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Patterns of Radiographic Findings in Pediatric Chest Radiographs In Enugu State, Nigeria: Multi-Center Study

Beatrice Ukamaka Maduka[1], Michael Promise Ogolodom[2*], Awajimijan Nathaniel Mbaba[3], Collins Jideofor Maduka[4], Agbo Julius Amechi[1], Rufus Abam[3] and Robert Oziegbe Akhigbe[5]

[1]Department of Medical Radiography and Radiological Sciences, University of Nigeria Enugu Campus, Nigeria

[2]Rivers State Hospitals Management Board, Port Harcourt, Nigeria

[3]Department of Radiology, Rivers State University Teaching Hospital, Port Harcourt, Rivers State, Nigeria

[4]Department of Haematology, Federal Medical Center, Umuahia, Abia State, Nigeria

[5]Department of Radiography and Radiological Sciences, Nnamdi Azikiwe University, Nnewi Campus, Awka Anambra State, Nigeria

[*]**Corresponding author:** Michael Promise Ogolodom, Rivers State Hospitals Management Board, Port Harcourt, Nigeria, Tel: +2348039697393; E-mail: mpos2007@yahoo.com

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Abstract

Background: Common and rare entities may manifest differently in younger children than in adults on chest radiograph and the sort of pathology encountered in pediatric patients also varies. This study was designed to evaluate the common radiographic chest findings in pediatric patients to obtain comprehensive data that will serve as a reference for the diagnosis of pediatric chest diseases in our locality.

Materials and Methods: This was a cross-sectional retrospective review of radiological reports of pediatric patients who underwent chest X-ray investigations in two selected hospitals in Enugu metropolis. Ethical approval for this study was obtained from the Human Research and Ethics Committees of the study centers.

Results: Out of 200 cases studied, 82% (n=164) was pathological with pneumonia having the highest frequency of occurrence, 17.0% (n=34). Normal finding accounted for about 18% (n=36). Out of the total sample size, females were highest 55.50% (n=111) when compared with their male counterparts 44.50% (n=89). Age group >1 year-4 years was highest 18.50% (n=37) and the least was age group 11 days -20 days, which is 4.0% (n=8). Pneumonia has weak positive correlation at (r=0.37, p=0.29), Pneumothorax has weak positive correlation with age at (r=0.14, p=0.70), Normal finding has weak positive correlation (r=0.51, p=0.13), Neonatal respiratory distress syndrome (r=0.10, p-value=0.77).

Conclusion: Pneumonia was the most common radiographic chest finding in this study. The female population was highest in this study. The majority of the patients were within the age range of >1 year to 4 years of age. There was no statistically significant relationship between pneumonia and patients' age.

Keywords: Chest radiograph; Patterns of findings; Pediatric

Introduction

Diagnostic imaging of the pediatric chest differs vastly from that of the adult patient. Both common and rare entities may manifest differently in younger children than in adults. Additionally, the sort of pathology encountered in pediatric patients also varies. The chest radiograph is a valuable diagnostic tool for pediatric chest pathology; its applications include screening, diagnosis and monitoring response to medications of respiratory illnesses. A chest radiograph is a unique imaging modality in that it can be archived and systematically evaluated and thus enabling cross-study comparisons [1].

The chest radiograph is one of the most commonly requested radiological investigation in the assessment of the pediatric patient. It can be performed on pediatric patients for a number of indications [2] including respiratory disease (e.g respiratory distress syndrome), cardiac disease, bronchitis, pneumonia, pulmonary tuberculosis, pneumothorax, trauma, foreign bodies, septic screening. They may also be requested as part of a skeletal survey or to confirm the position of central and umbilical lines, as well as nasogastric tubes [3].

The chest X-ray remains the starting point in the imaging armamentarium. Different views known as projections can be adopted in producing a chest radiograph by changing the

relative orientation of the body and the direction of the X-ray beam. The projections can be classified into routine projections and additional projections. The routine projections are; posteroanterior projection, Antero-posterior projection, and lateral projection while the additional projections are oblique projection, right or left lateral decubitus projections, apical projection and lordotic projection and the expiratory view. Required projections can vary by country and hospital, typically an erect posteroanterior projection is the first preference for the following reasons; it reduces the magnification of the heart, therefore, preventing the appearance of cardiomegaly, it reduces radiation dose to radiation-sensitive organs such as thyroid, eyes, and breast. It visualizes maximum areas of the lung, it moves scapula away from the lung field, it is more stable for the patient as they can hold onto the unit which reduces the patient's movement, and its compression of breast tissues against the film cassette reduces the density of tissue around the centering point bases, therefore visualizing them more clearly [4]. When PA projection is not possible then an anterior-posterior projection will be taken. Anterior-posterior (AP) imaging is used when the patient is non-ambulatory but usually results in the reduction of image quality, including magnification of heart size and poorer detail of lung structure. The AP technique can obscure pathology that is present and produce artefactual opacities [5] Nonetheless, in pediatric chest imaging, the anterior posterior projection is frequently employed to reduce stress in positioning and ensures the patient comfort.

Computed Tomography (CT), Magnetic Resonance Imaging (MRI), Ultrasound Imaging and Radionuclide Imaging can be helpful in detecting abnormalities or diseases of the chest. However, there is widespread use of chest radiography in emergency diagnosis and treatment because it is fast and easy, the exam requires little or no special preparation, and it uses a very small dose of ionizing radiation to produce images when compared to CT or radionuclide imaging [6].

The common findings in a pediatric chest radiograph include cardiomegaly, pneumothorax, pneumoperitoneum, emphysema, pleural effusion, congestive heart failure, pneumonia, asthma, cystic fibrosis and non-accidental injuries [7]. Others are intrathoracic cystic lesions including congenital diaphragmatic hernias e.g. Morgagni hernia [8]. It was noted, that common findings of pediatric chest radiographs present several unique challenges and nuances stemming from the congenital variants and pathologic processes specific to the population [9]. Furthermore, it has also been documented that CXR interpretations are subjective, thereby making it difficult to achieve measurements that are reproducible, reliable, and valid [10-12].

A chest radiograph is one of the most common radiological investigation undertaken in pediatric clinical practice in our setting. Consequently, identification and familiarization with the range of common pediatric radiographic chest findings especially in a low-income setting like ours is indispensable for the optimization of care for our pediatric population. Referring clinicians look to radiologists to provide diagnoses that will direct clinical decision-making. Errors in interpretation may lead to inappropriate further imaging, incurring additional radiation exposure and cost, as well as psychological effects on the patients and their families. In this study, we aimed to assess common radiographic chest findings in pediatric patients to obtain comprehensive data that will serve as a reference for the diagnosis of pediatric chest diseases.

Materials and Methods

This was a cross-sectional retrospective review of radiological reports of pediatric patients who underwent chest X-ray investigations in two selected hospitals in Enugu metropolis. A sample size of 200 was used for this study, and they were selected purposively based on the inclusion criteria from the radiology department database of the selected study centers from March 2017 to July, 2017. Radiological reports of pediatric patients with information such as age, gender, clinical indications and radiological findings were included. Ethical approval for this study was obtained from the Human Research and Ethics Committees of the study centers. All patients' information obtained was treated with a high level of confidentiality and was used for the purpose of this research only. Information retrieved includes; patient's gender, age, clinical indications and the radiological findings. The obtained data were processed using Excel 2013 version and Statistical Package for Social Sciences (SPSS) version 20 (IBM Corporation, Chicago, IL, USA). The data were analyzed in line with the study objectives using descriptive statistic (frequency table, chart and percentages) and inferential statistics. The Spearman's Correlation test as done to ascertain if any correlations exist between the age of the subjects and the findings. Statistical significance was set at $p<0.05$.

Results

Out of 200 patients' records included in this study, 82% (n=164) pathological cases were identified with pneumonia having the highest frequency of occurrence, 17.0% (n=34), followed by neonatal respiratory distress syndrome and bone fracture 7.5% (n=15) each respectively and the least was metastatic lung disease 1.0% (n=2). Normal findings accounted for about 18% (n=36) **(Table 1).** Of the 34 cases of pneumonia noted in this study, 50% (n=17) were Bronchopneumonia as highest, followed by lobar pneumonia 32.35% (n=11) and the least was viral pneumonia 5.88% (n=2) **(Table 2)**.

Out of the 200 chest radiographs included in this study, females were highest 55.50% (n=111) when compared with their male counterparts 44.50% (n=89). Among the female population, 58.54% (n=96) pathological cases were identified, while among male, 41.46% (n=68) pathological cases were noted **(Tables 2 and 3)**. Age group>1 year-4 years was highest 18.50% (n=37), followed by age group>10 years-12 years

14.0% (n=28) and the least was age group 11 days-20 days, which is 4.0% (n=8) **(Table 2)**.

Table 1: Frequency and percentage of pediatric chest radiographic findings.

S/N	Findings	Frequency	Percentage
1	Pneumonia	34	17.00%
2	Pneumothorax	13	6.50%
3	Normal finding	36	18.00%
4	Neonatal respiratory distress Syndrome	15	7.50%
5	Chronic Obstructive Airway Disease (COAD)	12	6.00%
6	Ventricular Septal Defect (VSD)	8	4.00%
7	Pulmonary Tuberculosis (PTB)	11	5.50%
8	Metastatic Lung Disease (MLD)	2	1.00%
9	Trauma	7	3.50%
10	Congestive Cardiac Failure (CCF)	9	4.50%

Table 2: Frequency and percentages of the prevalence of all types of pneumonia in pediatric chest radiographs.

Types of pneumonia	Frequency (n)	Percentage%
Bronchopneumonia	17	50.00%
Aspiration pneumonia	4	11.76%
Viral pneumonia	2	5.88%
Lobar pneumonia	11	32.35%
Total	34	100.00%

The correlation between the chest radiographic findings identified in this study and the patients' age were evaluated and the results shows the following correlations with age; Pneumonia has weak positive correlation at (r=0.37, p=0.29), Pneumothorax has weak positive correlation with age at (r=0.14, p=0.70), No findings has weak positive correlation (r=0.51, p=0.13), Neonatal respiratory distress syndrome=(r=0.10, p-value=0.77), Chronic obstructive airway disease (r=-0.06, p-value=0.88), Ventricular septal defect (r=-0.07, p-value=0.84), Pulmonary Tuberculosis (r=0.33, p-value=0.35), Metastatic lung disease (r=0.61, p- value=0.06) Trauma (r=0.76, p-value=0.01), Hiatal hernia (r=0.79, p- value=0.007) **(Table 4)**.

Table 3: Frequency and percentage distribution of the age and gender of patients with pathology.

Age group	Frequency and percentage		
	Male with pathology	Female with pathology	Total
0 day-10 days	7 (10.29%)	5 (5.21%)	12 (7.32%)
11days-20 days	0 (0.00%)	6 (6.25%)	6 (3.66%)
21days-31days	4 (5.88%)	8 (8.33%)	12 (7.32%)
1-6 months	10 (14.71%)	10 (10.42%)	20 (12.20%)
7-12 months	9 (13.24%)	9 (9.38%)	18(10.98%)
>1 year-4 years	13 (19.12%)	19 (19.79%)	32 (19.51%)
>4 years-7 years	11 (16.18%)	15 (15.63%)	26 (15.85%)
10 years-12 years	8 (11.76%)	11 (11.46%)	19 (11.59%)
>12-16 years	6 (8.82%)	13 (13.54%)	19 (11.59%)
total	68 (41.46%)	96 (58.54%)	164 (100.00%)

There was no statistically significant relationship between pneumonia, pneumothorax, neonatal respiratory distress syndrome, Chronic obstructive airway disease, ventricular septal defect, pulmonary tuberculosis and metastatic lung

disease with the subjects' age. There were statistically significant relationships between trauma and hiatal hernia with patients' age **(Table 4)**.

Table 4: Showing the correlation of different chest radiographic findings and age.

Variables	Correlation Coefficient (r)	p-value
Pneumonia	0.369995	0.292631
Pneumothorax	0.138409	0.702965
Normal finding	0.509269	0.132718
Neonatal respiratory distress syndrome	0.107649	0.767228
Chronic obstructive airway disease	-0.05699	0.875737
Ventricular septal defect	-0.07256	0.842111
Pulmonary tuberculosis	0.332702	0.347565
Metastatic lung disease	0.612998	0.059504
Trauma	0.758389	0.011006
Congestive cardiac failure	0.713855	0.020411
Multi-chamber cardiac Enlargement	0.29309	0.41116
Inflammatory chest changes	0.508426	0.133468
Koch's disease	0.526508	0.117939
Bone fracture	0.164872	0.648988
Hiatal hernia	0.785007	0.007145

Discussion

In this study, out of the 200 pediatrics radiographs evaluated, pathological cases were 164, with pneumonia as the most common radiographic finding. This finding is similar to the findings of studies conducted by Fancourt et al. [1] and Davies [13]. In Fancourt et al. [1] study, which evaluated the chest radiograph findings in childhood pneumonia in nine countries (Bangladesh, Gambia, Kenya, Mali, South Africa, Thailand and Zambia). Out of 3587 interpretable chest radiographs, 54% (n=1935) were pathological with pneumonia been the most common radiographic finding 78.17% (n=1941). In Davies [13] study, which investigated the reliability of chest radiograph in diagnosing lower respiratory infections in children, reported pneumonia in pediatrics age groups as the most common radiographic finding 54.92% (n=67), of 122 radiographs included in his study. Although, some of the other findings such as pneumothorax, Koch's disease, trauma, metastatic lungs disease, inflammatory chest changes, pulmonary tuberculosis, congestive cardiac failure, bone fracture, hiatal hernia, ventricular septal defect, Chronic obstructive airway disease, neonatal respiratory distress syndrome and multi chamber-cardiac enlargement were noted but have slight variation of occurrence from this study. These discrepancies could be attributed to the different sample sizes used and the geographical variation of the studies. In this study also, Bronchopneumonia was the most common type of pneumonia identified in children.

In this study, females accounted for over 50% of the total population studied when compared with their male counterparts. This is in keeping with the studies conducted by Ugwu [14] and Garcia Basteiro et al. [15]. In the Ugwu's study, this evaluated the common pathological findings in pediatric chest radiographs in Enugu, among 102 patients who underwent chest radiography from January 2011 to December 2012. In his study, females were highest, 59.75% (n=49) and males were 42.24% (n=23) out the 82 pathological cases. In a similar study by Garcia Basteiro et al. [15], which assessed the radiological findings in young children investigated for Tuberculosis in Mozambique, reported females as highest 55.8% (n=24) and males were 44.2% (n=19). The increased female involvement in chest pathologies has been ascribed to Household Air Pollution (HAP). According to Lim et al. [16] and WHO [17], one global environmental exposure that has particular relevance for women is household air pollution that results from indoor burning of solid fuels(biomass and coal) for cooking and heating. Household air pollution exposure is responsible for over four million deaths each year, predominantly from COPD, cardiovascular diseases, acute pneumonia in children under age five years, and lung cancer [16-18]. In Gordon et al. [19] opinion, women and children have the highest exposure to HAP as a result of their domestic functions. Other researchers attributed this gender variation in the occurrence of chest pathologies to the early life exposures that take place in a wide range of time, beginning from the lung growth and maturation during the fetal period through young adulthood [18,20-22]. According to Pinkerto et al. [18], Gan et al. [23] and Klern et al. [24], differences in the anatomy and physiology between men and women also influence both the course of chest pathology and treatment response. The severity of chest disease has been reported to be highest in females with poorer clinical outcomes, worse lung function and survival disadvantage compared to males of all age groups [25-27]. Differences in the genetic and sex steroid hormones, both type and concentration have also been attributed to the cause of gender differences in chest disease occurrence [28].

In this study, greater numbers of the cases were within the age group >1 year to 4 years. This is similar to the findings in the studies conducted by Guo et al. [29], Garacia-Basteiro et al. [15] and Fancourt et al. [1]. In their studies, majority of the cases of chest pathologies identified, were within age group>1 year of age. In this study also, there was no statistically significant relationship between pneumonia, pneumothorax, neonatal respiratory distress syndrome, Chronic obstructive airway disease, ventricular septal defect, pulmonary tuberculosis and metastatic lung disease with the subjects' age. There were statistically significant relationships between trauma and hiatal hernia with patients' age. But there were weak positive correlations between trauma, hiatal hernia and pneumonia with the patients' age. Although, Chronic obstructive airway disease and ventricular septal disease showed weak negative correlations with the age of the patients.

Conclusion

Pneumonia was the most common radiographic chest finding in this study, with bronchopneumonia been the highest type of pneumonia. The female population was highest in this study. The majority of the patients were within the age range of >1 year to 4 years of age. There was no statistically significant relationship between pneumonia, pneumothorax, neonatal respiratory distress syndrome, congestive obstructive airway disease, ventricular septal defect, pulmonary tuberculosis and metastatic lung disease with the subjects' age. There were statistically significant relationships between trauma and hiatal hernia with patients' age. But there were weak positive correlations between trauma, hiatal hernia and pneumonia with the patients' age. Although, Chronic obstructive airway disease and ventricular septal disease showed weak negative correlations with the age of the patients.

References

1. Fancourt N, Knoll MD, Barger KB, Campo DJ, Campo DM, et al. (2017) Standardized interpretation of chest radiographs in cases of pediatric pneumonia from the perch study. Clin Intec Dis 64: 253-261.
2. Hardy M, Boynes S (2008) Paediatric Radiography. In book: Paediatric Radiography 1-10.
3. Morgan H, Pettel G, Reed M, Paul SP (2018) Indications for chest X-rays in children and how to obtain and interpret them. Nurs Child Young People 30: 30-37.
4. Fred A Mettler, Baiinger PW, Frank ED (2008) Merrill's atlas of radiographic positions and radiologic procedures. 9th Edition. 3: 216-219.
5. Skinner S (2015) Guide to thoracic imaging. Aust Fam Physicia 44: 558-562
6. Jam S (2016) Portable chest radiology. Respiratory Care 44: 1018-1032.
7. Garland LH (1949) Diseases and injury, incidence and prevalence. Lancet Alma London Eng 388: 1543-1602.
8. Mbaba AN, Abam R, Ogolodom MP (2019) An unusual case of huge morgagni hernia: the need for high index of suspicion. Health Sci J 13: 636.
9. Menashe SJ, Iyer RS, Parisi MT, Otto RK, Stanescu AL (2016) Pediatric chest radiographs: common and less common errors. Am J Roentgenol 207: 903-911.
10. Ben Shimol S, Dagan R, Givon-Lavi N (2012) Evaluation of the World Health Organization criteria for chest radiographs for pneumonia diagnosis in children. Eur J Pediatr 171: 369-374.
11. Williams GJ, Macaskill P, Kerr M, Fitzgerald DA, Isaacs D, et al. (2013) Variability and accuracy in interpretation of consolidation on chest radiography for diagnosing pneumonia in children under 5 years of age. Pediatr Pulmonol 48: 1195-1200.
12. Levinsky Y, Mimouni FB, Fisher D, Ehrlichman M (2013) Chest radiography of acute paediatric lower respiratory infections: experience versus interobserver variation. Acta Paediatr 102: 310-314.
13. Davies HE, Davies RJO, Davies CWH (2010) Management of pleural infection in adults: British thoracic society pleural disease guideline 2010. Thorax BMJ 65: 41-53.
14. Ugwu A. Common pathological findings in paediatric chest radiographs. 2018.
15. Garcia BAL, Lopez VE, Augusto OJ, Gondo K, Munnoz J, et al. (2015) Radiological findings in young children investigated for tuberculosis in Mozambique. PLOS One 10: 0133338.
16. Lim SS, Vos T, Flaxman AD, Danaei G, Shibuya K, et al. (2012) A comparative risk assessment of burden of disease and injury attributable to67 risk factors and risk factor clusters in 21 regions, 1990-2010: a systematic analysis for the Global Burden of Disease Study 2010. Lancet 380: 2224-2260.
17. http://apps.who.int/gho/data/node.main.135?lang=en,2014
18. Pinkerton KE, Harbaugh M, Han MK, Lesaux CJ, Winkste V, et al. (2015) Women and lung disease: sex differences and Global Health disparities: Pulmonary perspective. Am J Resir Crit Care Med 192: 11-16.
19. Gordon SB, Bruce NG, Grigg J, Hibberd PL, Kurmi OP, et al. (2014) Respiratory risks from household air pollution in low and middle income countries. Lancet Respir Med 2: 823-860.
20. Kajekar R (2007) Environmental factors and developmental outcomes in the lung. Pharmacol Ther 114: 129-145.
21. Melgert BN, Ray A, Hylkema MN, Timens W, Postma DS (2007) Are there reasons why adult asthma is more common in females? Curr Allergy Asthma Rep 7: 143-150.
22. Postma DS (2007) Gender differences in asthma development and progression. Gend Med 4: 133-146.
23. Gan WQ, Man SF, Postma DS, Camp P, Sin DD (2006) Female smokers beyond the perimenopausal period is at increased risk of chronic obstructive pulmonary disease: a systematic review andmeta analysis. Respir Res 7: 5.
24. Klern SL, Flanagan KL (2016) Sex differences in immune responses. Nat Rev Immunol 16: 626-638.
25. Raghavan D, Jain R (2016) Increasing awareness of sex differences in airway diseases. Respiratory 21: 449-459.
26. Rosenfield M, Davis R, Fitzsimmons S (1997) Gender gap in cystic fibrosis mortality. Am J Epidemiol 145: 794-803.
27. Hariness BCL, Elliot AC, Rosenbluth DB (2014) Gender differences in outcomes of patients with cystic fibrosis. J Women Health (Larchmt) 23: 1012-1020.
28. Townsend EA, Miller VM, Prakash YS (2012) Sex differences and sex steroid in lung health and disease. Endocr Rev 33: 1-47.
29. Guo M, Wang J, Sheng M, Zhou FL (2012) Radiological findings in 210 Paediatric patients with viral pneumonia: a retrospective study. Br J Radiol 85: 1385-1389.