

**Original article:**

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

**Dr. Sunil Kumar**

Associate Professor, Department of Radiodiagnosis, TeerthankerMahaveer Medical College & Research Centre, TMU, Moradabad, Uttar Pradesh, India.

**Corresponding Author:** Dr. Sunil Kumar, Associate Professor, Department of Radiodiagnosis, TMMC & RC, TMU, Moradabad, UP, India.

---

### **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.<sup>1</sup> About one

fourth to fifth of the total traumatic deaths are caused due to major thoracic injuries.<sup>2</sup> 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.<sup>3-6</sup> Literature has paucity of data on the early diagnosis and monitoring of diseases from radiological point of view.<sup>7,8</sup> 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.<sup>9</sup>The 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,<sup>10</sup> screening,<sup>11</sup> and preoperative<sup>12, 13</sup> and postoperative chest X-rays.<sup>14</sup>Maximum utility of these chest radiographs lies in the routine admission process which forms the main clinical indications of chest radiography.<sup>15</sup> 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.<sup>16- 18</sup>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 populations<sup>19</sup> or patients referred by general practitioners.<sup>20</sup>Radiological 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.<sup>21, 22</sup>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.<sup>23</sup>In 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%.<sup>24</sup>In 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.<sup>25</sup> 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.<sup>26</sup>Milkovic 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.<sup>27</sup>

## CONCLUSION

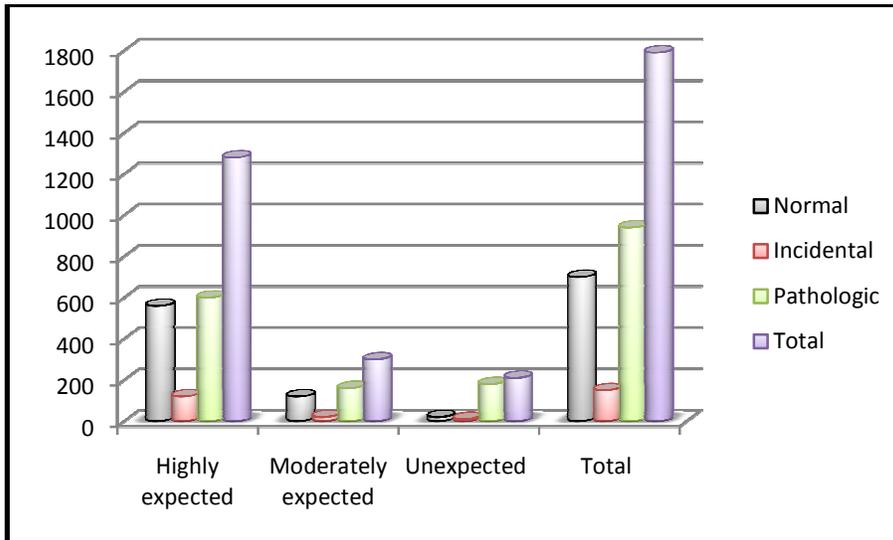
Under the observation of the above results, the authors concluded that a low rate of annotation exist for the radiological examination of the chest in the medical records. Future studies are recommended.

## REFERENCES

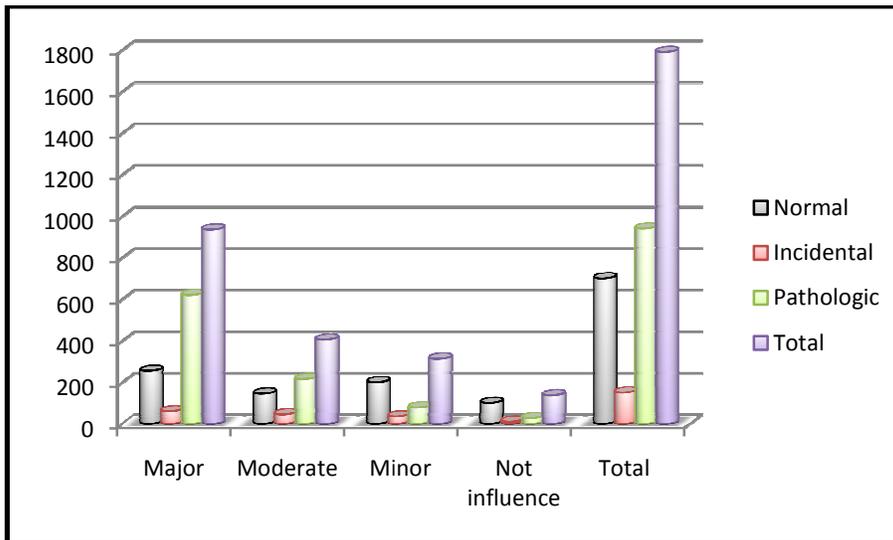
1. National Safety Council: Report on Injuries in America; 2009. Available: <http://www.east.org/resources/treatment-guidelines/cervical-spine-injuriesfollowing-trauma> Accessed: October 14, 2010.
2. Trupka A, Waydhas C, Hallfeldt K, et al: Value of thoracic computed tomography in the first assessment of severely injured patients with blunt chest trauma: results of a prospective study. *J Trauma* 2007, 43(3):405–412.
3. Peters S, Nicolas V, Heyer CM: Multidetector computed tomography spectrum of blunt chest wall and lung injuries in polytraumatized patients. *Clinical Rad* 2010, 65:333–338.
4. Deunk J, Brink M, Dekker HM, et al: Routine versus selective Multidetector-Row Computed Tomography (MDCT) in blunt trauma patients: level of agreement on the influence of additional findings on management. *J Trauma* 2009, 67(5):1080–1086.
5. Keough V, Pudelek B: Blunt chest trauma: review of selected pulmonary injuries focusing on pulmonary contusion. *AACN Clinical Issues* 2001, 12(2):270–281.
6. Magret M: Lung trauma. *Clinical Pulm Med* 2010, 17(2):75–81.
7. J. T. Geitung, L. M. Skjærstad, and J. H. G'othlin, "Clinical utility of chest roentgenograms," *European Radiology*. 2009; 9: 721–723.
8. A. M. Speets, Y. van der Graaf, A. W. Hoes et al., "Chest radiography in general practice: indications, diagnostic yield and consequences for patient management," *British Journal of General Practice*. 2006; 56(529): 574–578.
9. Dash H, Lipton MJ, ChatteyeeK, Parmley WW: Estimation of pulmonary artery wedge pressure from chest radiograph in patients with chronic congestive cardiomyopathy and ischemic cardiomyopathy. *Br Hearr J* 1980; 44: 322-26.
10. V. Verma, V. Vasudevan, P. Jinnur et al., "The utility of routine admission chest X-ray films on patient care," *European Journal of Internal Medicine*, vol. 22, no. 3, pp. 286–288, 2011.
11. A. Kubik, D. M. Parkin, M. Khlát, J. Erban, J. Polak, and M. Adamec, "Lack of benefit from semi-annual screening for cancer of the lung: follow-up report of a randomized controlled trial on a population of high-risk males in Czechoslovakia," *International Journal of Cancer*, vol. 45, no. 1, pp. 26–33, 1990.
12. M. Gagner and A. Chiasson, "Preoperative chest x-ray films in elective surgery: a valid screening tool," *Canadian Journal of Surgery*, vol. 33, no. 4, pp. 271–274, 1990.

13. C. Archer, A. R. Levy, and M. McGregor, "Value of routine preoperative chest x-rays: a meta-analysis," *Canadian Journal of Anaesthesia*, vol. 40, no. 11, pp. 1022–1027, 1993.
14. J. Munro, A. Booth, and J. Nicholl, "Routine preoperative testing: a systematic review of the evidence," *Health Technology Assessment*, vol. 1, no. 12, pp. 1–62, 1997.
15. S. Malnick, G. Duek, N. Beilinson et al., "Routine chest Xray on hospital admission: does it contribute to diagnosis or treatment?" *Israel Medical Association Journal*, vol. 12, no. 6, pp. 357–361, 2010.
16. J. T. Geitung, L. M. Skjærstad, and J. H. Gøthlin, "Clinical utility of chest roentgenograms," *European Radiology*, vol. 9, pp. 721–723, 1999.
17. A. M. Speets, Y. van der Graaf, A. W. Hoes et al., "Chest radiography in general practice: indications, diagnostic yield and consequences for patient management," *British Journal of General Practice*, vol. 56, no. 529, pp. 574–578, 2006.
18. American College of Surgeons: Advanced Trauma Life Support for Doctors, Student Course Manual. 7th edition. Chicago, IL: ACS; 2004.
19. T. Geitung, L. M. Skjærstad, and J. H. Gøthlin, "Clinical utility of chest roentgenograms," *European Radiology*, vol. 9, pp. 721–723, 1999.
20. A. M. Speets, Y. van der Graaf, A. W. Hoes et al., "Chest radiography in general practice: indications, diagnostic yield and consequences for patient management," *British Journal of General Practice*, vol. 56, no. 529, pp. 574–578, 2006.
21. M.C.Charny, G. M. Roberts, P. Beck, D. J.T.Webster, and C. J. Roberts, "How good are case notes in the audit of radiological investigations?" *Clinical Radiology*, vol. 42, no. 2, pp. 118–121, 1990.
22. R. F. McKee and E. M. Scott, "The value of routine preoperative investigations," *Annals of the Royal College of Surgeons of England*, vol. 69, no. 4, pp. 160–162, 1987.
23. "Routine preoperative investigations are expensive and unnecessary," *The Lancet*, vol. 322, no. 8365, pp. 1466–1467, 1983.
24. S. Neragi-Miandoab, M. Wayne, M. Cioroiu, L. M. Zank, and C. Mills, "Preoperative evaluation and a risk assessment in patients undergoing abdominal surgery," *Surgery Today*, vol. 40, no. 2, pp. 108–113, 2010.
25. L. Rucker, E. B. Frye, and M. A. Staten, "Usefulness of screening chest roentgenograms in preoperative patients," *Journal of the American Medical Association*, vol. 250, no. 23, pp. 3209–3211, 1983.
26. D. J. Grier, L. J. Watson, G. G. Hartnell, and P. Wilde, "Are routine chest radiographs prior to angiography of any value?" *Clinical Radiology*, vol. 48, no. 2, pp. 131–133, 1993.
27. R. H. Stables and B. Trotman-Dickenson, "Prospective assessment of the value of a chest radiograph in the performance of diagnostic cardiac catheterisation in adults," *British Heart Journal*, vol. 72, no. 6, pp. 540–541, 1994.

**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.

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