



Full Length Research Paper

Are routine chest radiographic examinations of students in Nigerian Universities still relevant? An imaging perspective

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Abstract

Routine chest radiographic examinations are usually performed for newly admitted students in Nigerian universities as a screening test for pulmonary tuberculosis (PTB). Such practice and their alleged benefits have generated a lot of controversy. The evidence in favour of a non-selective screening for PTB using chest radiography in young asymptomatic subjects is extremely meagre. We evaluated this practice in Nigeria's first and largest university. The chest radiographs of all consecutive newly admitted students taken over a 3-month period, between February and April 2011, were reviewed. All radiographs were read and classified as "normal" or "abnormal". The abnormal radiographs were then further classified based on standard radiological criteria on whether or not the abnormal lesions were indicative of PTB. 1021 chest radiographs were reviewed. Of these, 572 (56%) radiographs were obtained in males and 449 (44%) in females. The subjects' ages ranged from 16 to 53 years (mean 26.1 ± 8.9 years). 151 radiographs (14.8 %) were reported as abnormal on the basis of presence of an incidental finding or a clinically relevant radiographic abnormality. The students with an abnormal radiograph were about 8 years above the mean age for the normal group ($P=0.001$), but gender distribution was similar to the normal group. Detected abnormalities were categorized as affecting the heart (49, 4.8%), the bones (44, 4.3%), the lung (41, 4.0%), the diaphragm (9, 0.9%) or other structures (8, 0.8%). None of the detected lesions was clinically severe, except for a single case of suspected aortic aneurysm. Only 2.8% (29/1021) showed lesions compatible with PTB. Newly admitted students at our institution undergo routine chest radiography with a low positive yield for infectious PTB or any other clinically significant incidental findings. The current guidelines may require a review to ensure more efficient use of available resources and avoid unwarranted radiation exposure.

Keywords: Tuberculosis, chest X-ray, students, university, Nigeria.

INTRODUCTION

It is standard practice in Nigerian universities to run a tuberculosis (TB) screening program that includes obtaining a chest radiograph for all new students. The implied rationale for this screening is to detect early cases of TB and thus reduce TB transmission among students, most of who live in hostel facilities. Such detection programs and their alleged benefits have generated a lot of controversy (den Boon et al., 2006; van der Werf et al., 2008) Some authors believe these programs are still relevant in sub-Saharan African

countries with high TB prevalence, as opposed to western countries where such screening programs have been abandoned and restricted to selected groups or populations (Eisenberg et al., 2010; Gottridge et al., 1989). Others have over the years argued that a chest radiograph on its own is not sufficiently sensitive at identifying pulmonary TB to justify the expense and radiation exposure in asymptomatic healthy young individuals (Sarru et al., 1995).

Other studies have evaluated the use of chest radiography done only in patients with positive tuberculin skin tests or negative smear and found a low diagnostic yield as well as low specificity (Eisenberg et al., 2010; Chaturvedi et al., 1992). In addition, abnormalities

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Table 1. Demography and pattern of routine chest x-ray findings in newly admitted university students

Chest x-ray	N (%)	Mean age (years)	p-value	Male (%)	Female (%)
Total chest x-ray	1021	26.1±8.9		572(56)	449(44)
Normal chest x-ray	870(85.2)	24.9±8.4	0.001	489(56)	381(44)
Abnormal chest x-ray	151(14.8)	33.0±9.0		83(55)	68(45)
Lung abnormality	41(4)	33.1±10.3		24(59)	17(41)
Radiographic TB abnormality	29(2.8)	33.4±10.4		19(66)	10(34)
Other abnormality*	110(10.8)	33.0±9.00		56(51)	54(49)

*includes all non pulmonary findings on chest x-ray

detected were generally considered to be trivial and would have caused no problems if they had remained undetected and, moreover, none of such findings were related to tuberculosis (van't Hoog et al., 2012).

Although the evidence in favour of a non-selective screening for TB using chest radiography in young asymptomatic subjects is extremely meagre, at most (Chaturvedi et al., 1992; van't Hoog et al., 2012), even for countries with a high prevalence of TB. However it is often difficult to abandon traditions without providing sufficient evidence. (Ogbeide et al) demonstrated previously the low utility of such exercise in south-eastern Nigeria.

We evaluated this practice by reviewing the chest radiographs obtained from newly admitted students at Nigeria's largest university to further strengthen the body of knowledge and advocate for a better use of healthcare resources.

MATERIALS AND METHODS

We reviewed the chest radiographs of consecutive newly admitted students who presented for their obligatory medical examination at the University of Ibadan in Nigeria over a 3-month period between February and April 2011. Both undergraduate and postgraduate students were included and they were all referred for a chest x-ray. The radiographs were acquired using standard techniques for chest radiography by a trained radiographer. Only postero-anterior views were obtained. All radiographs were read by one of three consultant radiologists who classified them as "normal" or "abnormal". The abnormal radiographs were then further classified according to the type of abnormality, based on the nature of the tissues involved, and on whether or not the lesions were indicative of pulmonary TB, based on standard radiological criteria only (van Cleeff et al., 2005). Patients with suspected TB were referred to the university teaching hospital, but further clinical or microbiological data were not available for this study.

The data was analyzed using the SPSS (Statistical Package for the Social Sciences) software version 17.0 for windows.

Chi-square test was used to compare prevalence of abnormal findings between genders; while Student's t-test was used to compare age differences between groups. A P-value of 0.05 was accepted as statistically significant.

RESULTS

A total number of 1021 chest radiographs were reviewed. None of the students with a request form had symptoms—thoracic or otherwise indicated on it. The request form usually had 'routine chest x-ray' only written on it.

Five hundred and seventy-two (56%) radiographs were obtained in males and 449 (44%) were obtained in females (table 1). The subjects' ages ranged from 16 years to 53 years (mean 26.1±8.9 years); the mean age was 26.5± 8.8 years for the males and 32.6±8.7 years for females.

Table 1 further shows the number and types of detected radiographic abnormalities, with the age and gender characteristics.

Eight hundred and seventy radiographs (85.2%) were reported as normal, while 151 radiographs (14.8 %) were reported as abnormal due to the presence of an incidental finding or a clinically relevant radiographic condition.

The students with an abnormal chest radiograph were 8 years older than those who had a normal radiograph ($P=0.001$), but the gender distribution was similar in those with normal findings and those with abnormal findings.

Abnormalities were categorized as affecting the heart (49 subjects, 4.8%), the bones (44 subjects, 4.3%), the lung (41 subjects, 4.0%), the diaphragm (9 subjects, 0.9%) or other structures (8 subjects, 0.8%). Most of the non-pulmonary lesions were of a benign nature, such as dorsal vertebral scoliosis for bony lesions and cardiomegaly (an enlarged heart) for heart abnormality. Others include normal variants such as cervical rib, spinal bifida occulta and diaphragmatic hump. None of the detected lesions were clinically serious, except for a single case of suspected aortic aneurysm.

Of the 41 radiographs showing pulmonary abnormalities, 29 (70 %, or 2.8% of the total number reviewed) showed lesions that were compatible with TB. The subjects with these abnormalities had a similar mean age (33 years) as those with non-TB lung abnormalities, and the gender distributions did not differ significantly between the TB (66% men, 34% women) and non-TB groups (42% men, 58% women). The TB lesions generally consisted of old scars, and no instances of presumably highly infectious TB, such as open lung cavities, were found.

DISCUSSION

Our study found the use of routine chest x-rays in the pre-admission exercise of young Nigerians to be of minimal benefit. All chest radiographs assessed at our institution were obtained in asymptomatic individuals without documented indications for the examinations, presumably to detect tuberculosis. Only 41 (4%) of the 1021 patients had a lung abnormality detected at chest radiography. Of these only 29 (2.8%) were suspected to have pulmonary tuberculosis which was most likely non-infectious and less than 2% of the entire group had non critical incidental conditions. Over seventy percent of the patients in this group were younger than 30 years, and none of them had a major abnormality except one with a suspected aortic aneurysm. These numbers appear abysmally small to warrant the exposure of over 95% of young students; who would derive no immediate considerable benefit from the x-ray radiation, no matter how negligible the radiation dose, as has been reported (Ogbole et al., 2012).

A chest x-ray remains the most basic and most commonly requested radiological investigation. In the light of proper indication, its use and importance cannot be overemphasized. Its use for routine health examinations; preadmission, preoperative, pre-employment and lung cancer screening has long generated debates in literature (Chaturvedi et al., 1992; van Cleeff et al., 2005). A chest x-ray has been defined as "routine" when it is ordered and performed in the absence of proper clinical indication or suspicion of morbidity (Stolberg et al., 2005). Nevertheless the *International Basic Safety Standards for the Protection against Ionizing Radiation and for the Safety of Radiation Sources* (BSS) supports its routine use in TB screening in areas of the world like Nigeria where tuberculosis is prevalent (International Basic Safety Standards.,1996).

Our findings are consistent with many other workers who have shown the low utility of routine chest radiography in hospitalized patients, children, healthy pregnant women, preoperative patients and other groups (Eisenberg et al., 2010; Gottridge et al., 1989; Chaturvedi et al., 1992; Hubbell et al., 1985). Adeyekun et al also found a low diagnostic yield even in patients with positive purified protein derivative tests (Adeyekun et al., 2010).

Our study differed from previous investigations as we evaluated young students who were most likely from the society middle class and likely to be healthier than hospitalized or older subjects. The prevalence of undiagnosed disease in our sample population is expected to be low.

Tigges et al., reported few investigators who had relatively high diagnostic yield with routine radiography but suspected the results may have been influence by the high prevalence of cardiovascular disease in the sample population (Tigges et al., 2004).

To our knowledge, this is the first evaluation of routine chest radiography among students in Nigeria's largest and oldest tertiary institution. We are aware that other workers (Ogbeide et al., 2011; Adeyekun et al., 2010) in Nigeria have attempted to make similar submissions from different perspectives. We appraised the strength of their submissions with regards to benefits and harms and unfortunately found that the evidence for or against the use of routine chest x-rays was limited. We therefore decided to immediately review our practice and provide more information that may assist in the development of a guideline for the use of routine chest x-rays among students in the Nigerian university system.

The validity of our findings may be based on the fact the examinations were performed in a supervised environment and the radiographs reviewed by certified radiologists.

The period of collection of data was designed to allow the inclusion of both undergraduates and postgraduate students.

However it would have been more representative if our sample was collected over the entire year as the medical examination process usually spans a whole year mostly because of the fact that postgraduate students register at different times. It would have also been more robust to have interviewed each student for clinical symptoms of TB or history of contact with persons with TB and correlate this with the radiographic findings. A feedback of any microbiological test on those suspected of having radiographic evidence of TB would have given more information on the status of the students. On the other hand Adeyekun et al., had shown that this is not likely to produce a positive correlation.

A one-time chest radiographic examination may pose no significant risk as the radiation dose received is only a hundredth of the environmental yearly dose (Ogbole et al., 2012). It however provides a slim chance for the detection of a non symptomatic clinical abnormality that may require follow up or medical attention as in the case of a suspected aortic aneurysm in a young student.

The risk-benefit ratio or cost benefit for the Nigerian student may need for investigation as an out of pocket payment system is what obtains in many Nigerian institutions.

In summary, our findings indicate that a large proportion of asymptomatic students at our institution undergo routine chest radiography with very low positive

yield for serious pulmonary and non emergent incidental findings. If the main objective of chest radiographic screening is for detection of cases of infective TB, It may be more efficient, if only clinically suspected cases are selected for further work up based on a questionnaire screening. The current guidelines may therefore require a review along these lines to ensure better and efficient use of the available health resources.

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