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Indications and Findings of Pediatric Chest X-Rays in a Secondary Referral Hospital in Cameroon

Indications et résultats de la radiographie thoracique chez les enfants à l'Hôpital Régional de Buea

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Original Article

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ABSTRACT

Background: Chest radiography (CXR) remains a frontline imaging modality for evaluating thoracic pathology in children. However, international guidelines advise against its use in uncomplicated respiratory conditions, citing limited diagnostic value and risks from ionizing radiation. The aim of our study was to describe the indications and findings of pediatric chest radiography at Buea Regional Hospital (BRH), Cameroon.

Methods: A retrospective study was conducted over 18 months (January 2021–June 2022) using imaging department records. Data were collected for children aged 0–15 years who underwent chest radiography, excluding cases without radiologist interpretation. Sociodemographic characteristics, indications, and radiographic findings were analyzed descriptively.

Results: A total of 111 pediatric CXRs were reviewed. Males accounted for 56%, with a mean age of 4.3 years; infants aged 1 month to 1 year were most represented (37.8%). General practitioners and pediatricians requested most CXRs (47.3% and 45.5% respectively). Indications were not mentioned in 19.8% of cases. Among documented indications, cough (18.9%), cough with fever (15.3%), and suspected pneumonia (15.3%) were predominant. Overall, 35.1% of CXRs were normal. Bronchiolitis (33.3%) and pneumonia (19.8%) were the leading findings. In neonates, 66.7% of CXRs were normal.

Conclusion: These results highlight the importance of justified indications for CXRs to avoid unnecessary radiation exposure, especially in neonates and infants. This therefore raises the question of the relevance and necessity of applying the principles of radioprotection, particularly the principle of justification of procedures.

RESUME

Introduction : La radiographie du thorax (RT) reste une modalité d'imagerie de première ligne pour l'évaluation des pathologies thoraciques de l'enfant. Toutefois, les recommandations internationales déconseillent son utilisation dans les affections respiratoires non compliquées, en raison de sa valeur diagnostique limitée et des risques liés aux rayonnements ionisants. Le but de notre étude était de décrire les indications et les résultats des radiographies thoraciques pédiatriques à l'Hôpital Régional de Buea (HRB), Cameroun.

Méthodes : Une étude rétrospective a été menée sur une période de 18 mois (janvier 2021 – juin 2022). Les données ont été recueillies pour les enfants âgés de 0 à 15 ans ayant bénéficié d'une RT. Les caractéristiques sociodémographiques, les indications et les résultats radiographiques ont été analysés de manière descriptive.

Résultats : Au total, 111 radiographies thoraciques ont été examinées. Les garçons représentaient 56 % des cas, avec un âge moyen de 4,3 ans ; les nourrissons âgés de 1 mois à 1 an étaient les plus représentés (37,8 %). Les indications n'étaient pas mentionnées dans 19,8 % des cas. Les indications les plus fréquentes étaient la toux (18,9 %), la toux avec fièvre (15,3 %) et la suspicion de pneumonie (15,3 %). 35,1 % des RT étaient normales. La bronchiolite (33,3 %) et la pneumonie (19,8 %) étaient les principales anomalies observées.

Conclusion : Ces résultats soulignent l'importance de la justification des indications des radiographies thoraciques de l'enfant afin d'éviter une exposition inutile aux rayonnements ionisants, en particulier chez les nouveau-nés et les nourrissons.

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Introduction

Chest Radiography or chest X-ray (CXR) remains the first-line examination for any thoracic pathology in children. Despite the advent of modern techniques such as Ultrasound, Computer Tomography (CT), Magnetic Resonance Imaging (MRI) and Scintigraphy, chest X-ray remains a frontline examination in this field [1]. Its accessibility, affordability, and diagnostic utility make it indispensable for evaluating thoracic pathology in children. There is an extensive range of CXR indications for children, mainly unexplained fever, cough and fever, chest pain, difficulty in breathing and it is often sufficient to establish a diagnosis, especially in low to middle incomes countries with limited resources [2,3]. But there are many cases for which it is not relevant according to international recommendations. For example, in case of uncomplicated asthma, bronchiolitis, uncomplicated pneumonia, first episode of wheezing in infants, it is advice to avoid CXR [4,5]. Most of the time it does not add value to the clinical diagnosis, can lead to an incorrect diagnosis (considering the challenges in interpreting children CXR), unnecessary antibiotic prescription and additional costs [6]. And more important, it is a source of radiation exposure in children, who are more radiosensitive. Given the risk of exposure to ionizing radiation associated with this procedure, the benefit for this should outweigh the risk, following the radioprotection principles of justification [7].

Despite its diagnostic value, studies have shown that chest radiographs are often requested without clear clinical indications, leading to unnecessary radiation exposure [8–10]. This is especially concerning in neonatal and infant populations, where imaging challenges (such as motion artifacts and poor cooperation) can compromise image quality and diagnostic yield [11,12]. In Cameroon, and specifically at the Buea Regional Hospital (BRH), chest radiography is routinely employed to investigate respiratory and cardiac symptoms in children. However, there is limited data on the appropriateness of indications and the diagnostic outcomes of these procedures. This study aims to describe the indications and findings of pediatric chest radiography in a limited-resource setting, at Buea Regional Hospital.

Materials and Methods

We carried a retrospective study at Buea Regional Hospital (BRH) during a period of 18 months from January 2021 to June 2022, using records of the imaging department registers. BRH is a secondary health facility and a main referral hospital in the Southwest Region of Cameroon. The hospital is made up of four major departments, which include: Pediatrics, Internal Medicine, Surgery and Obstetrics, and Gynecology (OBGYN). The hospital also has specialized centers such as the Dialysis Center, Intensive Care Unit (ICU), Ophthalmology Unit, Dentistry, Medical Imaging, Neonatology, and kangaroo Mother Care (KMC) units. The technical staff at the Medical Imaging Center is composed of three radiologists, seven imaging technicians and sonographers and two biological engineers. The pediatric unit is made up of 2 pediatricians and 3 general practitioners. Information's on CXR of children aged 0 to 15 years from imaging unit registers were included in the study. Chest x-rays without radiologist interpretation were excluded. Data on sociodemographic characteristics, indications and results of chest x-rays were collected using a data extraction form. Data were verified, entered into the data collection form designed on Kobo Collect and exported to excel 2016 for cleaning and analysis. Information's were coded to ensure confidentiality. Categorical variables were presented as frequencies and percentages; quantitative variables as means with standard deviation (SD).

Results

A total of 111 CXR of children aged 0 to 15 years were included in this study, with predominance of male in 62 cases (56%) with a sex-ratio of 1.27. The most represented age group was of 1month-1year with 42 cases (37.8%), with a mean age of 4.3 years (figure 1).

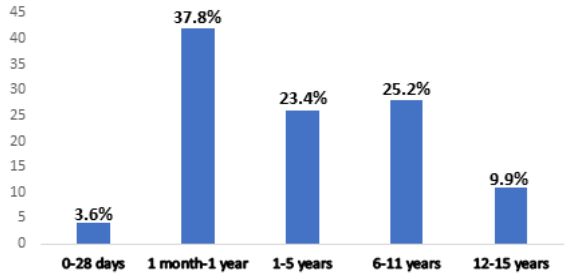

Figure 1: distribution according to age

Out of the 111 CXR requested, 52 (47.3%) were requested by a general practitioner and 50 (45.5%) by a pediatrician (figure 2).

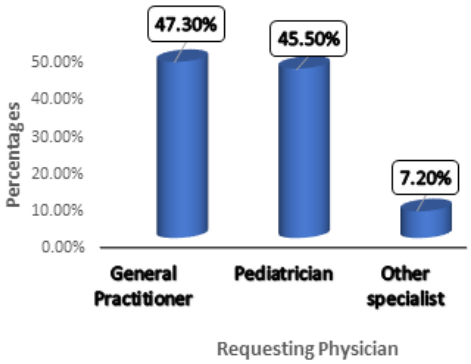

Figure 2: Chest X-ray distribution according to requesting physician

In most of the cases, the indication for the CXR was not mentioned 22 (19.83%). For the mentioned indications, cough (18.93%), cough associated with fever (15.32%) and suspicion of pneumonia (15.32%) were predominant (Figure 3).

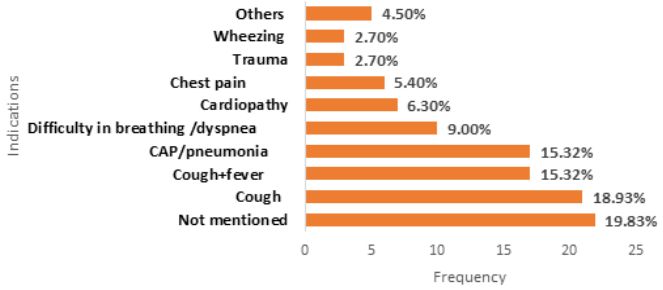

Figure 3: indications for chest X-ray

More than third of the CXR were normal 39 (35.14%). The main radiologic findings were bronchiolitis 37 (33.33%) and pneumonia 22 (19.82%) as shown on figure 4. CXR findings in neonates were normal in 66.7% of cases. Among infants the main finding was bronchiolitis.

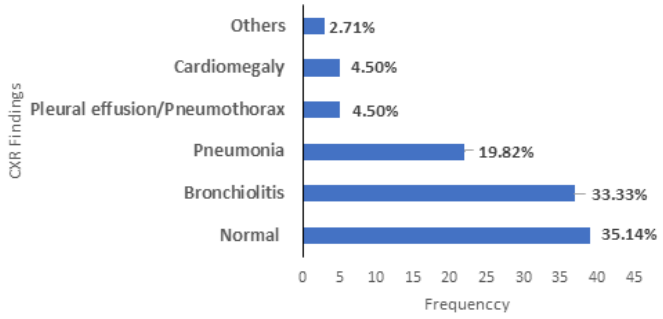

Figure 4: Chest X-ray findings

Figure 5: Chest X-ray of an Infant of 4 months, antero-posterior projection, showing diffuse bronchi walls thickening in favor of bronchiolitis. The heart is normal in shape and size. The pleural cavity is free

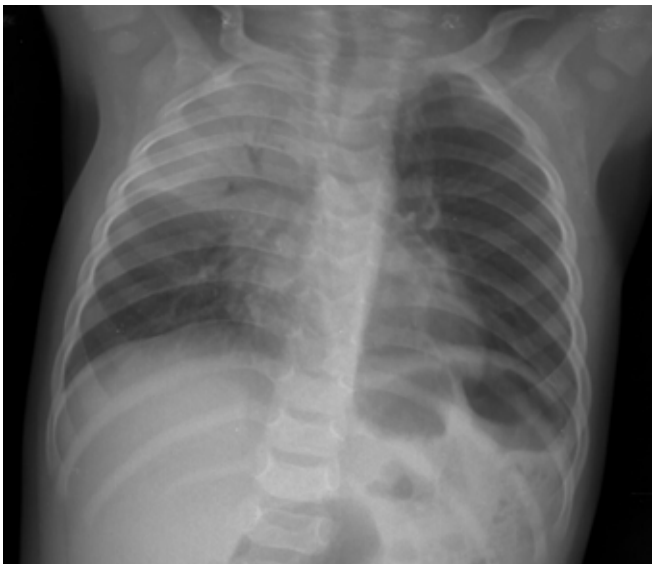

Figure 6: Chest X-ray of an Infant of 11 months, antero-posterior projection, showing a right upper lobe opacity, confluent, with well-defined margins and air bronchogram. The heart shape and size are normal. There is no pleural effusion. Diagnosis: right upper lobe pneumonia

Discussion

This study explored the indications and findings of pediatric chest radiography at the Buea Regional Hospital (BRH), highlighting both clinical trends and radioprotection concerns. The findings reveal that chest X-rays (CXR) are frequently requested for children presenting with respiratory symptoms, particularly cough, fever, and suspected pneumonia. These results align with global patterns, where respiratory tract infections remain the leading cause of pediatric imaging requests.

Demographic characteristics and referring physician

The study included 111 chest X-rays of patients aged one day to 15 years. The male gender was predominant in 56% of cases. Infants of one month to one year were the most represented (37.8%). These findings are similar to those of a study carry out in Ngaoundere in 2018, were males and infants (32.1%) were most represented[3]. The majority of chest radiographs were requested by pediatricians (47.3%) and general practitioners (45.5%), which reflects the structure of BRH, where these group of physicians are often the first point of contact for children, at emergency unit and outpatient department. While for pediatricians there should be high level of clinical suspicion and diagnostic rigor, it might be the case for general practitioners.

Indications for Chest X-ray

Cough was the most frequent indication (18.93%), followed by cough with fever (15.32%) and pneumonia (15.32%). Neossi et al found also cough as the main indication (22.1%)[3]. These findings are not consistent with those reported by Morgan et al.[13],

Citation as **J Sci Dis 2025, Vol 3 (4): 87 - 91**

who identified respiratory tract infections, suspected foreign body aspiration, and congenital anomalies as common indications for pediatric chest radiography. This highlights the fact that in BRH, physician mainly use symptoms as CXR indications. Cough represents a major physiological reaction to airway irritation and attempts to defend the respiratory tract by clearing it from irritant agents and extra mucous[14]. It is a common symptom among children, accounting for many outpatient visits, and affecting the quality of life of both children and their families. Generally, cough is a self-limiting symptom since among healthy children it is most often induced by respiratory tract infections triggered by viral, bacterial, and fungal airway pathogens[14,15]. In neonates, cyanosis and suspected congenital heart disease were prominent indications (33.33%), underscoring the importance of early cardiac screening in this age group. Most neonatal lung disorders can be diagnosed and managed with radiographs alone. But in some cases, like congenital lung malformations and cardiovascular abnormalities, cross-sectional imaging may provide essential additional clinical information, chest ultrasound and/or CT may be indicated[16,17].

However, the study also revealed that a significant proportion of chest X-rays were performed without documented clinical indications (19.83%). This raises concerns about adherence to radioprotection principles, particularly the principle of justification, which mandates that every imaging procedure must be clinically warranted[18]. Studies carried out in Yaounde, Cameroon, revealed unsatisfactory level of knowledge of referring physicians regarding justification of ionizing examinations[19,20]. Proposed solutions are education during medical studies and continuous education in hospitals on radiation protection, alongside with elaboration of imaging referral guidelines, clinical audit and regulation[19].

Radiographic findings

Among the 111 chest X-rays records reviewed, 37 (33.33%) showed bronchiolitis (bronchial syndrome or thickening of bronchial walls), 22 (19.82%) revealed pneumonia, and 39 (35.14%) were normal. The relatively high rate of normal findings suggests that some imaging requests may have been precautionary rather than diagnostic. This is consistent with literature indicating that uncomplicated bronchiolitis and acute bronchitis are not indications for chest radiography, as per the French Haute Autorité de Santé (HAS) guidelines[10]. Many studies and guidelines described chest X-ray as not recommended in case of uncomplicated bronchiolitis, asthma, pneumonia or first wheezing syndrome, since it might lead to an incorrect diagnosis, unnecessary antibiotic prescription, additional costs, and an increased length of stay in the hospital[4,6,8,21,22]. However, the overlap in radiographic features between viral and bacterial infections can complicate interpretation, especially in young children with atypical presentations. In such cases, chest radiography remains a valuable tool for evaluating the aetiology of fever without a focus, particularly in cases of hyperleukocytosis [23]. Although radiographs are not recommended for typical cases, CXR may help guide further investigations and management, especially in case of children with underlying respiratory/cardiac disease, a history of prematurity, significant hypoxia, focal abnormalities or severe respiratory distress [6].

Radioprotection and clinical implications

This study highlights a critical issue: the potential overuse of chest radiography in pediatric populations. Reducing radiation exposure in pediatric medical imaging is crucial due to children's heightened sensitivity to ionizing radiation and their longer life expectancy, which increases the risk of long-term effects [24]. Given the risks associated with ionizing radiation in children there is an urgent need to reinforce radioprotection protocols in resource-limited setting, emphasizing on justification and optimization respecting the principle of ALARA (As Low As Reasonably Achievable). This includes to ensure clear clinical indications before imaging. The education of clinicians and families on appropriate use of radiography [18]. the implementing decision-support tools to guide imaging requests (Imaging referral guidelines). the using digital radiography [25]. Training imaging technologists to protocol optimization: by tailoring imaging protocols based on the child’s age, size, and clinical need and using the lowest effective dose that still provides diagnostic-quality images [24]. The use of non-ionizing modalities such as ultrasound and MRI when appropriate [17]. The integration of artificial Intelligence (AI) algorithms to help detect abnormalities more accurately, reducing the need for repeat scans [25,26].

In resource-limited settings like BRH, where advanced imaging modalities may not be available, chest radiography remains a cornerstone of pediatric diagnostics. However, its use must be balanced against the risks, particularly in neonates and infants who are most vulnerable to radiation effects.

Conclusion

The main reasons for chest X-rays at Buea Regional Hospital are cough and suspected pneumonia. More than a third of the X-rays performed are normal. The most frequently observed pathologies are bronchial syndrome and pneumonia. These results highlight the importance of correct indications for CXR, as incorrect or inadequate indications lead to unnecessary exposure of children to ionizing radiation, particularly newborns and infants. This therefore raises the question of the relevance and necessity of applying the principles of radioprotection, particularly the principle of justification of procedures.

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Authors contribution: DFS, MTJR and FPY gave the topic idea, drafted the data extraction form and collected data. DFS and ONM analyzed data. DFS, MTJR and TSM drafted the manuscript. TJ, OYR, FPY and TSM helped reviewing the manuscript. BM and ZOF corrected the final version of the manuscript. All the authors agree with the final version.

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