Impact of clinical data on interpretation of chest radiographs

On partial fulfillment of the post graduate program in radiology

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List of abbreviations

CXR: chest x ray

Pt: patient

Dx: diagnosis

DDx: Differential diagnosis

PA: posteroanterior

Hx- History

TAH- Tikur Anbesa Hospital

ROC- receiver operating characteristic

AAU- Addis Ababa University

Abstract

BACKGROUND: The inclusion of clinical information may have unrecognized influence in the interpretation of diagnostic testing.

OBJECTIVE: The objective of the study was to determine the impact of clinical history on chest radiograph interpretation.

DESIGN: Prospective hospital based cross sectional study.

METHODS: 10 residents, 4 second year and 6 third year residents evaluated a total of 100 frontal CXRs. Clinical information was withheld during the first interpretation. After one month the radiographs were reviewed with clinical information. The residents reported their finding using a standardized reporting tool containing different clinical parameters (i.e., pattern of infiltrate; alveolar infiltrate, interstitial infiltrate, air bronchograms, hilar adenopathy, pleural effusion etc.).

SETTING: Tikur Anbesa teaching and referral Hospital

RESULTS: The accuracy improved from fair (k ¼ 0.281, p-value 0.000) to moderate (k ¼0.418 , p- value 0.000) for identification of ‘‘hilar or mediastinal LAP’’, from moderate (k ¼ 0.557 , p- value -0.000) to substantial (k ¼ 0.705 , p-value – 0.000) for identification of pneumothorax , from fair (k ¼ 0.340 , p-value-0.000) to moderate (k ¼ 0.425 , p-value -0.000) for identification interstitial infiltrate with the addition of clinical history. The sensitivity increased from 23.5 % to 40%, from 44.4 % to 55.6 %, and from 46.2 to 51.3 % for hilar or mediastinal LAP, pneumothorax and interstitial infiltrate respectively with the addition of clinical history. Except for identification of the interstitial infiltrate which were found to be statistically significant,

for the rest two parameters there was an overlap of the 95 % CIs, suggesting that even though addition of clinical Hx resulted in higher sensitivity, it was not statistically significant. Although there was an increase in kappa values for Identification of ‘‘rib fracture ’’ and ‘‘pleural effusion,’’ and a decrease in the kappa value for identification of ‘‘cardiomegaly ’’, ‘‘alveolar infiltrate ’’, and “air bronchograms’’ with the addition of clinical information, there was substantial overlap of the 95% CIs, suggesting that inclusion of clinical history did not result in a statistically significant change in the reliability of these findings.

CONCLUSIONS: The addition of clinical Hx resulted in improvement in the sensitivity of many of the clinical parameters, interstitial infiltrate being statistically significant. The knowledge of clinical Hx also has an impact in interpretation of CXRs for the junior residents as compared to senior residents. So residents should be advised to obtain clinical Hx whenever they read.

1. Introduction

1.1 Background

The inclusion of clinical information in diagnostic testing may influence the interpretation of the clinical findings (1). The interpretation of radiographic image has several components one is perception of features (detection) another is decision making (cognitive process) (4).

Clinical history or impression given by referring physician could possibly establish preconceptions about the nature and location of suspected abnormality. This preconception can influence in 3 different ways 1st – the availability of the clinical Hx influences in a positive way and helps increase diagnostic accuracy , 2nd -the availability of the clinical history may increase false positive diagnosis, biasing the Overall interpretation and 3rd – knowledge of clinical history doesn't affect the accuracy of interpretation (1,2,5).

The impact of clinical information on the interpretation of radiographic studies remains an issue of debate. Previous studies have found that clinical information improves the accuracy of radiographic interpretation for a broad range of diagnoses (1–4) whereas others do not show improvement (5–7). Additionally, clinical information may serve as a distraction that leads to more false-positive interpretations. (8)

Such controversies seem to have resulted from different study models adopted by different researchers. (2)

The chest radiograph (CXR) is the most commonly used diagnostic imaging modality. Nevertheless, poor agreement exists among radiologists in the interpretation of chest radiographs. (1)

1.2 Statement of the problem

X-ray request form is a form of communication b/n the referring doctor and the radiology department .A well-defined, clear and relevant clinical information enables the radiologist to

optimize the diagnostic value of the radiograph requested thereby shortening the investigation time and also improving the quality of service offered to the patient.

Study done in Nigeria by O.A. Afolabi showed that Clinical information were adequate and complete in only 34.4%.

Research done in Khartoum by Mohamed O.Yousef et al. evaluated the completeness of radiologic examination forms; in this study Eleven elements of the request form: patient full name, patient age, patient sex, clinical indication, patient mode, patient history, last menstrual period, clearness of the requested exam, date of examination and referring physician name were analyzed using 5 governmental hospitals and 1 private center as a study area, and the result showed that less than 20% of the clinical history was detailed.

Previous reports have shown that up to 20% of radiographic examinations are clinically unhelpful either due to inappropriate or wrong request (6). Thus to improve the radiological support and utilization there is a need for adequately and relevant details of the radiological request (6). However inadequate request form filling is a worldwide problem.

Inadequately filled request forms lead to examination which is clinically unhelpful, exposes the patient with unnecessary radiation and also leads to delayed Dx which also indirectly affects the overall quality of patient care. Therefore objectively assessing the impact or influence of clinical data on interpretation of chest radiographs will help to improve the completeness of the radiology request forms especially of the detailed and relevant clinical data's thereby enabling the radiologist to optimize the diagnostic value of the films that have been requested.

1.3 Significance of study

Even though there is no research done on completeness of chest radiograph request forms in Ethiopia, as in many African countries incompletely filled requests are seen more frequently in radiology department. There is a lot of assumption for this problem; work load, lack of

awareness on the relevance of clinical data on interpretation of chest radiographs and the most common one is the belief of the clinicians that clinical data can give a preconception to the radiologist which may bias the finding and leads to false positive results.

Again to our knowledge there is no research done on the impact of clinical data on chest radiograph interpretation in Ethiopia.

The purpose of this study is to determine whether the clinical data gives a positive or negative impact on chest radiograph interpretation.

1.4 Research question

- Does clinical data has an impact on interpretation of chest radiographs?
- Does knowledge of the clinical history increase the rate of true-positive and/or false-positive readings related to the history?

1.5 Objective

1.5.1 General objective

- The objective of this study is to determine whether clinical data gives a positive or negative influence on interpretation of chest radiographs.

1.5.2 Specific objective

- To assess the impact of clinical data on CXR interpretation for gross, typical or subtle radiologic findings
- To compare the impact of clinical data on interpretation of CXR for junior and senior radiology residents

2. Literature review

There are a number of researches done on impact of clinical data on interpretation of radiographs and most are done on experimental bases which has its own limitation that it can't be applied in real life because of artifactual increase in perception. There are also a few reports done in non-experimental / real life condition blinding the participants which can correlate well with the impact of the clinical data on real life.

A study done by Peter Doubilet;Peter G. Herman showed that residents reported the true findings 23 out of a possible 32 times (a 72% true positive rate) with a suggestive history, and only five times (a 16% true-positive rate) with a non-suggestive history. This difference is statistically significant ($p < 0.01$ by the paired Student's t-test or by the Wilcoxon rank sum test). All nine false-positive statements encountered were related to entities suggested by the history.

For the combined resident-staff readings, true-positive rate increased from 38% (nonsuggestive history) to 84% (suggestive history), a statistically significant increase ($p < 0.01$ by the paired Student's t-test or by the Wilcoxon rank sum test). Again, all nine false positives were suggested by the history.

Doubilet and Herman [1 2] inserted test chest radiographs into the daily workload of radiologists who were unaware that a study was being carried out, they found a statistically significant increase in the rate of true positive interpretations in the presence of a suggestive as compared with a non-suggestive history, along with a concomitant increase in false positives.

In 1963, Schreiber [3] reported a statistically significant increase in the true-positive rate when a clinical history was provided; it had no impact on the false positive rate.

Potchen et al. [5] found a statistically significant increase in the detection of abnormalities with a suggestive as opposed to an irrelevant patient history. They found no differences in the interpretation of normal radiographs.

In one of the few studies performed that did not use chest radiographs to examine this question, Eldevik et al. [6] concluded from an investigation using spinal CT scans and myelograms that (1) a significant number of interpretations were changed when the clinical history was known and (2) more studies were interpreted correctly without the clinical history than with it.

Barbara C. Good et al. found knowledge of clinical history does not affect the accuracy of chest radiograph interpretations for the detection of interstitial disease, nodules, and pneumothoraces.

Study done in Children's Hospital of Philadelphia and Boston Children's Hospital showed the addition of clinical history did not have a substantial impact on the inter-rater reliability in the identification of any infiltrate, alveolar infiltrate, interstitial infiltrate, pleural effusion, or hilar adenopathy. Inter-rater reliability in the identification of air bronchograms improved from fair (k ¼ 0.32) to moderate (k ¼ 0.53). Intra-rater reliability for the identification of alveolar infiltrate remained substantial to almost perfect for all 6 raters with and without clinical information. One rater had a decrease in inter-rater reliability from almost perfect (k¼ 1.0) to fair (k¼ 0.21) in the identification of interstitial infiltrate with the addition of clinical history.

3. Methods

3.1 Study design

Prospective Hospital-based Cross sectional study

3.2 Study setting

The research was conducted in Tikur Anbesa referral hospital Ethiopia.TAH is the largest referral hospital in the country, with 700 beds. Since 1998 it become a university teaching hospital with various departments and faculties.

3.3 Study population

3.3.1 Case sample

Cases and controls for this study were selected sequentially from among patients undergoing posteroanterior chest imaging at st Paul and Tikur Anbesa inpatient and outpatient facilities. All the films used in the study (41 normal and 59 abnormal cases) were acquired over a period of one months.

The abnormalities consists of different diseases which could commonly encountered in general radiological reading practice. The clinical history was gained from the physicians radiological request paper. Each radiograph with its clinical history was evaluated by an expirienced cardiothoracic radiologist from Toronto , Canada and two cardiothoracic fellows from department of radiology ,TAH and their interpretation was used as a standard reference.

3.3.2 Inclusion criteria

All PA chest imaging with atleast acceptable quality within one month period of time

3.3.3 Exclusion criteria

Suboptimal or poor quality radiographs

3.4 Sampling techniques

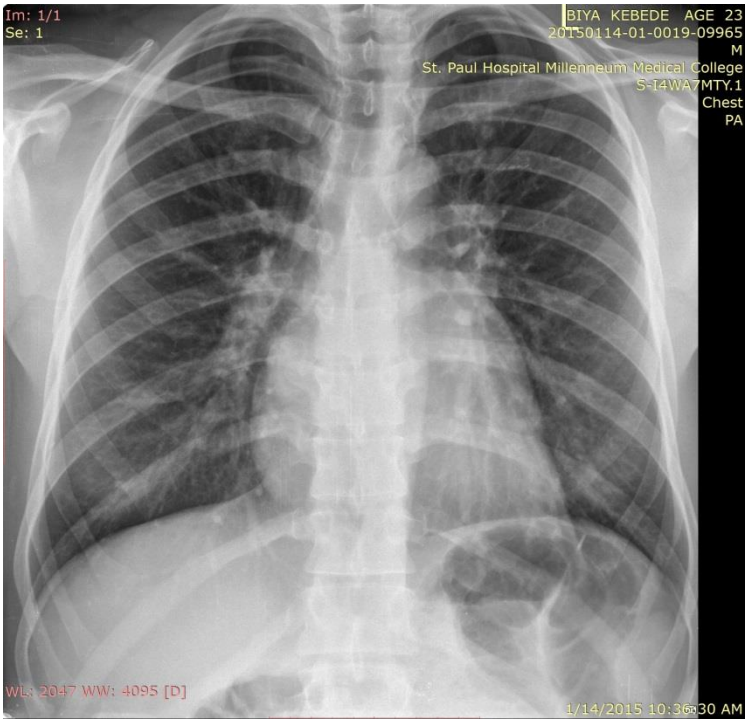
Non probablity consecutive sampling technique was used and all frontal CXRs in the study period which fullfils the inclusion criteria were included.

X- ray film interpretation

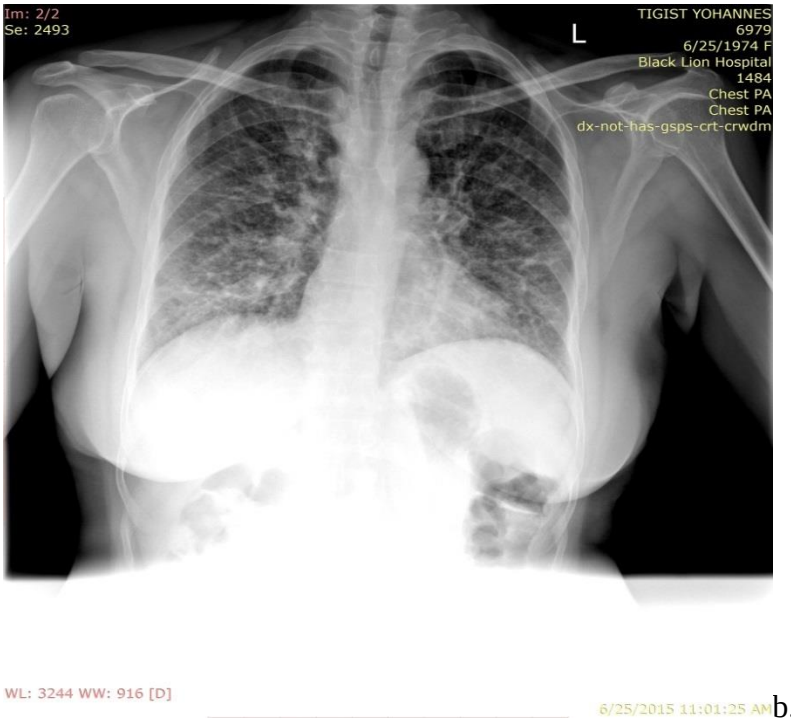
10 residents at Tikur Anbesa hospital , six 3^{rd} year and four 2^{nd} year reasidents volunteered to participate in the research . Each resident independently read the films twice , without history first and with history later .

The interval between the first and the second reading was 1 month. Each resident read 20 same CXRs twice out of a total of 100 CXRs .Films were presented in random order and

the time requird for reading was not restricted. All images were visualized by readers as JPEG file format(fig 1- sample CXR). Each resident completed a study questionnaire for each radiograph. Abnormal images were classified as subtle, typical, or gross (very easily detected) disease. The residents also rated the image quality of the film as excellent, good, acceptable, poor, or unacceptable. Any pathological condition had to be classified into 9 different categories based on the presence or absence of : alveolar infiltration ; interstitial infiltration ; air bronchograms , cavitation , hilar or mediastinal LAP , pleural Effusion , pneumothorax , Rib fracture , and cardiomegaly. The disease had to be localized in specific lung lobes or in the hilar, or perihilar and had to be categorized on a four -point scale: definitely absent, probably absent, probably present, or definitely present. (see Supporting Information, Appendix).



a.



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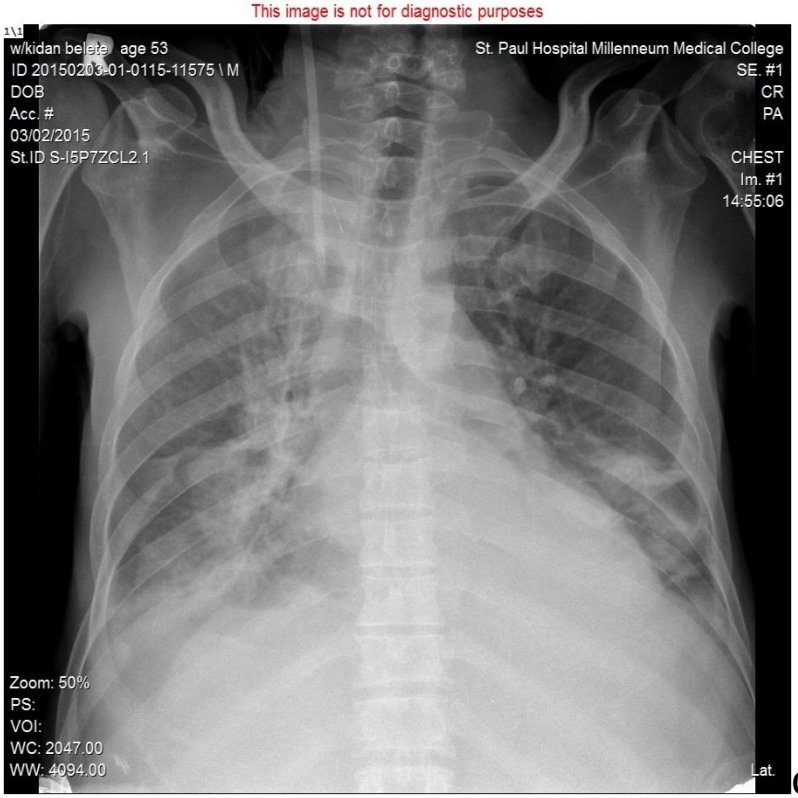

c.

Fig-1- sample CXRs, demonstrating a.severe MS (echocardiography confirmed), b. lymphangitis carinomatosis and c. pneumothorax with pachy consolidations

3.5 Data analysis

Every data was checked for completeness right after collection and data entry and analysis was carried out by using SPSSv.20 (SPSS for windows). Different variables were recoded for further analysis.

Accuracy was assessed using the kappa statistic to determine overall residents agreement to the standard reference for each pathlologic finding /variable with and without history and the sensitivity and specificty was also analysed .

The following benchmarks were used to classify the strength of agreement:

poor (<0.0), slight (0–0.20),

fair (0.21–0.40),

moderate (0.41–0.60),

substantial (0.61–0.80),

almost perfect (0.81–1.0).

Negative kappa values represent agreement less than would be predicted by chance alone.

ROC curves were also calculated to show accuracy both with and without clinical history.

Ethical considerations

Ethical permission was obtained from the department of radiology , college of health sciences, AAU .

4.RESULTS

Patient Sample

The radiographs were from patients ranging in age from 1 to 84 years. Forty four (44%) patients were male and the rest were female.

Quality of the film was assessed and graded by the residents and 18.3 % were graded as excellent, 55% were good, 20 % were acceptable and 6.7% were graded as poor or unacceptable. The quality of the film as graded by the residents is presented in table 1.

Among the abnormal CXRs, the finding was graded as subtle (10.5 %), typical (11 %) or gross (37%). Fig 2. Demonstrates the percentage of the subtlety of the films as a pie chart.

		Frequency	Percent
	excellent	22	18.3
	good	66	55.0
	acceptable	24	20.0
	poor/unacceptable	8	6.7
	Total	120	100.0

TABLE 1- **residents' grading on the quality of the film**

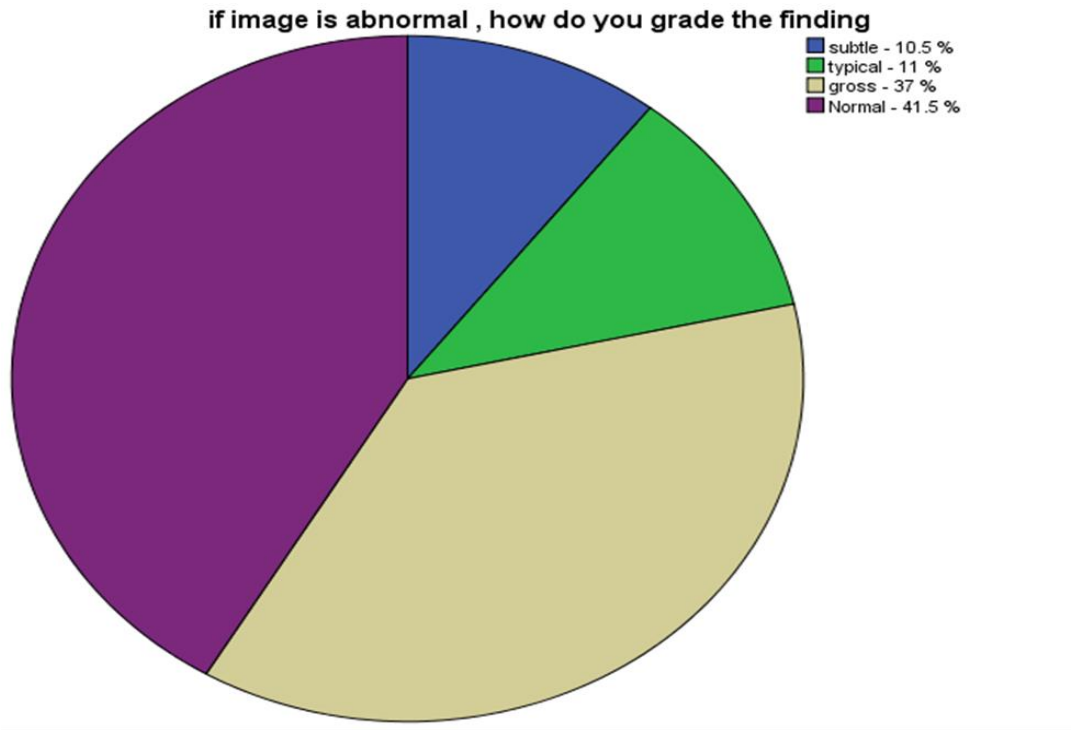

Fig 1-grade of the finding as subtle , typical or gross

4.1 Raters' accuracy

The kappa coefficients for the agreement of the Residents with the standard references across the 9 clinical measures of interest with and without access to clinical history are plotted in Figure 2.

Normal CXR

Of the 41 CXRs which were normal, 79.3 % was read as normal by the residents without the availability of the clinical History and with the addition of History the sensitivity increased to 81.7 %. The specificity (87.2 %) was not affected with the addition of the clinical data. The accuracy of the reading without History was 83.7% and with the availability of the History 84.5%.

The kappa value for normal CXRs without History was 0.667; P-value of 0.000 and with the addition of clinical History the kappa value was 0.689; p-value of 0.000.

Interstitial infiltrate

Among the 59 abnormal CXRs, 12 of them (19.9%) had interstitial infiltrate. the residents were able to detect this in 46.2 % of the cases without History and with the addition of the clinical History they were able to detect in 51.3 % of the cases. The specificity was 87.5 % and 90% for CXRs read without clinical History and CXRs read with clinical History respectively.

The accuracy of the residents for detecting interstitial infiltrate was 66.9% without clinical History and 70.7 % with the addition of the clinical History.

The kappa value for interstitial infiltrate without History and with knowledge of the clinical History was 0.340; P-value of 0.000 and 0.428; p-value of 0.00 respectively.

This finding is also demonstrated by bar graph (fig 2) and ROC curve (fig 3).

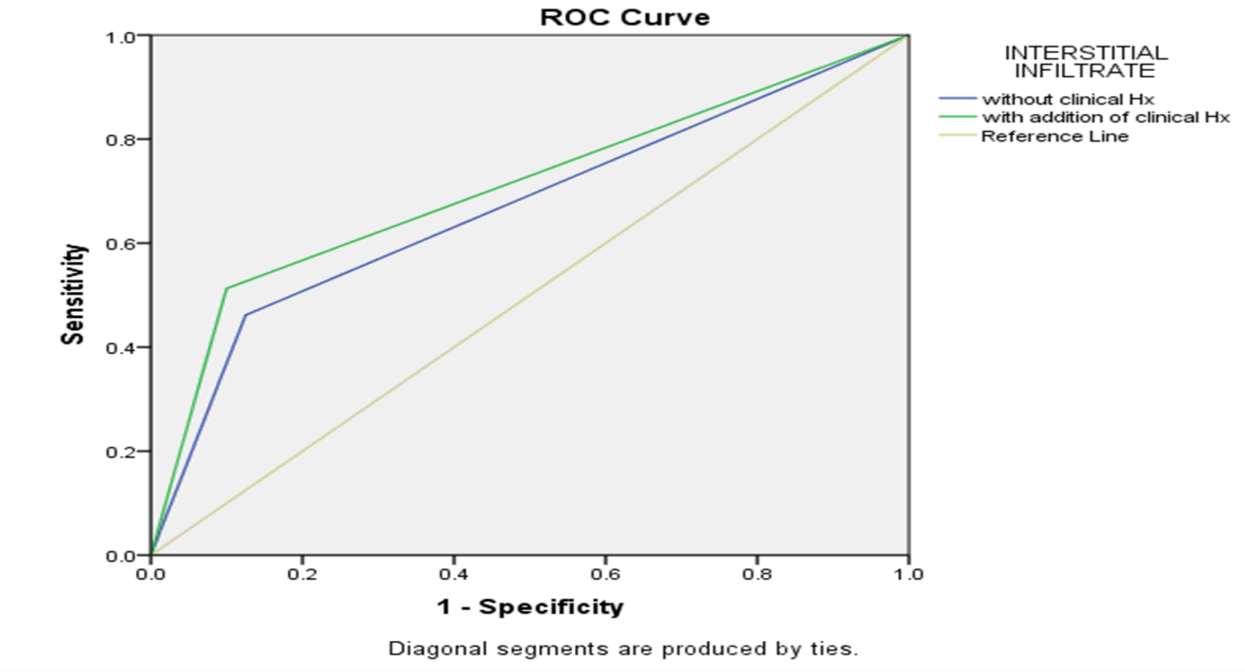

Fig 3- ROC curves of reporting accuracy for all residents with no clinical details and with clinical details for identification of interstitial infiltrate.

Pneumothorax

From the 59 abnormal radiographs 3 of the cases had pneumothorax and when residents read the CXRs without the clinical History they correctly identified the lesion in 44.4 % of the cases and with the availability of the clinical Hx they were able to detect the pathology in 55.6 % of the cases. The specificity was 99.5% for CXRs read without History and 100 % when the CXRs were read with the knowledge of the clinical history.

The accuracy of the residents for detecting pneumothorax was 72 % without the availability of clinical history and 77.8 % with the addition of the clinical history.

The kappa value for pneumothorax without History and with knowledge of the clinical history was 0.557; P-value of 0.000 and 0.705; p-value of 0.00 respectively.

This finding is also demonstrated by bar graph (fig 2) and ROC curve (fig 4).

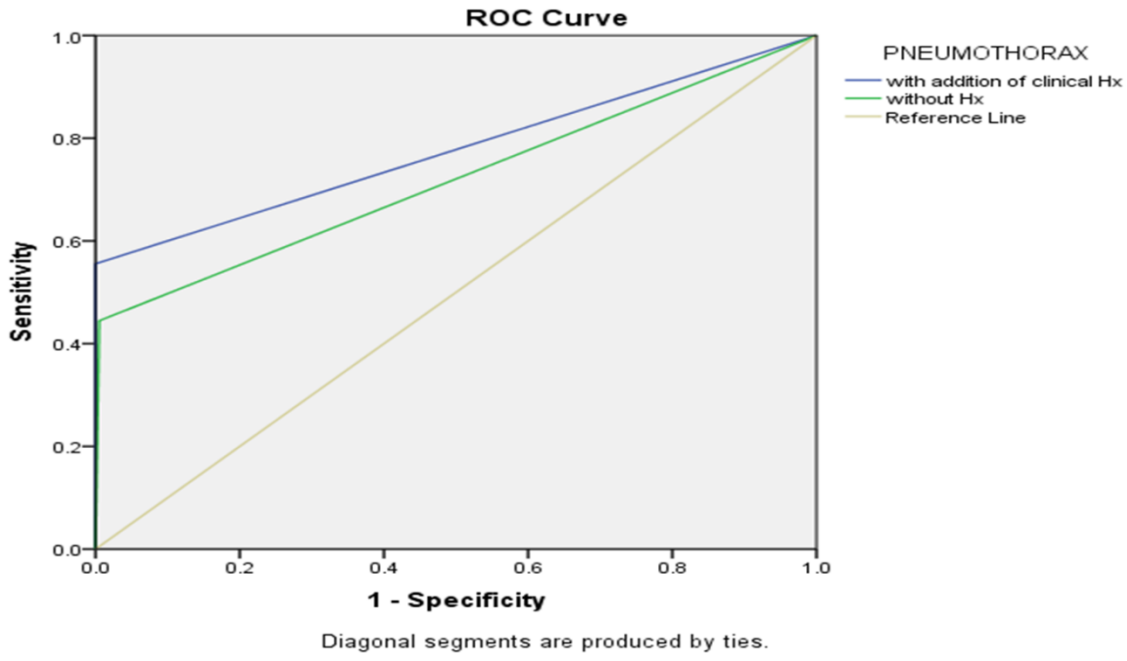

Fig 4- ROC curves of reporting accuracy for all residents with no clinical details and with clinical details for identification of pneumothorax.

Hilar or mediastinal LAP

Among the 3 CXRs with hilar or mediastinal LAP, about 23.5 % of the cases were detected without the knowledge of clinical history and with access to clinical history, the residents were able to detect the lesion in 40 % of the cases. The accuracy for detecting hilar or mediastinal LAP were 60 % when the radiographs were read without clinical history and with access to the clinical history the accuracy were 69 %.

The kappa value k -0.289, p-0.000 for the first session (without clinical history) and for the 2nd session (i.e. with access to the clinical history) k-0.418, p-0.000. This result was statistically not significant.

This finding is also demonstrated by bar graph (fig 2) and ROC curve (fig 5).

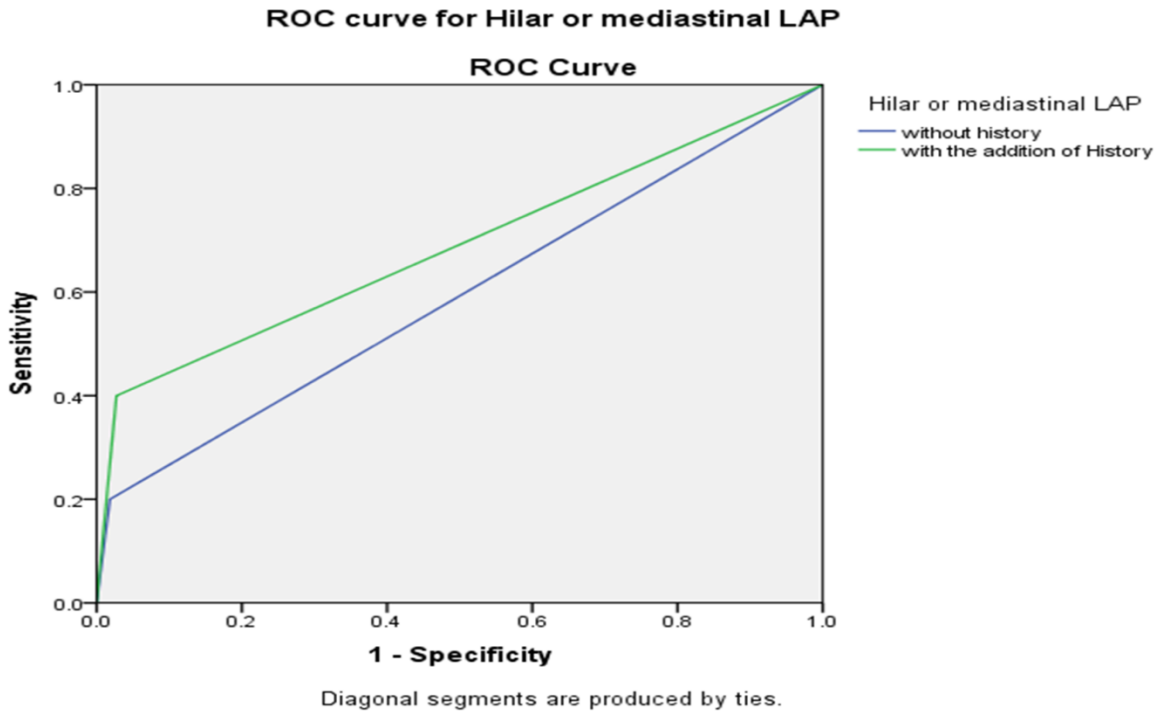

Fig 5- ROC curves of reporting accuracy for all residents with no clinical details and with clinical details for identification of Hilar or mediastinal LAP.

Rib fracture

There were 2 CXRs with rib fractures and among this residents were able to detect the lesion in 83.3 % of the cases when CXRs were read without the knowledge of the clinical history and with the availability of the clinical history they were able to correctly detect the lesion in 100% of the cases. The specificity was 99.5 % and 100 % for CXRs read without and with clinical history respectively.

The accuracy of the residents in detecting rib fracture was 91.4 % and 100 % without clinical history and with the addition of clinical history respectively.

The kappa coefficient for rib fracture without history and with knowledge of the clinical history was 0.907; P-value of 0.000 and 1; p-value of 0.00 respectively.

This finding is also demonstrated by bar graph (fig 2).

Pleural effusion

Among the abnormal CXRs 12 of them had bilateral /unilateral pleural effusions , from these residents were able to detect the pathology in 76.9 % of the cases without the clinical history and when the clinical history was provided they were able to detect the lesion in 79.5 % of the cases. The specificity was 92.5% and 94.4 % for CXRs read without and with clinical history respectively.

The accuracy of the residents in detecting pleural effusion were 84.7 % and 87 % when the CXRs were read without the clinical history and with clinical history respectively

The kappa coefficient for interstitial pleural effusion without history and with knowledge of the clinical history was 0.675; P-value of 0.000 and 0.732; p-value of 0.00 respectively.

This finding is also demonstrated by bar graph (fig 2).

Cavitation

Among the 2 CXRs with cavitary lesion, residents were able to detect the lesion in 75 % of the cases without the clinical history and with the knowledge of history they were able to detect the lesion in 75 % of the case. The specificity was 98.5 % for both reading sessions .The accuracy of the residents in detecting cavitary lesion were 86.8 % for both reading sessions.

The kappa value for identification of cavitation without the clinical history and with knowledge of the clinical history was 0.590; P-value of 0.000 and 0.590; p-value of 0.00 respectively.

This finding is also demonstrated by bar graph (fig 2).

Air bronchograms

Among the 5 CXRs with air bronchograms, residents were able to detect the lesion in 33.3 % of the cases without the provision of the clinical history and in 22.2 % with the addition of the clinical history .the specificity were 97.2 for CXRs read without the knowledge of the clinical history and 96.1 % for CXRs read with the knowledge of the clinical history.

The accuracy of the residents for detecting air bronchograms were 65.2% and 59% when the CXRs read without and with clinical history respectively.

The kappa value for identification of air bronchograms without the clinical history and with knowledge of the clinical history was 0.371; P-value of 0.000 and 0.223; p-value of 0.00 respectively.

This finding is also demonstrated by bar graph (fig 2).

Alveolar infiltrate

Among the 59 abnormal CXRs, 12 had alveolar infiltrate. And the residents were able to detect these lesions in 63.4 % of the cases without the clinical history and with the addition of the clinical history they were able to detect the lesion in 61% of the cases. The specificity was the same in both reading sessions being 86.7 %.

The accuracy of the residents in detecting alveolar infiltrate were 75 % and 73.9 % when the CXRS read without and with clinical history respectively.

The kappa value for identification of alveolar infiltrate without the clinical history and with knowledge of the clinical history was 0.475; P-value of 0.000 and 0.456; p-value of 0.00 respectively.

This finding is also demonstrated by bar graph (fig 2).

Cardiomegaly

Among the 7 CXRs having cardiomegaly, residents were able to interpret the finding in 58.3 % of the cases without the knowledge of the clinical history and in 54.2 % with the clinical history added. The specificity was the same in both reading sessions (99.4 %). The accuracy of the residents in diagnosing cardiomegaly without clinical history was78.9 % and 76.8 % when the clinical history was added.

The kappa value for identification of cardiomegaly without the clinical history and with knowledge of the clinical history was 0.475; P-value of 0.000 and 0.456; p-value of 0.00 respectively.

This finding is also demonstrated by bar graph (fig 2).

The overall accuracy of the residents for the abnormal radiographs was 75.6 without the knowledge of clinical history and 77.9 with the knowledge of the clinical history.

When our data was analyzed according to the year of residency, for the second year residents sensitivity improved when clinical history was included for 3 of the clinical parameters (pneumothorax- [from 0 % to 25 %] ; pleural effusion [from 84.6 % to 92.3 %] and alveolar infiltrate [from 60 % to 80 %]) , sensitivity decreased for two of the parameters (cardiomegaly [from 66.7 % to 55.6 %] ; interstitial infiltrate [from 50 % to 42.9 %]) and the sensitivity was the same for three of the parameters (rib fracture ; hilar or mediastinal LAP and air bronchograms). For the third year residents sensitivity increased for identification of interstitial infiltrate (from 44 % to 56 %) and rib fracture (66.7 % to 100%), sensitivity decreased for identification of air bronchograms (from 40 % to 20 %) and alveolar infiltrate (from 65.4 % to 50 %) when clinical history was included. The sensitivity was the same for the rest 5 parameters (cardiomegaly, pneumothorax, pleural effusion, hilar or mediastinal LAP and cavity).

When our data was analyzed based on the sub groups " gross ", "typical'', " subtle'' the study showed among the 19 CXRs in which the abnormality was graded as subtle by the standard references, residents reported the true findings 2 out of a possible 19 times (a 25% true positive rate) in both reading sessions. Again from these 19 subtle findings 9 of them (47.4%) were interpreted as normal in both readings. The availability of the clinical history yielded no improvement for either the ''typical' 'or ''subtle'' category, and in particular for the subtle case category, in which improvement, if any, would be expected Table 2- below shows the kappa values of the gross and typical lesions when read without and with history.

Considering the clinical parameter "zone of lung involvement" (for identification of the involved lung) our study showed kappa value of k- 0.451 , p-0.000 for the second year residents with moderate degree of agreement and k-0.758 , p-0.000 for the third year residents with substantial degree of agreement with the standard.

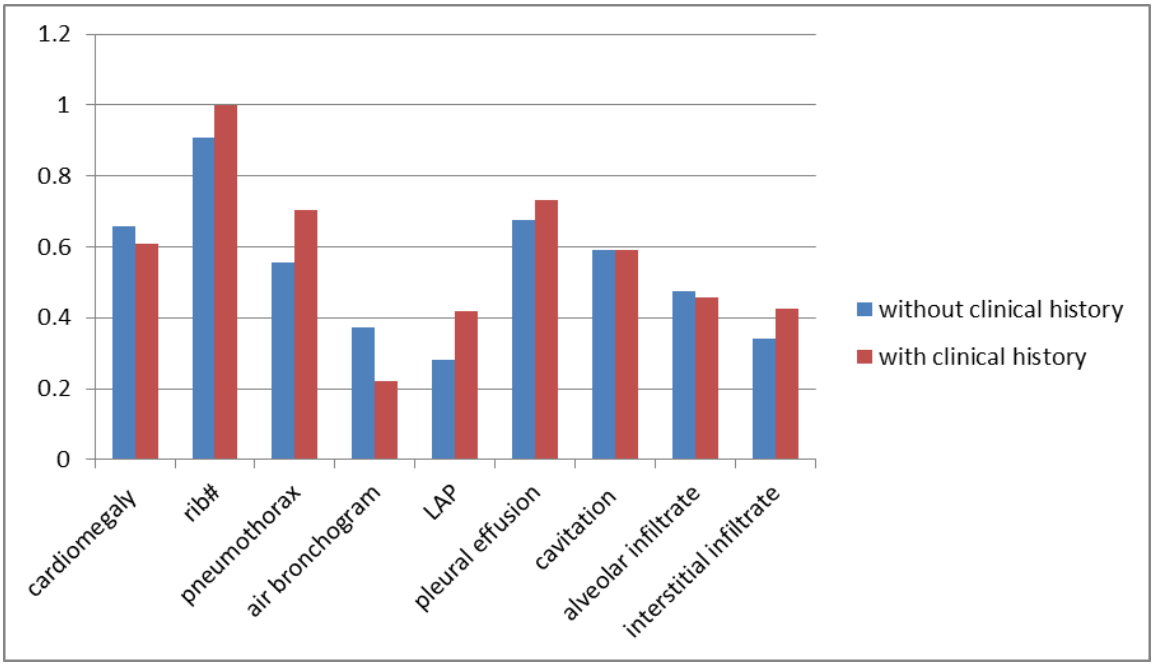

Fig 2- accuracy of all residents with no clinical details and with clinical details for identification of the nine clinical parameters (Kappa value in the y axis and the clinical measures in the x- axis)

	‘‘Gross’’ films		‘‘Typical’’ films	
abnormality	Kappa		Kappa	
	Without history	With history	Without history	With history
Interstitial infiltrate	0.166 (P-0.152)	0.310 (P-0.007)	0.607 (p-0.04)	0.792 (p-0.000)
Alveolar infiltrate	0.313 (p-0.007)	0.284 (0.015)	0.353 (p-0.030)	-0.073 (p-0.684)
Air bronchograms	0.335 (p-0.002)	0.184 (p-0.078)		
cavitation	0.645 (p-0.000)	0.736 (p-0.000)		
LAP	0.240 (p-0.39)	0.509 (p-0.000)		
Nodule	0.153 (p-0.141	0.414 (p-0.000)	0.138 (p-0.484)	0.138 (p-0.484)
Pleural effusion	0.456 (p-0.000)	0.563 (p-0.000)	0.891 (p-0.000)	0.891 (p-0.000)
pneumothorax	0.736 (p-0.000)	0.882 (p-0.000)		
Rib fracture	1 (p-0.000)	1 (p-0.000)		
cardiomegaly	0.620 (p-0.000)	0.598 (p-0.000)		

TABLE 2: kappa values for gross film Readings and typical Cases for identification of the clinical parameters without and with clinical History.

5. Discussion

In our study the accuracy improved from fair (k ¼ 0.281, p-value 0.000) to moderate (k ¼0.418 , p- value 0.000) for identification of ‘‘hilar or mediastinal LAP’’, from moderate (k ¼ 0.557 , p- value -0.000) to substantial (k ¼ 0.705 , p-value – 0.000) for identification of pneumothorax , from fair (k ¼ 0.340 , p-value-0.000) to moderate (k ¼ 0.425 , p-value -0.000) for identification interstitial infiltrate with the addition of clinical history. The sensitivity increased from 23.5 % to 40%, from 44.4 % to 55.6 %, and from 46.2 to 51.3 % for hilar or mediastinal LAP, pneumothorax and interstitial infiltrate respectively with the

addition of clinical history. Except for identification of the interstitial infiltrate which were found statistically significant, for the rest two parameters there was an overlap of the 95 % CIs, suggesting that even though addition of clinical history resulted in higher sensitivity, it was not statistically significant.

Although there was an increase in kappa values for Identification of ‘‘rib fracture ’’ and ‘‘pleural effusion,’’ and a decrease in the kappa value for identification of ‘‘cardiomegaly ’’, ‘‘alveolar infiltrate ’’, and “air bronchograms’’ with the addition of clinical information, there was substantial overlap of the 95% CIs, suggesting that inclusion of clinical history did not result in a statistically significant change in the reliability of these findings. This result is comparable to the study done by Matthew Test, BS et al, where they found an increase in k- value for identification of any infiltrate, interstitial infiltrate and pleural effusion although this were statistically not significant. Also in contradiction to our study, they found an increase in k- value for identification of alveolar infiltrate as well as of air bronchograms. In contrast to our result which showed an increase in k- value for identification of hilar or mediastinal LAPs this study showed a decreased k- value for identification of hilar LAP when clinical history was added. B/c the hilar and mediastinal areas are relatively hidden areas where lesions can be missed or overlooked it is convincing to have an increased sensitivity with the addition of clinical history.

The overall accuracy for detecting the abnormal findings increased from 75.6% to 77.9 % when clinical history was added which is comparable to studies done by Potchen et al, Schreiber et al and Doubilet and Herman et al.

On our study we found that the clinical history had an impact in 5 out of 8 clinical parameter of interest for the 2nd year residents as opposed to the 3rd year residents where the addition of clinical history didn’t affect in 5 out of the 9 parameters (in 5 of this parameters the sensitivity was the same when CXRs read without or with clinical history). The study also found that the accuracy of localizing the finding to a specific lung zone were also higher for the 3rd year residents (k-0.758 ,p-0.000) than for the 2nd year residents(K- 0.451 , p-0.000).This finding suggests that clinical history has a higher impact in junior residents as compared to the senior residents. This finding is also

comparable to the study done by Kyung sup song et al. (14) where they found a statistically significant increased detection rate when clinical history was added for the 1st, 2nd and 3rd year residents while there was no improvement for the staff radiologists, indicating that knowledge of clinical history has an impact on interpretation of radiographs especially for those with less experience than the most experienced radiologists.

Addition of clinical data has no impact for the subtle case in our study which was comparable to the study done by Barbara C. Goo et al, where the availability of the clinical history yielded no improvement for either typical or subtle category, and in particular for the subtle case category, in which improvement, if any, would be expected .In contrast to our study most studies found that clinical history has a substantial impact in detecting subtle but unambiguous lesions. The reason for this finding in our case could be attributed to the fact that most of the subtle findings were not written in the reporting format as yes or no type of question and the residents were expected to detect and write this findings in the additional /other finding category (see supporting format – appendix 1), therefore This factor may have decreased the residents 'suspicion for a given finding even in the presence of clinical information.

Regarding the normal CXRs the addition of clinical history didn't have an impact on interpretation in our study which is comparable to the study done by Potchen et al. [7], where they found no differences in the interpretation of normal radiographs.

6. Limitation

This study had several limitations.

1st - the radiographs were randomly selected within a one month period and included diverse age groups as well as a variety of disease condition which made the analysis difficult.

2nd - this study does not meet the criteria of a balanced study design as defined by Loy and Irwig.[13] A study was characterized as balanced if half of the radiographs were read with

and half without clinical information in each of the 2 reading sessions. The proposed benefit of such a design is to control for possible changes in ability or reporting practices of the raters that may have occurred between study periods. Given the short period of time b/n the two readings 1 month, it is unlikely for the residents reporting practice to change over the study period in our situation.

3rd - the residents interpreted the films outside of their standard workflow and utilized a standardized reporting tool that focused on the presence or absence of pathologic process. These factors may have increased the residents' suspicion for a given finding even in the absence of clinical information. This may have biased the results toward finding no difference in the identification of a finding with the addition of clinical history.

Thus, the inclusion of clinical information in radiograph interpretation in clinical practice may have greater impact on the identification pathologies than was found in this study.

7. Conclusion and recommendation

The results of our study suggest that knowledge of clinical history has increased the accuracy of chest radiograph interpretations for the detection of interstitial infiltrate. However, it doesn't show any statistically significant impact in the other clinical parameters. This result may be attributed to the fact that the study was done in experimental bases where a standardized reporting tool utilized that focused on the presence or absence of pathologic processes which may have increase the residents' suspicion for a given finding even in the absence of clinical information. This may have biased the results toward finding no difference in the identification of a finding with the addition of clinical history.

Our result suggests that even if it is not statistically significant many of the clinical parameters did show some improvement when clinical history was added. And the overall accuracy for detection of abnormal findings increased from 75.6 % to 77.9 % with the addition of the clinical history.

As well documented in the previous studies even if history is not important for detection, it may have an important role in determining the specific nature and significance of detected abnormalities as well as for narrowing the DDX. Therefore we recommend further studies on the impact of clinical data on interpretation of radiographs.

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APPENDIX

Participant information sheet

This is a research done in radiology department and we are collecting data for a research purpose. This form explains why we do this study, your role in the study, the benefits and risks of involving in this study and confidentiality of the information that you will give us.

1. Purpose- The purpose of this study is to assess the impact of clinical data on interpretation of chest radiographs.

2. Procedures - After a brief introduction by data collectors, questioners and cases will be administered to consenting participants.

3. Risks associated with the study- Apart from the time you spend with us; there is no harm that you will undergo by participating in this study.

4. Benefits of the study- this study will be used as a role model to show the importance of clinical data in interpretation of CXR thereby improving the overall quality of health care system.

5. Confidentiality of your information- The information that you will give us will be totally confidential. Once the data is entered into a computer, it will be coded and becomes unidentifiable/ anonymous. Your personal information that could lead to your identification will never be disclosed both in oral or written form.

6. Terminations of the study- We will only include participants who give consent without any obligation. You also have full right to withdraw from the research at any time of the study.

I would also like to inform you that this study is approved by the ethical committees of the Department of radiology, Addis Ababa University.

The principal investigator is Dr. Abrehet Zeray, Department of radiology, AAU. Email: abrehetzeray@gmail.com

Questioner

(Case:-)

1- How do you grade the quality of the film
   a- excellent,
   b- good,
   c- acceptable,
   d- Poor, or unacceptable.
2- Do you think this image is abnormal
   a- Yes
   b- no
3- If yes to Q2 how do you grade the finding
   a- subtle
   b- typical
   c- gross (very easily detected)
4- how do you rate the likelihood of the presence or absence of the radiologic finding;
   a- definitely absent,
   b- probably absent,
   c- probably present,
   d- definitely present

5-which lung zone is involved

a- right upper zone f- d & e

b- right middle zone g- a & b

c- right lower zone h- b & c

d- left upper zone i- diffuse/multifocal

e- left lower zone j- bilateral perihilar

k- other:----------

Choose the type of abnormality

6-pattern of infiltrate

a- alveolar infiltrate

b- interstitial infiltrate

7-air bronchograms

a- present
b- absent

8- Cavitation

a- present

b- absent

9-lymphadenopathy (hilar or mediastinal)

a-present

b-absent

10-solitary nodule/multiple nodule

a-present
b-absent

11-pleural effusion

a-present
b-absent

12-pneumothorax

a-present
b-absent

13-rib fracture

a-present
b-absent

14- cardiomegaly

a-present
b-absent

15- if yes/ present to question number 12, which chamber is enlarged

a-left atrium
b-right atrium
c-left ventricle
d-right ventricle
e-left sided enlargement
f- right sided enlargement
g- other :----------

16- NORMAL CXR

a- yes
b- no

17- Additional /other findings

18- based on your finding and additional clinical information write your top 3 DDx or most likely Dx

1-

2-

3-