol to conduct CXR [26]. Moreover, Sears (2004) examined 772 patients in a level one trauma center for 12 months. They reported that it is not obligatory to conduct radiography for all patients referring to blunt chest trauma. Resorting to a surgeon's opinion to determine radiography-needed cases results in a decrease of 50% in the

number of requested CXRs and corresponding expenses as well as accuracy [27].

Routine chest X-ray in patients with respiratory complaints and chest trauma may help diagnose and manage the patient. However, in patients with non-respiratory complaints, routine chest X-rays can lead to high health system costs and increased workload on the medical system.

## Conclusion

Conducting CXR without true clinical indication not only could not change clinical diagnosis but also have various negative effects on resource utilization and financial services. Also, burden volume would increase for emergency radiographs and result in low-quality images that cannot provide desirable goals. Also, many patients would be deprived of optimal radiographic services due to unreasonable requests for CXR. Despite low cost of one unit of CXR, the aggregate number of chest radiographs obviously impose a considerable cost to a health care system annually. Accordingly, CXR should not take place merely because of hospital reception. Although routine radiological evaluation appears to be more common due to the epidemic of COVID-19 disease, it should be considered that it will impose a high cost on the health care system.

## Suggestions

- By identifying cases that may not take advantage of chest radiography, we can reduce surplus expenses and excel in human resource management and treatment acceleration.
- By devoting more attention and care to clinical examinations and descriptions, differential diagnosis can be limited and then remove screening without indications.
- Further studies with larger sample sizes and multicenter studies and different time intervals are suggested.

## Conflict of Interest

There was no Conflict of interest in the current research.

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