Systematic chest radiography during pre-employment check-up

N Kouamé, A M Ngoan-Domoua, and A N Konan

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 evolutional 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.

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): evolutional pulmonary tuberculosis
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 vertebra 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 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.

**Table 1** Results of the analysis of 2540 job applicants’ chest radiographies

<table>
<thead>
<tr>
<th>Type of abnormality</th>
<th>Number</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Evolutional pleuroparenchymatous lesions</td>
<td>45</td>
<td>1.8</td>
</tr>
<tr>
<td>Pleuro-parenchymatous sequel lesions</td>
<td>21</td>
<td>0.8</td>
</tr>
<tr>
<td>Cardiomegaly</td>
<td>102</td>
<td>4.0</td>
</tr>
<tr>
<td>Normal radiography</td>
<td>2372</td>
<td>93.4</td>
</tr>
<tr>
<td>Total</td>
<td>2540</td>
<td>100.0</td>
</tr>
</tbody>
</table>

**Table 2** Detail of evolutional pleuroparenchymatous lesions

<table>
<thead>
<tr>
<th>Type of abnormality</th>
<th>Number</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apical parenchymatous infiltrate</td>
<td>12</td>
<td>26.7</td>
</tr>
<tr>
<td>Apical cavitory pneumopathy</td>
<td>7</td>
<td>15.6</td>
</tr>
<tr>
<td>Non-excavated apical pneumopathy</td>
<td>16</td>
<td>35.5</td>
</tr>
<tr>
<td>Pleuritis</td>
<td>10</td>
<td>22.2</td>
</tr>
<tr>
<td>Total</td>
<td>45</td>
<td>100.0</td>
</tr>
</tbody>
</table>
The main objective of this systematic radiographic check-up during pre-employment medical examination was to look for tuberculosis disease, particularly thoracic,\textsuperscript{1,4,11} and also chest pathologies.\textsuperscript{9,10} In 7% of the subjects, X-rays presented an abnormality. These results were similar to other African and Asian studies\textsuperscript{4,6,7,12} and were apparently not important enough to justify X-ray diagnosis\textsuperscript{13} and the heavy cost for the company organising the check-up.\textsuperscript{1,10} Among these pathological results we noted evolutive 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 evolutive 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 Schenk\textsuperscript{9} found 0.26\% of evolutive pulmonary pathology. Su et al\textsuperscript{13} 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,\textsuperscript{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 pandemics whose strong relation with tuberculosis is known, the presence of 45 cases of evolutive clinically silent tuberculosis forces us to speak in favour of retaining systematic chest radiography in the pre-employment check-up.

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 evolutive 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 evolutive clinically silent tuberculosis forces us to speak in favour of retaining systematic chest radiography in the pre-employment check-up.

References
13. World Health Organization. Scientific group on the indications and the heavy cost for the company organis...