

ORIGINAL RESEARCH

EVALUATION OF ACCURACY OF CHEST RADIOGRAPHY FOR EVALUATING SIGNIFICANTLY ABNORMAL PULMONARY VASCULARITY IN CHILDREN WITH CONGENITAL HEART DISEASE**Dr. Vishal Gupta¹, Dr. Arvind Anand², Dr. Smita Nair³, Dr. Amit Gupta⁴**¹Professor & Head, Department of Radiodiagnosis² Professor, Al Falah School of Medical Sciences & Research Centre, Dhauj, Faridabad, Haryana³ Asst. Professor, Department of Paediatrics,⁴ Asst. Professor, Department of Radiodiagnosis,^{1,3,4} School of Medical Sciences and Research Sharda University, Plot No 32/34, Knowledge Park III Greater Noida, U.P. Pin Code 201310, India**Abstract****Background:** The present study was conducted for assessing accuracy of chest radiography for evaluating significantly abnormal pulmonary vascularity in children with congenital heart disease.**Materials & methods:** A total of 30 pediatric subjects of less than fifteen years of age were enrolled as control group. Simultaneous inclusion of 60 children with confirmed diagnosis of presence of congenital heart disease were also enrolled. Among them, 30 children with congenital heart disease had increased pulmonary vascularity (Group 1) while 30 children with congenital heart disease had decreased pulmonary vascularity (Group 2). The Separate reviewing of all the radiographs was done by skilled and experienced radiologists. All the results were recorded and analysed using SPSS software.**Results:** Mean accuracy of chest radiography among subjects of group 1, group 2 and control group was 88.5 percent, 78.1 percent and 76.8 percent respectively. Mean sensitivity of chest radiography among subjects of group 1, group 2 and control group was 89.4 percent, 62.8 percent and 94.2 percent respectively. Mean specificity of chest radiography among subjects of group 1, group 2 and control group was 78.4 percent, 91.5 percent and 93.7 percent respectively.**Conclusion:** Chest radiography is a decent preliminary diagnostic technique for identifying significantly abnormal pulmonary vascularity among paediatric subjects with congenital heart disease.**Key words:** Chest radiography, Pulmonary, Congenital heart disease**Introduction**

The pediatric cardiology field has developed rapidly over the past few decades. More children than ever born with congenital heart disease (CHD) are growing into adulthood. Primary care providers play a key role in diagnosis, management, and referral of children with CHD because many common cardiac complaints (eg, feeding intolerance, cyanosis, chest pain, palpitations, and syncope) are first addressed in the primary care setting. The spectrum of heart disease in children ranges from common complaints to complex single-ventricle physiology, acute myocarditis, and heart transplantation. In order to attain the millennium development goals, several health programs have been established aiming at reducing infectious diseases and malnutrition: the principal causes of death in children of developing countries.¹⁻³

Approximately 25% of children born with a CHD will need heart surgery or other interventions to survive. Balloon atrial septostomy is performed acutely in cases of TGA, allowing adequate blood mixing, and in cases of pulmonary hypertension, relieving right-sided pressures.⁴ Abnormal formation or enlargement of great vessels can compress airways and cause large and small airway obstructions. Alterations in pulmonary blood flow associated with congenital heart disease (CHD) can cause abnormalities in pulmonary mechanics and limitation of exercise. CHD can lead to pulmonary arterial

hypertension. Lymphatic abnormalities associated with CHD can cause pulmonary edema, chylothorax, or plastic bronchitis.^{5, 6} Hence, the presence study was conducted for assessing accuracy of chest radiography for evaluating significantly abnormal pulmonary vascularity in children with congenital heart disease.

Materials & methods

The presence study was conducted for assessing accuracy of chest radiography for evaluating significantly abnormal pulmonary vascularity in children with congenital heart disease. A total of 30 pediatric subjects of less than fifteen years of age were enrolled as control group. Simultaneous inclusion of 60 children with confirmed diagnosis of presence of congenital heart disease were also enrolled. Among them, 30 children with congenital heart disease had increased pulmonary vascularity (Group 1) while 30 children with congenital heart disease had decreased pulmonary vascularity (Group 2). The diagnosis for an abnormal pulmonary vascularity pattern was determined from cardiac catheterization as a gold standard. All chest radiographs were performed by using the chest radiographic techniques and parameters adjustment according to body weight. Separate reviewing of all the radiographs was done by skilled and experienced radiologists. All the results were recorded and analysed using SPSS software.

Results

Mean age of the subjects of group 1, group 2 and control group was 28.6 months, 30.1 months and 31.8 months respectively. Majority proportion of subjects of all the three study groups were boys. Mean accuracy of chest radiography among subjects of group 1, group 2 and control group was 88.5 percent, 78.1 percent and 76.8 percent respectively. Mean sensitivity of chest radiography among subjects of group 1, group 2 and control group was 89.4 percent, 62.8 percent and 94.2 percent respectively. Mean specificity of chest radiography among subjects of group 1, group 2 and control group was 78.4 percent, 91.5 percent and 93.7 percent respectively.

Table 1: Demographic variable

Variable	Group 1	Group 2	Control group
Mean age (months)	28.6	30.1	31.8
Boys/girls	18/12	17/13	18/12
Mean height (cm)	84.6	83.1	85.8

Table 2: Accuracy of chest radiography

Variable	Group 1	Group 2	Control group
Accuracy (%)	88.5	78.1	76.8
Sensitivity (%)	89.4	62.8	94.2
Specificity (%)	78.4	91.5	93.7

Discussion

Worldwide, congenital heart defects (CHD) are the main heart diseases found in children. Heart defects have a prevalence of eight cases per 1,000 live births across the globe, representing approximately 1.35 million newborns each year with CHD. Early detection of CHD is of primary importance for improvements in the quality of life and reducing morbidity and mortality of children. Primary care physicians need to be rejuvenated of the manifestations and management for early diagnosis and energetic diligence. Family physicians need to periodically monitor and manage progress. With advances in both corrective and palliative surgery, the number of children with CHD surviving to adulthood has increased dramatically.^{7- 9} Hence, the presence study was conducted for assessing accuracy of chest radiography for evaluating significantly abnormal pulmonary vascularity in children with congenital heart disease.

In the present study, mean age of the subjects of group 1, group 2 and control group was 28.6 months, 30.1 months and 31.8 months respectively. Majority proportion of subjects of all the three study groups were boys. Mean accuracy of chest radiography among subjects of group 1, group 2 and control group was 88.5 percent, 78.1 percent and 76.8 percent respectively. Our results were in

concordance with the results obtained by previous authors who also reported similar findings. In a study conducted by Itoh H et al, one hundred and fifty lungs from the cases below 15 years of age with various congenital heart diseases and 80 controls were used for histometrical and histological studies. Cases with congenital heart disease were divided into two groups of the increased and the decreased pulmonary blood flow. In the former group, the thickness of the pulmonary arterial media was the same as that of controls in the neonatal period, and through the wall thickness gradually decreased in a pattern seen in controls, the thickness was constantly larger than that of controls. In some cases, the media increased gradually within 6 months after birth. Pneumonia and massive pulmonary hemorrhage were seen in a higher incidence in autopsy cases. Pneumonia in younger infants was histologically characteristic and possibly more correlated to their death. In the latter group, most of the cases were with the thinner medias of the pulmonary arteries. Massive pulmonary hemorrhage was not common in the latter group.¹⁰ When the neonate is suspected to have heart disease, chest roentgenogram is usually performed to rule out pulmonary disease as well as to evaluate pulmonary vascular marking and cardiomegaly. Some CHD has characteristic features such as "boot shaped heart" which could be seen in the TOF/PA and its variants. This peculiar cardiac contour originates from concave small pulmonary trunk compared to the large aorta and right ventricular hypertrophy. Another specific feature called the "egg on string" appearance can be seen in TGA. Narrow cardiac pedicle due to the almost anterior-posterior relationship of the transposed great vessels and "radiologic-absence of the thymus" make such peculiar cardiac border. Pulmonary vascular markings depend on the degree of pulmonary stenosis and amount of pulmonary blood flow. Pulmonary venous congestion may suggest poor mixing at the atrial level with increased pulmonary blood flow due to a wide open ductus arteriosus. The characteristic "figure of 8" or "snowman appearance" in the supracardiac TAPVR could not be seen in the neonatal period and is rarely seen in the modern era of rapid diagnosis and early repair.¹¹⁻¹⁴

In the present study, Mean sensitivity of chest radiography among subjects of group 1, group 2 and control group was 89.4 percent, 62.8 percent and 94.2 percent respectively. Mean specificity of chest radiography among subjects of group 1, group 2 and control group was 78.4 percent, 91.5 percent and 93.7 percent respectively. In a similar study conducted by Tumkosit M et al, authors determined the accuracy of chest radiography for evaluating significantly abnormal pulmonary vascularity in children with congenital heart disease. The accuracy, specificity, positive predictive value, and negative predictive value of chest radiography to characterize pulmonary vascularity patterns in the three groups were moderate to high, falling between 73 and 92 %, 61 and 96 %, 71 and 94 %, and 71 and 98 %, respectively. The sensitivity of chest radiography to interpret decreased pulmonary vascularity patterns was low (24–68 %), whereas the sensitivity to interpret normal and increased pulmonary vascularity patterns were high (84–94 %).¹⁵

Conclusion

From the above results, the authors conclude that chest radiography is a decent preliminary diagnostic technique for identifying significantly abnormal pulmonary vascularity among paediatric subjects with congenital heart disease.

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