

ROLE OF CHEST X-RAY IN DIAGNOSIS OF LOWER RESPIRATORY TRACT INFECTIONS IN CHILDREN LESS THAN FIVE YEARS OF AGE IN COMMUNITY

Shaikh Qamaruddin Nizami¹, Zulfiqar Ahmed Bhutta²,
Rumina Hasan³ & Yousuf A Husen⁴

ABSTRACT:

Objectives: To compare radiological findings of chest radiograph with the diagnosis of pneumonias in children as per IMCI guidelines and; see its utility in community setting and; compare the variance in their reporting between trained pediatric radiologist and treating pediatrician.

Setting: Four periurban communities in Karachi were selected for study.

Methods: Children presenting with cough and fever at especially established clinics were investigated with oro-pharyngeal swabs, blood culture and chest radiograph.

Results: 6383 children were seen with acute respiratory infection during January 2002 to February 2003. Of these 1203 children had pneumonia and severe pneumonia. Chest radiographs were obtained in 823 children. Only 45 % of these radiographs had signs suggestive of infection. There was no significant difference of opinion between radiologist and pediatrician in reports of those radiographs having signs suggestive of infection. However 19 % of all radiographs were reported as non-interpretable for any meaningful interpretation due to poor quality of film by pediatrician but majority of these radiographs were considered within normal limit by radiologist. There was no correlation between reports of radiographs and isolation of organisms from oro-pharyngeal swabs. Nearly half of children with pneumonia and those who grew organisms from oro-pharyngeal swabs had normal chest radiographs.

Conclusion: Chest radiographs have little value in diagnosis of pneumonia in children less than five years of age and; no significant difference of opinion between pediatrician and radiologist was found in interpretation of radiographs.

KEY WORDS: Acute respiratory infections, children, burden of diseases

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1. Dr. Shaikh Qamaruddin Nizami FCPS,
Department of Pediatrics
 2. Dr. Zulfiqar Ahmed Bhutta FRCPCH
Department of Pediatrics
 3. Dr. Rumina Hasan Ph.D
Department of Microbiology
 4. Dr. Yousuf A Husen FCPS, FRCR
Department of Radiology
- 1-4. The Aga Khan University & Hospital
Karachi Pakistan

Correspondence:

Dr. S. Q. Nizami
Abdul Sultan Jamal Professor of Pediatrics
Department of Pediatrics
The Aga Khan University & Hospital
P. O. Box. 3500
Karachi, Pakistan
E-Mail:qamaruddin.nizami@aku.edu

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INTRODUCTION

Radiology has been an important tool in investigation of diseases since its invention in late nineteenth century. Though new techniques in radiology such as CT scan, magnetic resonance imaging (MRI), contrast studies etc have improved the diagnostic abilities of physicians but plain radiograph remains the most commonly used radiological tool. The interpretation of the radiograph depends upon several factors such as quality of the film and competence of the interpreter.^{1,2} The quality of films depends upon the machine used, power, exposure time and cooperation of the patient. Competence of interpreter of radiograph is also an important factor and depends upon his training and

experience in a particular setting. Though some degree of learning about radiology is a part of undergraduate and postgraduate curriculum not only in Pakistan but around the world, it is seldom sufficient to interpret even a simple x-ray. Physicians often refer to radiologist specially trained in the respective field whenever there is difficulty in interpretation of radiograph. Radiological investigations in the developed world are always undertaken by centers specialized in radiography and supervised by trained radiologist. This is not the case in developing world especially in Pakistan. In Pakistan, x-ray centers with few exceptions are owned either by general practitioners or other nonprofessionals. Machines used for taking radiographs are often old and substandard. Radiologists are hired on part time basis to report the radiographs or the general practitioner reports these radiographs if he is the owner of the x-ray centre. This results in poor quality of interpretation of the radiographs and subsequent mismanagement of the patient. Most consultants or specialist try to interpret radiographs themselves.

Since respiratory infections in children are a common cause of morbidity and mortality in Pakistan and other developing countries³, physicians treating these children often ask for a chest radiograph to diagnose the pneumonia and other respiratory conditions. The management of acute respiratory infections (ARI) in children less than five years of age has been standardized under Integrated Management of Childhood Illnesses (IMCI) protocol developed by WHO. These IMCI guidelines don't ask for a chest radiograph for diagnosis of pneumonia which is based on clinical finding such as tachypnoea and chest indrawing. In spite of this fact, physicians treating the children with symptoms of ARI often ask for radiograph. These radiographs are often asked from substandard x-ray centers with improper reporting. This results in wasting of financial resources of poor patients both in obtaining the radiograph and subsequent management. Hence in order to look at the utility of chest

radiograph in the management of ARIs in children at community level we did a study in periurban communities in Karachi, Pakistan.

PATIENTS & METHODS

This study was part of the larger study looking at the prevalence of ARIs and burden of disease reported elsewhere. Four peri-urban sites i.e. Sultanabad, Hijrat Colony, Sher Pao Colony and Rehri Goth were selected for the study. One study clinic was established in each study area manned by a medical officer, trained in management of ARI as per IMCI guidelines. Children two months to five years of age presenting at these clinics with fever and cough were classified into "No pneumonia", "Pneumonia" and "Severe pneumonia" according to IMCI guidelines. After obtaining informed consent from their parents/guardian a radiograph of chest was obtained from local x-ray centre within 24 hours of diagnosis of pneumonia and severe pneumonia in addition to other investigations such as complete blood count and blood culture and throat (oropharyngeal) swabs cultures. Few cases of "No pneumonia" also got investigated though they were not supposed to be investigated as per IMCI guidelines. The children were provided treatment as per guidelines without taking finding of radiograph into consideration. These radiographs were interpreted by Principal investigator (PI) who is pediatrician and later independently by Pediatric radiologist at the Aga Khan University Hospital. The clinical diagnosis at the time of interpretation of radiograph was ignored as all these children were supposed clinically to have pneumonia.

The radiographic findings were classified as: **Normal:** If there was no abnormal opacity or infiltration seen on the radiograph.

Suggestive of infection: If the radiograph showed signs of consolidation, opacity or infiltration on one or both sides of the lung field or in perihilar region.

Miscellaneous: If the radiograph showed cardiomegaly or other non-pulmonary findings.

Poor film: If the quality of radiograph was poor enough to get any meaningful interpretation.

Table-I: Findings of Chest radiographs in different respiratory illnesses reported by pediatric radiologist.

Findings of x-rays	URTI		Pneumonia		Severe pneumonia		Total	
# of cases	5180		1053		150		6383	
Normal	42 (47.7%)		322 (51.1%)		47 (43.1%)		411 (50.4%)	
Suggestive of infection	43 (48.9%)		269 (43.5%)		55 (50.5%)		367 (45.0%)	
Misc.	3		25		4		32	
Poor film	-		10 (0.3%)		3		13 (0.6%)	
Total	88		626		109		823	

RESULTS

The study was conducted from January 2002 to February 2003. A total of 6383 children with ARIs were seen at these clinics. Of these 1203 children had pneumonia or severe pneumonia. Chest radiographs were obtained only in 823 cases due either to refusal on the part of parents or other logistic reasons. Nearly half of these were reported to be within normal limits by pediatric radiologist (Table-I). No significant difference was seen in findings of radiograph of children among different types of respiratory illnesses. There was no significant difference of opinion between pediatric radiologist and PI about those radiographs reported as suggestive of infection (Figure 1). In 19.2% cases, radiographs were considered of poor quality to give any opinion by PI but on

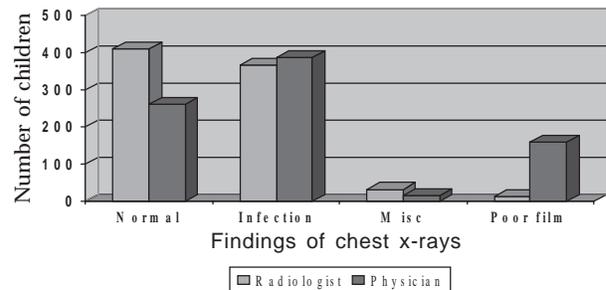


Figure 1: Comparison of reports of radiographs between physician and radiologist

subsequent review by pediatric radiologist, majority of them were considered to be within normal limit (Table-II).

The findings of radiograph were found to have no correlation with isolation of organism from oropharyngeal swab cultures. Nearly half of the children with growth of pathogenic organisms from oropharyngeal

Table-II: Comparison of radiograph reports between physician and radiologist in different illnesses

Illness (# of cases)	URTI (5180)			Pneumonia (1053)			Severe pneumonia (150)			Total (6383)		
	RAD # (%)	PI # (%)	P=	RAD # (%)	PI # (%)	P=	RAD # (%)	PI # (%)	P=	RAD # (%)	PI # (%)	P=
Normal	42 (47.7)	23 (26.1)	<0.003	322 (51.4)	217 (34.7)	<0.001	47 (43.1)	21 (19.3)	<0.001	411 (49.9)	261 (31.7)	<0.001
Suggestive of infection	43 (48.9)	35 (39.8)	=0.2	269 (43.0)	294 (47)	=0.1	55 (50.5)	59 (54.1)	=0.9	367 (44.6)	388 (47.4)	=0.4
Misc.	3 (3.4)	0	NS	25 (4)	15 (2.4)	NS	4 (3.7)	1 (0.9)	NS	32 (3.9)	16 (1.9)	NS
Poor film	0	30 (34.1)	<0.001	10 (1.6)	100 (16)	<0.001	3 (2.7)	28 (25.7)	<0.001	13 (1.6)	158 (19.2)	<0.001
Total	88	88		626	626		109	109		823	823	

RAD = Radiologist PI = Principal investigator

Table-III: Organisms isolated from throat swabs vs. reports of chest radiograph in children with acute respiratory infections

Organisms isolated from throat swab	Reports of chest radiograph				Total
	Normal	Suggestive of infection	Miscellaneous	Poor film	
Hemophilus influenzae	33	29	3	3	68
Hemophilus para-influenzae	20	22	3	0	45
Streptococcus pneumoniae	9	8	2	1	20
Klebsiella pneumoniae	29	21	2	1	53
Miscellaneous	13	6	0	0	19
Total # of +ve cultures	104	86	10	5	205
No growth	246	215	15	8	484
Total	350	301	25	13	689

swabs had radiograph of chest within normal limit (Table-III).

DISCUSSION

As mentioned earlier, reporting of radiograph varies from person to person even if they are trained specially in this field. An effort was made to standardize reporting format for chest radiograph in a meeting of "Child Health Epidemiology Reference Group" (CHERG)¹ but no standardized format could be finalized. Due to absence of any standardized reporting format variation in interpretation of radiograph is unavoidable. Moreover inter-observer variability particularly about definition of infiltration is natural which may or may not suggest infective process. This aspect is quite obvious in this study as only half of the radiograph with a suggestive diagnosis of infection had clinical pneumonia as majority of these radiograph had only infiltrations and not definite consolidation. Though number of radiographs done in children with upper respiratory infections (URTI) was not high but same trend is seen in these cases also. Thus a normal report of chest radiograph does not rule out infection and presence of infiltrations does not mean infective process. This fact is further substantiated from lack of correlation between reports of chest radiograph and clinical findings i.e., tachypnoea, chest indrawing or isolation of organisms. Though it may be argued that the radiographs were not obtained at appropriate time

to have significant findings but in a symptomatic child this argument is not sustainable. Best time for obtaining radiograph would be presence of symptoms and signs of infection and the radiograph in this study were obtained within 24 hours of presentation.

Quality of radiograph is as important as the interpreter's training, experience and competence. In this study about one fifth of the radiograph films were of poor quality considered by the PI but lack of difference of opinion between physician and radiologist in the remaining radiograph indicates the same trend of non-specificity of infiltrations in diagnosis of pneumonia. It is also seen here that variability between a properly qualified physician and radiologist may be low if the quality of film is acceptable. Keikara O et al⁴ reported about 24% inter-observer variability in reporting radiograph even among trained radiologists. Similarly Davies et al⁵ found agreement varying between 0.76 to 0.91 among observers reporting radiographs. Hopstaken et al⁶ also reported similar results. However, in our study except in the film of poor quality, we didn't see much inter-observer variability.

Utility of chest radiograph in management of pneumonias in children remains doubtful. In our study it was seen that the radiological findings had no correlation with the clinical diagnosis of pneumonia or the isolation of organisms from these children. Similar findings of absence of correlation with clinical and radio-

logical diagnosis have been reported by Keikara O et al⁴ also. In a systemic review of studies, Swingler GH⁷ also found no correlation between radiological findings and clinical and etiological diagnosis of pneumonia in children. Thus if the findings of chest radiograph are used for prescribing of antibiotics in children, half of the cases of pneumonia will go without antibiotics leading to high morbidity and mortality. Similarly many cases of simple URTI will get antibiotics on the basis of finding of chest radiograph. Poor quality of radiograph is another important issue as cost of obtaining radiograph is substantial for common poor man and may be beyond his reach. If an x-ray can't help in management of the children or results in mismanagement, the meager financial resources of patient get wasted. Thus in community setting, radiographs should be asked in selected cases only.

CONCLUSION

Utility of obtaining of chest radiograph in children presenting with ARI in community has limited value and should be avoided. This is in accordance with IMCI guidelines which also emphasizes on management of ARI and use of antibiotics on the basis of clinical signs and symptoms. Even in cases where radiograph is indicated, it should be obtained from standard x-ray centers to have appropriate quality.

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