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Interest of systematic chest radiography during periodic medical visits in workers

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Abstract
Background: Systematic chest X-ray is the most prescribed examination by occupational physicians during periodic medical check-ups in our context, unlike in most countries where this practice has been discontinued.
Objective: The objective was to determine the diagnostic yield and cost-effectiveness of chest radiography during periodic medical check-ups of workers in Ngaoundere.
Materials and methods: A cross-sectional and descriptive study carried out in Ngaoundere Regional Hospital, from January to December 2018, concerning all persons coming to perform a systematic chest X-ray in the context of the periodic medical check-up having consented to participate in the study. Postero-anterior (PA) chest radiographs were obtained from all workers during this periodic medical check-ps. The variables studied were: age, sex, clinical manifestations, antecedents, job type, cost, and chest X-ray results. Statistical analysis was performed using the Sphinx Plus² - Lexica-V5 Edition software.
Results : 753 workers were selected for this study, of whom 88.04% were men and 11.96% women, a sex ratio H / F of 7.4, the average age was 39 ± 7.89 years, with extremes of 24 and 56 years, the most frequent job type were the administration (38.37%), the storekeepers (17.92) and the drivers (15.27%), most of them were asymptomatic (97,47%), some had cough (2.52%), chest pain (2.12%), dyspnea (0.26%) and fever (0,13%). History was dominated by lung infection (2.39%), pleurisy (1.06%) and tuberculosis (0.79%). 7.43% of workers occasionally smoked tobacco and consumed alcohol. 41 cases of pathologies (5.44%) were found on the chest x-ray, including 1 case (0.13%) of major pathology, 40 cases (5.31%) of minor pathologies. When the results of the chest X-ray are compared with the clinical signs and the pathological history of the workers, it is found that the only case with major abnormalities on the chest X-ray showed clinical signs and that the other cases with minor abnormalities had either clinical signs or antecedents related to these abnormalities. The cost of a chest x-ray at the time of our study was 5,000 FCFA ($8.59), for a total of 3. 675 000 FCFA ($6473.74) for all the x-rays performed.
Conclusion: In view of the low rate of abnormalities on the chest x-ray and the minor nature of the pathologies, it can be said that the routine X-ray of the chest during the periodic medical check-ups has a low diagnostic yield and a low cost-effectiveness ratio and is not profitable. It should be non-systematic and case-by-case based on the clinical context and background of workers.

Keywords: chest x-ray, workers, periodic medical check-ups, diagnostic value, cost

Introduction

The periodic medical examination is a visit to which the employee is subjected in the course of his employment, carried out by the working doctor, on which the company depends. This is the central element of worker health surveillance. Prescribed by law, its purpose is to pronounce on the suitability or incapacity of the worker at the job type and to ensure that he does not present any contagious disease that could endanger the health of other workers [1]. During these periodic medical examinations, the occupational doctor carries out an interrogation, the clinical examination, and can carry out or prescribe the additional examinations necessary for the determination of the compatibility between the job type and the state of health of the worker, including the detection of conditions that may lead to a contre-indication to this job, an occupational disease that may result from the professional activity of the worker and the detection of dangerous diseases for the professional environment of the worker. The regulation does not specify the examinations to be performed during the periodic medical visits, thus leaving the choice to the doctor to prescribe the examinations according to the risk and the epidemiological context [2]. Of all the complementary examinations, the chest radiography is certainly the most prescribed by the occupational physicians. Its usual justification outside any occupational exposure is the search for undifferentiated tuberculosis [3]. Adekol and al. in a study on routine chest X-ray in pre-employment medical examination for healthcare workers found a single abnormality that was cardiomegaly in 4.8%, so 66% was over 41 years old therefore significantly associated with age, he therefore concluded that this practice was not necessary and should be reserved for older workers [4]. Moifo and al. in a study assessing the role of routine chest X-ray in asymptomatic students during university enrollment in a tuberculosis-endemic area find that this practice has low

diagnostic yield and is therefore not profitable in a context where resources are limited [5]. X-rays of the chest are probably the screening test whose prescription has decreased the most in France helped by the abandonment of its systematic prescription in occupational medicine, obstetrics or preoperatively, the current consensus in France is not to ask for routine radiography under 60 years old [6]. Indeed its reading is difficult and not free of false negatives and especially false positives, resulting in the prescription of additional exams heavy and unnecessary. In some countries, this examination is in great demand by the employees, firstly because of the high proportion of smokers in the workplace who wish to self-control, but also because those workers would like to have a certain advantage at the expense of the employer. For the occupational physicians, the experience of systematic prescriptions for chest x-rays does not show any particular benefit, especially for areas where no potential respiratory risk is to be monitored [6]. Zima- Ebeyard and al. in a study entitled Interest of Systematic Diagnostic Radiology of the chest during Periodic Medical Visits (PMV) among workers in Gabon, found a high performance for screening for tuberculosis and low for lung cancer, they therefore propose that thoracic radiography should be performed on a case-by-case basis and should be preceeded by a clinical examination including a thorough anamnesis and in particular a good interview on known occupational and environmental exposures [3]. The last similar study carried out in our country dates back to 1998 by Nouthe Djudgang and al who arrived at the same conclusion [7]. Yet in our country the practice of routine chest x-ray in medical periodic visits is still very common, practically requested routinely by almost all working physicians, despite the abandonment by many countries. Thus, we proposed to evaluate the interest of this practice in the follow - up of the workers in our context, in particular as regards the diagnostic yield and the cost - effectiveness ratio.

Materials and Methods

We carried out a cross-sectional descriptive study at the regional hospital of Ngaoundéré, during one year from January to December 2018, concerning all persons coming to realize a systematic radiography of the thorax as part of the periodic medical visits. Initial consultation was carried out at the Emergency Unit by General Practitioners to screen for any underlying illness and also to assess past medical history. A PA chest radiograph was then obtained at the Diagnostic Radiology Unit upon presentation of a request form that contained the following information; name, age, gender, job type and clinical findings. The quality of the radiographs was first checked by radiology technician and final interpretation of the radiographs was done with the aid of a view box by two consultant radiologists with more than 5 years of experience in the interpretation of chest radiographs. The abnormalities found on the chest X-ray were coded as normal, minor and major according to the need or not for a complementary assessment. The results of the chest x-ray were confronted with the clinic and the antecedents. We evaluated the cost of single-view conventional PA chest radiograph at this hospital at the time of the study. The local currency, the *Communauté Financière Africaine* franc (F CFA) was used to determine the cost and then converted to United States dollars ($) using the exchange rate as at the time of the study. Data were collected with the aid of a standardized questionnaire. The collected data were analyzed statistically using the Sphinx V5 Edition statistical software.

Results

A total of 753 workers were enrolled. There were 663 men (88.04%) and 90 women (11, 96%), giving a sex ratio of 7:37. The mean age of the study population was 39 years, with a minimum of 26 years and a maximum of 56 years (Figure 1).

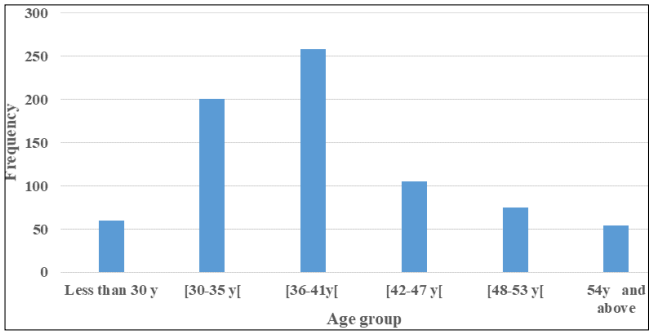

Fig 1: Distribution of patient by age

Workers were mostly administrative staff with 38.37%, drivers with 17.92%, and storekeepers with 15.27% and technicians with 7.43% (Table 1).

Table 1: Distribution by job type

Profession	Frequency	Percentage (%)
Administration	289	38.37
Driver	135	17.92
Storekeeper, handling work	115	15.27
Technician	56	7.43
Accountant	40	5.31
Cashier	33	4.38
Mechanic	1	2.52
Watchman	15	1.99
Others	51	6.77
Total	753	100

An interrogation and clinical examination of the workers before the chest X-ray revealed that 734 (97,47%) were asymptomatic, 19 workers (2.52%) had cough, 16 workers (2.12%) had chest pain, 2 workers (0.26%) dyspnea and one person (0.13%) fever. In addition, there was a history of tuberculosis in 6 workers (0.79%), pleurisy in 8 workers (1.06%) and pulmonary infection in 18 workers (2.39%). 56 cases (7.43%) of occasional smoking and alcohol drinking were declared.

Of the 753 radiographs obtained, 712 were normal (94.55%), while 41 x-rays (5.44%) showed abnormalities (Table 2), thus 14 cases (1.85%) of blunting of left costo-phrenic angle, 9 cases (1.19%) bunting of right costo-phrenic angle, 8 cases (1.06%) of cardiomegaly, 3 cases (0.39%) of basal infiltrate, 6 cases (0.79%) of apical infiltrate and one case (0.13%) of right pleural liquid effusion of mean abundance with right para-tracheal opacity.

Table 2: Distribution of patient by chest x ray results

Results	Frequency	Percentage (%)
Normal chest x ray	712	94.50
Blunting of left costo-phrenic angle	14	1.80
Blunting of right costo-phrenic angle	9	1.19
Cardiomegaly	8	1.06
Basal infiltrate	3	0.39
Apical infiltrate	6	0.79
Moderate right pleural effusion + anterior superior right paratracheal opacity	1	0.132
Total	753	100

Among these abnormalities 40 cases (5.31%) were considered minor and one case (0.13%) as major (Figure 2).

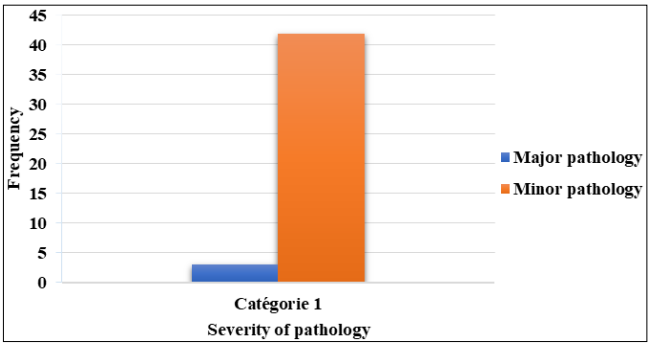

Fig 2: Distribution of pathology by severity

(Figure 3, 4, 5, 6 and 7) show the examples with minor and major abnormalities encountered.

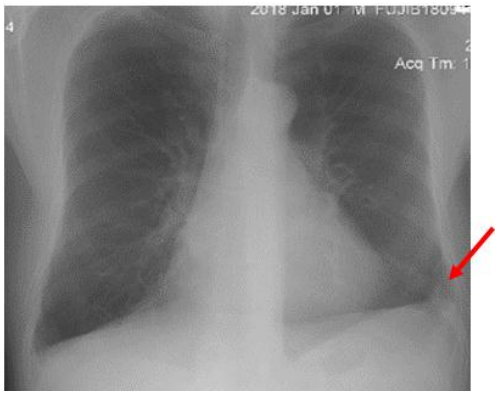

Fig 3: Blunting of left costo-phrenic angle (red arrow)

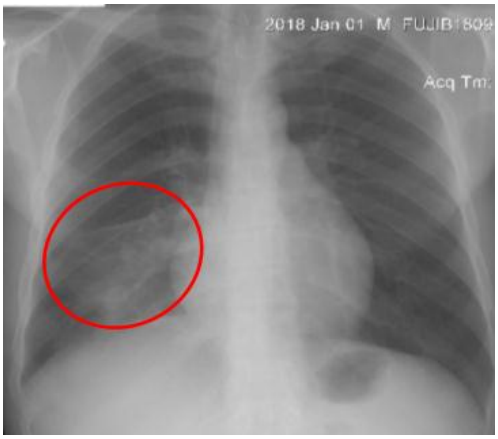

Fig 4: Right basal infiltrate (red circle)

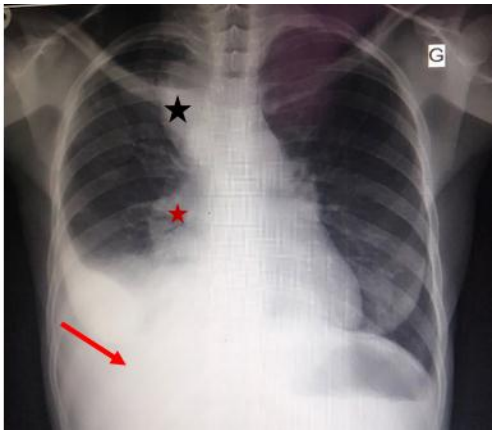

Fig 5: Moderate right pleural effusion (red arrow), anterior superior right paratracheal opacity (black star) and right hilary opacity.

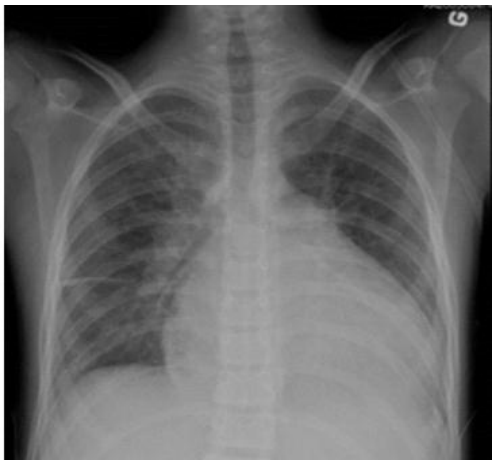

Fig 6 : Cardiomegaly.

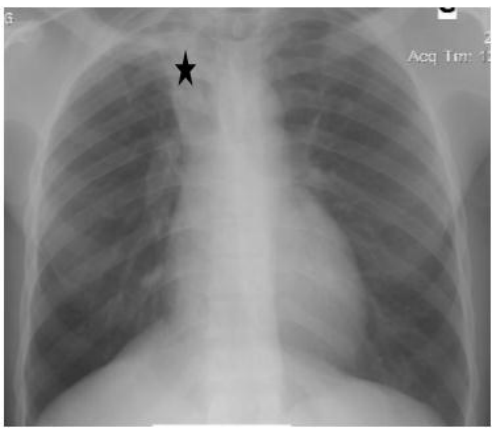

Fig 7: Right apical infiltrate (black star).

When the results of the chest X-ray were compared with the clinical signs and the pathological history of the workers, it was found that the only case with major abnormalities on the chest X-ray showed proven clinical signs, 56.52% of the workers with blunting of costo-phrenic angles on chest X-ray complained of chest pain (Table 3) and that one third of those patients had a history of pleurisy, 77.77% of workers with basal or apical infiltrate had a history of either tuberculosis or lung infection (Table 4). The cost of a single-view PA chest radiograph at the Ngaoundere Regional Hospital at the time of the study was 5 000 F CFA ($ 8.59). The direct cost of all the 753 radiographs obtained was estimated at 3,765,000 F CFA ($ 6,469).

Table 3: Distribution of chest x ray results by clinical signs.

	Clinical signs			
Results	**Cough**	**Chest pain**	**Dyspnea**	**fever**
Normal chest x ray	17	02	/	/
Blunting of left and right costo-phrenic angle	/	13	/	/
Cardiomegaly	/	/	01	/
Basal infiltrate	01	/	/	/
Apical infiltrate	/	/	/	/
Moderate right pleural effusion + anterior superior right paratracheal opacity	01	01	01	01

Table 4: Distribution of chest x ray results by antecedents

	Antecedent		
Results	**Tuberculosis**	**Pulmonary infection**	**Pleurisy**
Normal chest x ray	01	10	01
Blunting of left and right costo-phrenic angle	/	02	06
Cardiomegaly	/	/	/
Basal infiltrate	01	01	/
Apical infiltrate	04	01	/
Moderate right pleural effusion + anterior superior right paratracheal opacity	/	01	01

Discussion

Most of the workers in our studied population were men, this was due to the fact that most of the personnel of the companies occupy posts dedicated to men, such as storekeepers, drivers, assistant drivers and mechanics, and posts dedicated to few women, hence the low representation of women in this study. With an average age of 39 years, we think that this represents perfectly the majority of people of working age, able to exercise the different trades found in the companies concerned by these periodic medical visits, the majority of these staff was between 30 and 47 years old, about 78%, Adeko *et al.* [4] in a study of routine chest X-ray during pre-employment medical visits to health workers found an average age of 26.6 years and from 20 to 49 years was predominant, this difference is due to the fact that in this study the people concerned are still looking for work whereas in our study, they are confirmed workers in different companies. In our series, 712 radiographs were normal or 94.55% against 41 cases of abnormalities found or 5.44%, these results are similar to those of Adeko and Al who had found in a study in pre-employment 95.2% normal radiographs and 4.8% abnormalities [4], and quite apart from those of Moifo and al who found 2.5% of pathologies in a study evaluating the role of routine chest radiography in students during university enrollment in an area endemic for tuberculosis [5].

Among the abnormalities found in our series, one was major or 0.13%, in a patient with known and proven clinical manifestations, 40 pathologies or 5.31% were minor, as in most studies [5, 7, 8, 9]. Zina - Ebeyard and al in Gabon found 1.5% progressive pathologies in a study of 3276 chest x-rays during periodic medical visits [3]. When the results of the chest X-ray were compared with the clinical signs and the pathological history of the workers, it was found that the only case with major abnormalities on the chest X-ray showed proven clinical signs, 56.52% of the workers with blunting costo-phrenic angle on chest X-ray complained of chest pain and that one third of these patients had a history of pleurisy, 77.77% of workers with basal or apical infiltrate had a history of either tuberculosis or pulmonary infection. The medical history and clinical signs for which abnormalities were found on the chest x-ray were history of TB and pleurisy in 0.28% each. 1.97% of abnormalities on chest X-ray were found in the context of chest pain, dyspnea and fever. For this reason, most authors recommend that chest X-rays should be performed on a case-by-case basis after a clinical examination including a thorough anamnesis and in particular a good interrogation on the known occupational and environmental exposures [3-10]. It is likely that chest radiographs were obtained from these healthy persons to detect any occult disease such as lung cancer as early as possible so that cure can be possible, even though chest radiography has been found to have a poor sensitivity for the detection of lung cancer [11]. Some studies have shown no benefit in screening even a high-risk group such as smokers for lung cancer using radiography [12, 13]. Also, even if some of these workers might have been exposed to the germ *Mycobacterium tuberculosis*, normal chest radiographs have been demonstrated in up to 15% of patients with proved tuberculosis [14]. Physically active healthy individuals involved in highly competitive sporting activities might have a physiologic enlarged cardiac silhouette.

When exposed to ionizing radiation, the advantages to potential risks should always be carefully considered. If the possible benefits are offset by the potential risks, the procedure can also be considered [5]. The cost-effectiveness of any diagnostic radiology procedure must also be carefully considered, particularly in a resource-poor environment such as ours, as the expense of resources in procedures with low diagnostic performance would not be cost-effective. The cost of X-rays varies from one country to another, within a country, from one city to another, whatever the cost, the X-ray of the chest must be able to provide a benefit to the patient. In our series, only one patient was able to really benefit from her X-ray, one could really do without X-rays of the chest in other staff.

Some limitations were however encountered during this study, including the fact that only single-view chest radiographs were obtained, and no previous or further investigations were available for the workers whose radiographs showed some parenchymal changes which we considered of no grave pathologic consequence based on radiological presentation alone. We could not therefore rule out previous tuberculosis among those with apical or basal infiltrate.

Conclusion

The 5.44% abnormalities rate found in the study appears to be low and calls into question the usefulness and cost-effectiveness of thoracic chest X-ray in periodic medical visits. The only major pathology was found in a person with proven and known clinical signs. However, patients with lesions on the chest X-ray had clinical signs and antecedents related to these abnormalities, hence the interest of an interrogation and a preliminary clinical examination that could make it possible to discuss the appropriateness of the whether or not the chest X-ray is performed. It should be unsystematic and case-by-case depending on the clinical context and worker history.

Declaration of Interest

The authors declare to have no competing interest in relation to this article.

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