

Systematic chest radiography during pre-employment check-up

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Abstract

The aim of this study was to specify the importance of chest radiography during pre-employment check-ups in the tropical environment.

A cross-sectional study of chest X-rays of 2540 apparently healthy job applicants in seven private companies in Abidjan, Côte d'Ivoire, was carried out over a 5-year period. The chest X-rays were performed in posterior-anterior, frontal, standing position. Two senior radiologists performed a double-blind study in search of parietal, mediastinal, and pleuroparenchymatous abnormalities.

The 2540 subjects were all males with ages ranging between 20 and 36 years. In 93% of the cases (2372 job applicants) the frontal chest X-ray was normal but 168 (7%) presented abnormal images. The observed lesions were dominated by cardiomegaly (102 cases) followed by pulmonary parenchymatous lesions (35 cases), and by pleural liquid effusions (10 cases). The parenchymatous abnormalities were represented by 35 evolutionary lesions in the form of 12 apical parenchymatous infiltrates, 7 excavated apical pneumopathies, and 16 non-excavated condensations. The 10 cases of pleural abnormality were encysted pleuritis.

Frontal chest radiology can be useful in pre-employment check-ups in the tropical environment by helping to screen for contagious pulmonary lesions that may be undetected at a clinical examination.

Introduction

A pre-employment check-up is universally accepted as being necessary before beginning a new job. Among the elements which compose this check up, systematic chest radiographs are often performed. The objective is to avoid hiring an employee who could have a contagious pathology which could endanger other employees.

Chest radiology is cheap and easy to carry out and gives information about cardiovascular and mediastinal diseases as well as infectious and contagious pleuropulmonary pathologies specific to tropical countries. Nevertheless chest radiology has the disadvantage of using X-ray images that are superimposed on only one plane. Present knowledge about its systematic perfor-

mance in a pre-employment check-up shows that it may sometimes prove useless and that it lacks any medical justification.¹⁻³ However, a rigorous clinical examination, intracutaneous tuberculin test, and other more effective imaging means would be more expensive and are less frequently available in the developing world.

Our study intends to show that the systematic performance of chest radiology is still important in pre-employment check-ups in the tropical environment.

Methods and patients

From August 2004 to July 2009 we carried out a retrospective study by analysis of 2540 frontal chest X-rays of male job applicants of seven private companies in Abidjan, Côte d'Ivoire. The continuous series was our sampling method. Job applicants did not present any thoracic manifestations and were judged apt for the job at the clinical examination. The chest X-rays were performed with a Phillips bone/lung radiographic device. The examinations were performed by experienced medical imaging technicians. Applicants were asked to take off their shirts. The examination was performed in postero-anterior, frontal, standing position and in deep inspiration. Analogue 36×43 cassettes were used. They contained films of the same format and development was done with a KONICA SRX 101A automatic developer.

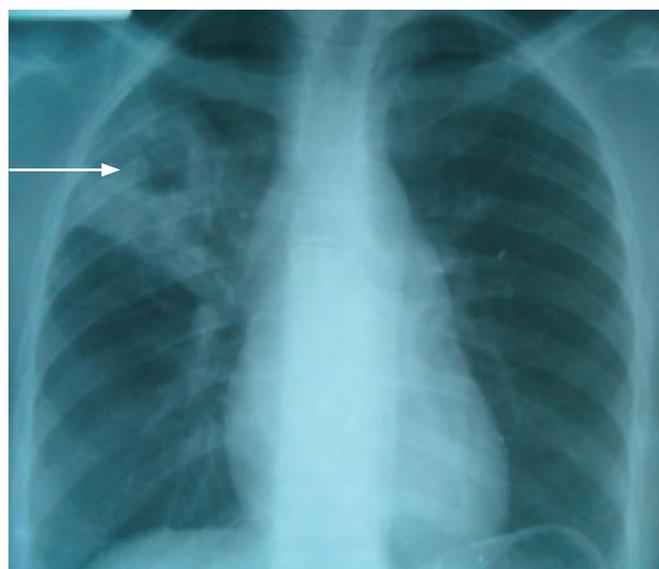


Figure 1 A 28-year-old apparently healthy young man. The X-ray showed a right apical cavitary consolidation (arrow): evolutionary pulmonary tuberculosis

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The analysis of the X-rays was performed by two senior radiologists in a double-blind study and conflicting results were accepted consensually. Only X-rays which conformed to the quality criteria were analysed. These criteria were:

- perfect exposure of the X-rays indicated by the visualisation of vessels at the back of the cardiac area and at the periphery of 1.5–2 cm of the thoracic edge, as well as the visualisation of at least three of the first thoracic vertebrae;
- a deep inspiration (indicated by the presence of more than five anterior costal bows above the right diaphragmatic dome);
- the taking of strict frontal X-ray (indicated by the equidistance of the spinous line in comparison with the internal edges of the clavicles);
- the standing position (presence of the sac with gastric air), the absence of superimposition of scapulas on the pulmonary areas;
- the perfect framing of the X-ray demonstrating the last cervical vertebrae and the pleural sacs.

The study of the X-rays consisted of the search for elementary lesions in the supraclavicular, axillary, and diaphragmatic soft parts first. Then a study of parietal bone structures (scapulas, clavicles, ribs and vertebrae). The study of the mediastinum consisted of looking for an abnormality at the level of lines and mediastinal bows followed by the determination of a cardio-thoracic ratio whose normal value was inferior or equal to 0.5. Pleural structures were studied by checking the freedom of the different sacs (cardiophrenic, costodiaphragmatic). Finally the pulmonary parenchyma was studied comparatively and bilaterally from the apex to the base. The different radiographic lesions were put together according to their number, morphology, and their location in a syndrome, which helped us reach a conclusion. The definitive diagnoses were communicated by the company doctor who carried out complementary examinations to confirm the pathologies suggested by the radiologists.

Results

All our patients were males. Their ages ranged between 20 and 36 years with a mean age of 28.13 years. They were considered by the companies' doctors to be subjects without any evolutionary pathology and without any

Table 1 Results of the analysis of 2540 job applicants' chest radiographies

Type of abnormality	Number	Percentage (%)
Evolutional pleuro-parenchymatous lesions	45	1.8
Pleuro-parenchymatous sequel lesions	21	0.8
Cardiomegaly	102	4.0
Normal radiography	2372	93.4
Total	2540	100.0

known cardio-thoracic history.

Some 2540 frontal, standing chest X-rays of satisfactory quality were studied; 2372 (93%) did not show any particular abnormality and 166 X-rays (7%) presented abnormal images (see Table 1). The observed lesions were dominated by cardiomegaly (102 cases, 61.4%) followed by pulmonary parenchymatous lesions (35 cases, 21.1%) and by pleural liquid effusions (10 cases, 6%). The 102 cases of cardiomegaly presented a cardio-thoracic index superior to 0.54. The parenchymatous abnormalities were represented by 35 evolutionary lesions in the form of 12 apical parenchymatous infiltrates, 7 excavated apical pneumopathies, and 16 non-excavated condensations (see Table 2). The 10 cases of pleural abnormality were encysted pleuritis. The 35 cases of evolutionary pleuroparenchymatous lesions represented 2% of all cases. The 21 sequel lesions were made up of 12 cases of apical atelectasis and 9 pleural calcifications.

Discussion

The 2540 subjects in our study who had chest radiography were all applicants for posts as urban bus drivers and labourers in factories. This type of job attracts mainly males in Africa, which is why our population sample was 100% male. This observation is different from other reports, particularly in the Asian literature,⁴ where as many women as men apply for similar jobs.

The mean age was 28 years – a young population which was applying for a first job. It is this age bracket that is more affected by pandemics such as tuberculosis and HIV/AIDS infection^{5,6} and where thoracic manifestations are preponderant.^{6,7} For the recruitment of pilots in the USA,⁸ the mean age was lower (23 years).

Of the X-rays analysed during our study 93% were normal. Our results agree with other reports, particularly Ladd et al,¹ who found 95% of X-rays normal. Cox et al⁸ found 97% normal X-rays in 3500 applicants for the post of pilot in the USA and Su et al⁴ found nearly 100% of X-rays normal. This leads us to wonder whether chest radiography during pre-employment check-up is not really as useless as most of the authors in developed countries think.^{1,9,10}

Table 2 Detail of evolutionary pleuroparenchymatous lesions

Type of abnormality	Number	Percentage (%)
Apical parenchymatous infiltrate	12	26.7
Apical cavitary pneumopathy	7	15.6
Non-excavated apical pneumopathy	16	35.5
Pleuritis	10	22.2
Total	45	100.0

The main objective of this systematic radiographic check-up during pre-employment medical examination was to look for tuberculosis disease, particularly thoracic,^{1,4,11} and also chest pathologies.^{9,10} In 7% of the subjects, X-rays presented an abnormality. These results were similar to other African and Asian studies^{4,6,7,12} and were apparently not important enough to justify X-ray diagnosis¹³ and the heavy cost for the company organising the check-up.^{1,10} Among these pathological results we noted evolutionary pleuropulmonary parenchymatous lesions (45 cases, 2%) and cardiovascular abnormalities (102 cases, 4%) of cardiomegaly type whose exploration had not been undertaken by the companies' doctor because of its high cost.

Apical evolutionary lesions considered as pulmonary tuberculosis by the radiologist were confirmed by bacteriological examinations by the company doctor. The same was true for encysted pleuritis. This fortuitous discovery of pleuropulmonary tuberculosis represented 2% of our population. Our results are higher than others in the literature. Mitchell and Schenk⁹ found 0.26% of evolutionary pulmonary pathology. Su et al⁴ found 0.12% of pulmonary tuberculosis. This low level of the discovery of tuberculosis by chest X-ray in Europe as well as in Asia and Africa, where this pathology is rife in endemic mode, could be explained by the fact that a pre-selection was done by the company doctors, who after a careful clinical examination eliminated applicants who presented general or physical functional signs which could lead to tuberculosis. The World Health Organization (WHO), and most of the European and American authors,^{1,10} would like to give more importance to intracutaneous tuberculin test than to chest radiography. But in our tropical context with a strong prevalence of HIV/AIDS, tuberculin intradermoreaction tests are often uninterpretable because of the anergy.⁶

Conclusion

Systematic chest radiography during pre-employment check-ups in our study and in the literature has helped to identify about 7% chest pathologies, including 2% of

infectious evolutionary parenchymatous lesions likely to constitute a risk for the working community of a company. It is for this reason, and taking into consideration the weak ratio between the cost and profit, as well as the radiation risk, that WHO and European and American authors recommend carrying out intracutaneous tuberculin tests in the place of chest radiography. But in our tropical context and considering the anergy caused by HIV/AIDS pandemics whose strong relation with tuberculosis is known, the presence of 45 cases of evolutionary clinically silent tuberculosis forces us to speak in favour of retaining systematic chest radiography in the pre-employment check-up.

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