

Original article:

Assessment of Clinical Effect of Chest Radiographs by Analyzing Medical Records: A Retrospective Analysis

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Abstract

Background: Trauma forms the leading cause of mortality among children and in most cases of geriatric patients. About one fourth to fifth of the total traumatic deaths are caused due to major thoracic injuries. For better prognosis and favourable treatment outcomes, it is important to identify these injuries at the earliest. A high mortality rate ranging from 10 to 25 percent has been noticed in patients suffering from major thoracic injuries. Literature has paucity of data on the early diagnosis and monitoring of diseases from radiological point of view. Thus we conducted this retrospective analysis evaluate the clinical influence of chest radiography in a large number of examinations.

Materials & Methods: 1790 Chest radiographs were collected from various clinical departments out of which 1000 were male and 790 were female. The examinations were performed during a six-week period. The classification of chest radiograph was normal, incidental, or pathologic. Normal was defined as without incidental or pathologic findings in the parenchyma, pleurae, or hila. Incidental findings were defined as a chest examination showing findings deviating from normal but without need for medical treatment. Incidental findings included changes such as aortic calcifications, elongated thoracic aorta, minor pleural calcifications or scars, or mild chronic obstructive disease. Pathologic findings were those in need of medical treatment, such as pneumonic infiltrates, cardiac incompenation, pneumothorax, or rib fractures. Primarily it was noted whether the medical records contained any written reference to the radiological examination, apart from the proper radiology report. Statistical analysis was performed using all the results were analyzed by SPSS software. Chi-square test was used to analyze the level of significance.

Results: Maximum radiographs were referred from department of internal medicine, while approximately 25% of the cases were referred from the general surgery department. Pathologic findings were noticed in approximately 50 %of the total radiographs while less than 10 % showed incidental findings. Half of the cases had major influence in treatment planning while in less than 10 % cases, no influence occurred on treatment. The highest annotation rate of the radiologic outcome in the clinical medical records, about 60 %, occurred when the radiologic outcome had a major influence on treatment.

Conclusion: Chest radiology examinations in the medical records have a low rate of annotation.

Key Words: Examination, Radiographs.

INTRODUCTION

Trauma forms the leading cause of mortality among children. In geriatric patients also, it forms a major cause of death. An estimated economic impact of over \$650 billion has been put over the economy of United States in 2007.¹ About one

fourth to fifth of the total traumatic deaths are caused due to major thoracic injuries.² For better prognosis and favourable treatment outcomes, it is important to identify these injuries at the earliest. A high mortality rate ranging from 10 to 25 percent has been noticed in patients suffering from major

thoracic injuries.³⁻⁶ Literature has paucity of data on the early diagnosis and monitoring of diseases from radiological point of view.^{7,8} Thus we conducted this retrospective analysis evaluate the clinical influence of chest radiography in a large number of examinations.

MATERIALS & METHODS

Chest radiographs requested from clinical departments performed on 1000 male and 790 female patients were evaluated. The age range was 17–98 years (median 62 years). The age range for male patients was 17–91 years (median 64 years), and the age range for female patients 18–98 years (median 70 years). The examinations were performed during a six-week period. The classification of chest radiograph was normal, incidental, or pathologic. Normal was defined as without incidental or pathologic findings in the parenchyma, pleurae, or hila. Incidental findings were defined as a chest examination showing findings deviating from normal but without need for medical treatment. Incidental findings included changes such as aortic calcifications, elongated thoracic aorta, minor pleural calcifications or scars, or mild chronic obstructive disease. Pathologic findings were those in need of medical treatment, such as pneumonic infiltrates, cardiac incompenation, pneumothorax, or rib fractures. At the time of the study electronic medical records had not been fully implemented, and medical records were available on paper and on microfilm. The referring physician's reaction to the radiologic outcome (how the referring physician evaluated the report) was divided into three groups (highly expected results, moderately expected results, and unexpected results). Highly expected results were those where the clinician received confirmation of a clinical suspicion of pathology such as pneumonia or a normal radiography report on a routine study done for screening purposes.

Moderately expected results were those where clinical suspicion was not very high but was confirmed, or another chest pathology than the suspicion given in the referral form was present to account for symptoms. Unexpected results were those where the radiologic findings were contrary to the clinical suspicion, such as normal chest radiography on a patient with clinical suspicion of pneumonia. The influence of the chest radiography examination on the patients' treatment was divided into four groups: major influence, moderate influence, minor influence, and no influence. Major influence represented a radiology report that initiated or changed medical treatment. Moderate influence represented cases where the outcome of chest radiography confirmed the tentative clinical diagnosis, and treatment was started. Minor influence represented cases where radiology confirmed already diagnosed disease and induced no change in treatment. No influence represented cases where radiology did not influence treatment. All available medical records including daily notes, nurses' records, summaries, and the request forms for chest radiography were analyzed. Primarily it was noted whether the medical records contained any written reference to the radiological examination, apart from the proper radiology report. Statistical analysis was performed using all the results were analyzed by SPSS software. Chi-square test was used to analyze the level of significance.

RESULTS

About 90% of the radiographs came from the department of internal medicine, while one fourth of the cases were referred by department of general surgery. Pathologic findings were noticed in approximately 50% of the total radiographs while less than 10% showed incidental findings as shown in **Graph 1**. **Graph 2** shows influence of radiographs on the treatment. About 50% of the

cases had major influence in treatment planning while in less than 10 % cases, no influence occurred on treatment. The highest annotation rate of the radiologic outcome in the clinical medical records, about 60 %, occurred when the radiologic outcome had a major influence on treatment (**Table 1**). Successively lower annotation rates were noted for the groups of medium and minor influence.

DISCUSSION

For the assessment of pulmonary vascular hemodynamic and its related disorder, a physician rely mostly on the chest X-rays since they represent a non-invasive procedure. In contrast to the observations presumed by most of the physicians, the sensitivity of chest radiographs is not very good.⁹The real value of radiology for the referring physician and the patient can be assessed by analyzing its clinical utility. One obvious way of doing this is to register and analyze how and when radiology has induced treatment changes or been used to monitor treatment. A large number of papers report the lack of clinical utility or efficacy of routine admission,¹⁰ screening,¹¹ and preoperative^{12, 13} and postoperative chest X-rays.¹⁴Maximum utility of these chest radiographs lies in the routine admission process which forms the main clinical indications of chest radiography.¹⁵ Chest radiographs in which pathologies can be located have a better impact on the clinical practice in contrast to the chest radiographs in which no pathologic lesion is seen.^{16- 18}Thus we retrospectively analysed the clinical influence of chest radiography in a large number of examinations.

In the current study out of the 500 pathologic examinations, moderately expected and unexpected outcomes were noted in approximately 35.5%. Unexpected outcome was noted in almost 10 % of all examinations. Higher influence of Chest radiographs demonstrating pathology has been

notice in the clinical treatment in comparison to the radiographs demonstrating incidental or normal findings. This is similar with the findings from other reports on hospital populations¹⁹ or patients referred by general practitioners.²⁰Radiological reports without radiological pathologic findings impose a special problem for the assessment of the influence of reports. Since literature quotes none or minimal studies which could utilize the data on the negative examination report of radiology, such reports should not be underestimated. On the other hand, there maybe increased number of false positive findings in a population with low prevalence of disease.^{21, 22}Disease prevalence has been deeply studies by Kundel et al and they hypothesized that high impact on the positive predictive value of a test is generated by disease prevalence.²³In an example presented in that paper, it is shown that as the prevalence of disease is changed; the positive predictive value of a diagnostic test is also changed. For instance, if the prevalence of disease in one population is 5% but 0.05% in another, a diagnostic test with a sensitivity of 95% and a specificity of 99% would have a positive predictive value of 83% in the population with a disease prevalence of 5%, but only 4.5% in the population with a disease prevalence of 0.05%.²⁴In a report on a change of strategy in an ICU, from routine to on-demand chest radiography, the same amount of abnormalities was detected on a reduced number of chest radiographs without affecting the readmission rate, ICU, or hospital mortality rates.²⁵ In a study by Malnick et al., there were relevant findings on physical examination or a clear clinical indication for performing the test only when chest radiography had significant impact on patient management.²⁶Milkovic et al evaluated the chest Radiography Findings in Primary Pulmonary Tuberculosis in Children. From the results, they

concluded that the parenchymal changes are clearly strongly present, and should be sought and appreciated in the diagnostic work-up for pulmonary tuberculosis in childhood but leading radiographic finding in pulmonary tuberculosis in childhood remains hilar lymphadenopathy.²⁷

CONCLUSION

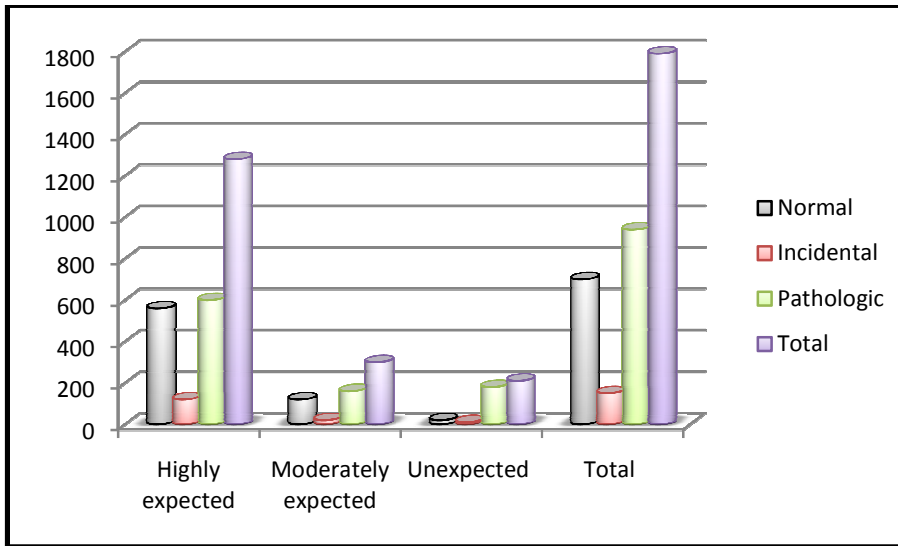
Under the observation of the above results, the authors concluded that a low rate of annotation exist for the radiological examination of the chest in the medical records. Future studies are recommended.

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Graph 1:Correlation between radiographic outcome and clinician’s expectations in 1790 chest radiographs, grouped according to the chest radiography findings.



Graph 2:Change of treatment planning by 1790 radiographic chest examinations, grouped according to chest radiographic outcome.

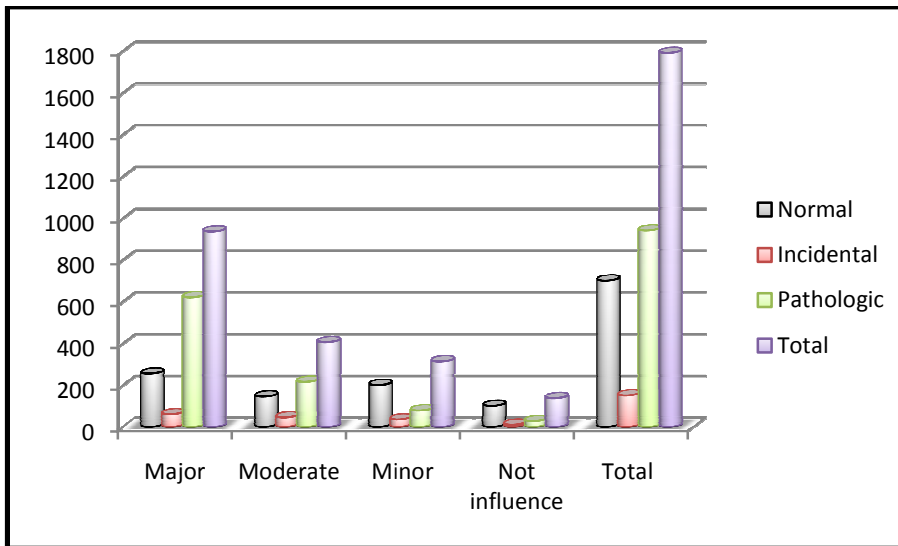


Table 1:Annotations' rate in the medical records about the outcome of chest radiography of 1790 examinations, grouped according to influence of the chest radiography outcome on treatment.

Variable	Annotation	No annotation	Total
Major	560	399	970
Moderate	210	210	435
Minor	46	260	320
No influence	22	83	120
Total	838	952	1790