

Clinical, Microbiological and Radiological Characterises of Lower Respiratory tract Infection in Children with Established Congenital Heart Diseases.

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Introduction: Acute Lower Respiratory Tract Infection (ALRTI) is the most common cause of death in children under five. Various demographic, socio-economic and environmental factors have been associated with ALRTI, with conflicting results. Children with congenital heart diseases are more vulnerable to lower respiratory tract infections following the fact that they had an anatomical defect that causes hemodynamic disturbance of lung circulation and mucosal oedema finally leads to decreased lung compliance and recurrent lower respiratory tract infections. **Methods:** Children aged between 1 month and 18 years with clinically established congenital heart disease confirmed by echocardiography and presenting with signs and symptoms suggestive of lower respiratory tract infection were enrolled in the study. A detailed history was taken and routine blood investigations were done in all cases. Chest X-Ray was done to confirm the clinical diagnosis. **Results:** Mean age of the study subjects was 2 years. VSD was seen in 64.9% of cases while 10.5% of cases had VSD and ASD. The most common presenting symptoms were: cough (98.2%), reduced feeding (97.4%), fever (89.5%), running nose (67.5%) and wheeze (49.1%). Leucocytosis and raised ESR were seen in 66.7% and 64.9% cases respectively. In Throat swab Commensals were seen in 36% of cases while gram-positive cocci were seen in 3.5% cases respectively. In blood culture Streptococcus pneumoniae being the commonest organism isolated. Bilateral and unilateral opacities on chest x-ray were seen in 16.7% and 12.3% cases respectively. **Conclusion:** Bronchopneumonia was the commonest LRTI in children with the predominance of VSD.

Keywords: LRTI, Congenital heart disease, Chest X-ray

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Introduction

Acute Lower Respiratory Tract Infection (ALRTI) is the most common cause of death in children under five. Acute respiratory infections (ARI) result in 1.9 million childhood deaths per year in developing countries and 20% of these deaths are from India [1]. Epidemiological factors and the disease burden differ in developing and industrialised countries [2-6]: in industrialised countries morbidity predominates, whereas in developing countries mortality due to acute lower respiratory tract infections (ALRTI) is a significant problem, along with considerable morbidity and hospitalisations, particularly in children aged <5 years.

Various demographic, socio-economic and environmental factors have been associated with ALRTI, with conflicting results [2-7]. Congenital heart disease is primarily a disease condition of infant's neonates and children. Out of all congenital anomalies, congenital heart disease is the leading condition of mortality and morbidity in children under 5 years of age [8]. Often the circulatory derangement also places stress on the respiratory system itself [9]. Children with congenital heart diseases are more vulnerable to lower respiratory tract infections following the fact that they had an anatomical defect that causes hemodynamic disturbance of lung circulation such as pulmonary over circulation, increased capillary wedge pressure and left atrial pressure which results in luminal narrowing and mucosal oedema finally leads to decreased lung compliance and recurrent lower respiratory tract infections [10].

There is a conflict among study results regarding the vulnerability of children with CHD for LRTI [11-13]. also there is a paucity of such studies in the Indian setting. Hence this study is taken up to evaluate clinical, radiological & microbiological characteristics of lower respiratory tract infection in children with CHD.

Material & Methods

Setting: This study was conducted at a tertiary care medical teaching hospital.

Duration and Type of Study: This study was done over two and half years. This was a Hospital-based Cross-sectional study.

Sampling Methods: A consecutive type of non-probability sampling was used during the study.

Sample Size Calculation: A consecutive type of non-probability sampling was used during the study. A total of 114 children between the age of 1 month and 18 years attending the outpatient/inpatients in our hospital.

Inclusion Criteria

01. Children from 1month to 18 years of age.
02. Children with established congenital heart diseases as proved by echocardiography.
03. Infant and children with clinical signs and symptoms of the lower respiratory tract infection.

Exclusion Criteria

01. Children already operated for congenital heart disease
02. Children with signs and symptoms of upper respiratory tract infections.
03. Children less than 1 month and greater than 18 years of age.
04. Those who are unwilling to get an x-ray, blood tests, microbiological tests

Data Collection Procedure: Children's with clinically established congenital heart disease confirmed by echocardiography and presenting with signs and symptoms suggestive of lower respiratory tract infection were enrolled in the study. A detailed history was taken and routine blood investigations such as CBC, CRP, ESR was done in all cases. Chest X-Ray was done in these children to assess the portion of lung involvement and to confirm the clinical diagnosis. Sputum culture along with blood culture was performed in selected children for microbiological evaluation and confirmation of particular pathogen causing the lower respiratory tract infections.

Any Scoring System used- Nil.

Surgical Procedure if any -Nil

Statistical Analysis: The quantitative data was represented as their mean \pm SD. Categorical and nominal data were expressed in percentage. All analysis was carried out by using SPSS software version 21.

Results

A total of 114 children were included in the final analysis. The mean age of the study subjects was 2 years with 43.9% of the cases being 1 year or less and 53.5% cases were between 1-5 years of life

[Table .1]. Out of the total 114 cases, 67.5% were males and 32.5% were females [Fig.1]. VSD was seen in 64.9% of cases while 10.5% of cases had VSD and ASD. Isolated ASD and PDA were seen in 12.3% of cases [Table.2]. Most common presenting symptoms were: cough (98.2%), reduced feeding (97.4%), fever (89.5%), running nose (67.5%) and wheeze (49.1%) [Table.2]. Inter-costal indrawing and subcostal indrawing were seen in 36% and 40.4% cases while both inter-costal and sub-costal indrawing were seen in 23.7% of cases [Table.2]. In lab investigations, Leucocytosis and raised ESR were seen in 66.7% and 64.9% cases respectively. Positive CRP was seen in 8.8% of cases [Table.2]. In Throat swab Commensals were seen in 36% cases while gram-positive cocci were seen in 3.5% cases respectively [Table.2]. Blood culture was done in 25 cases with Streptococcus pneumoniae being the commonest organism isolated (n-16) [Table.2]. Bilateral and unilateral opacities on chest x-ray were seen in 16.7% and 12.3% cases respectively. Bronchopneumonia was diagnosed in 57.9% of cases while Bronchiolitis and Lobar pneumonia was diagnosed in 33.3% and 8.8% cases respectively. IV antibiotics were required in 92.1% of cases while oral antibiotics were given in 7.9% of cases [Table.2].

Table 1. Distribution of cases as per age group

Age group (yrs)	N	%
	50	43.9%
1-5 years	61	53.5%
6-10 years	3	2.6%
Total	114	100.0%
Mean age - 2.0 +/- 1.68 years		

Figure.1. Distribution of cases as per Gender

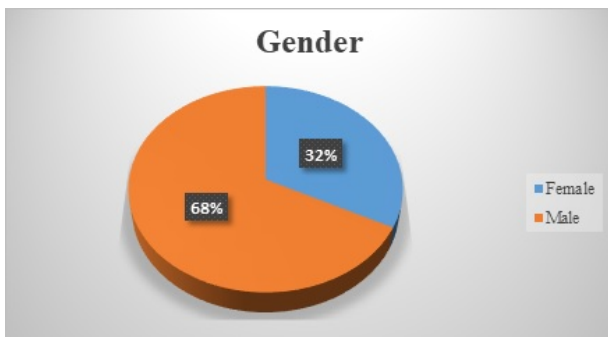


Table.2: Clinical and lab parameters

Clinical & Laboratory parameters		N	%
Type of CHD	ASD	14	12.3
	PDA	14	12.3
	VSD	74	64.9
	VSD, ASD	12	10.5

Symptoms	Fever	102	89.5%
	Cough	112	98.2%
	Running Nose	77	67.5%
	Wheeze	56	49.1%
	Reduced Feeding	111	97.4%
Chest indrawing	Inter-costal	41	36.0%
	Sub-costal	46	40.4%
	Both	27	23.7%
Lab Investigations	Leucocytosis	76	66.7%
	ESR Raised	74	64.9%
	Positive CRP	10	8.8%
Throat Swab	None	69	60.5%
	Commensal	41	36.0%
	Gram Positive Cocci	4	3.5%
Blood Culture	Not Done	89	78.1%
	Hemophilus influenza	4	3.5%
	Staphylococcus aureus	1	0.9%
	Streptococcus pneumoniae	16	14.0%
	Streptococcus viridans	3	2.6%
	No growth	1	0.9%
Chest X ray	Not Significant	81	71.1%
	b/l Opacities	19	16.7%
	u/l Opacities	14	12.3%
Final Diagnosis	Bronchiolitis	38	33.3%
	Bronchopneumonia	66	57.9%
	Lobar pneumonia	10	8.8%
Antibiotics	IV	105	92.1%
	Oral	9	7.9%

Discussion

LRTI are defined in the International Classification of Diseases as infections that affect airways below the epiglottis [14]. Some children have predisposing risk factors such as prematurity, CHD, chronic lung disease, immune disorders, being below 5 years of age, environmental smoke exposure, oropharyngeal incoordination with Aspiration syndrome [15-18]. The incidence of CHD differs for populations and the most common type of CHD is VSD [19]. Children with hemodynamically significant-CHD (HS-CHD) with congestive heart failure are more at risk for LRTI causing mortality and morbidity [20-22]. Some kind of CHD that leads to increased pulmonary flow (e.g.VSD, PDA) or CHD with desaturation (e.g. TOF, DORV, truncus arteriosus) carries a higher risk of recurrent respiratory tract infections and increased frequency of hospitalizations [23].

Type of CHD: In our study VSD were seen in 64.9% of cases while 10.5% cases had VSD and ASD. Isolated ASD and PDA were seen in 12.3% of cases.

The commonest CHD was ventricular septal defect (50.00%) in the study by Sadoh et al. [22]. while in the study by Gabriela K et al. [24]. The most common types of CHD were Patent Ductus Arteriosus (47.6%), followed by Ventricular Septal Defect (47%). Singh PK et al. [25]. in their study observed VSD in 43.6% cases while 7.7% cases had VSD and ASD. Isolated ASD and PDA were seen in 28.2% and 17.9% cases respectively. Pongiglione G et al. [23]. a similar study observed the most frequent heart defects as a ventricular septal defect (23.1%) and coarctation of the aorta (14.3%).

Demography: Mean age of the study subjects was 2 years with 43.9% of the cases being 1 year or less and 53.5% cases were between 1-5 years of life. In the present study 67.5% were males and 32.5% were females. Sadoh et al. [22]. in their study evaluated the contribution of CHD to pneumonia in children seen in a tertiary hospital. There were 121 children with pneumonia of which 61(50.40%) were males and their mean age was 10.2 ± 10.93 months. Singh PK et al. [25]. studied a total of 43 patients with CHD and recurrent LRTI with 53.4% males and 46.5% females. Sahan OY et al. [26]. evaluated 50 children who had congenital heart disease and were hospitalized with lower respiratory tract infections. There were 26 boys and 24 girls. The average age of the cyanotic group was 23.88 ± 28.81 , and the acyanotic group was 12.25 ± 15.45 months old. Gabriela K et al. [24]. their study also observed the majority of children (80%) being under 1 year of age.

Presenting Complaints: Symptoms and signs of pneumonia may be subtle, particularly in infants and young children. The combination of fever and cough is suggestive of pneumonia; other respiratory findings (eg, tachypnea, increased work of breathing) may precede the cough. Neonates and young infants may present with difficulty feeding, restlessness, or fussiness rather than with cough and/or abnormal breath sounds [27]. In the present study, the most common presenting symptoms were: cough (98.2%), reduced feeding (97.4%), fever (89.5%), running nose (67.5%) and wheeze (49.1%). Gabriela K et al. [24]. in their study clinical symptoms mostly found where the difficulty of breathing (98%), fever (85.2%), cough (75.2%), and runny nose (63.1%). Similarly in the study by Sadoh et al. [22]. and Singh PK et al. [25]. The most common presenting complaints were cough and fever. In a multicenter population-based study that included 2358 children <18 years hospitalized

With radiographic evidence of pneumonia, 95 percent had a cough, 90 percent had a fever, 75 percent had anorexia, 70 percent had dyspnea, and 55 percent had chest indrawing [28].

Investigations: Most common investigation finding in pneumonia cases in neonates, young infants, and young children (ie, <5 to 10 years of age) is leukocytosis followed by raised acute phase reactants (ESR & CRP) [29,30]. In the present study, leucocytosis and raised ESR were seen in 66.7% and 64.9% cases respectively while positive CRP was seen in 8.8% cases. Gabriela K et al. [24]. a similar study observed leukocytosis in 81% of cases. Chest X-ray image inpatient with ALRTI can be in the form of mild infiltrate in one lung until extensive consolidation in both lungs. The presence of infiltrates and the increase of Broncho vascular pattern are specific radiologic findings for bronchopneumonia [2]. In the present study infiltration was observed in one-third of the cases which is lower (80%) than that observed in the study by Gabriela K et al. [24].

Organism: Viruses are the most common etiology of CAP in older infants and children younger than five years of age [28,31]. However, bacterial pathogens, including *S. pneumoniae*, *S. aureus*, and *S. pyogenes*, also are important because they are associated with increased morbidity and mortality [32,33,34]. Studies have shown that *S. pneumoniae* is the single most common bacterial pathogen causing pneumonia in all patients beyond the first few weeks of life [35]. In the present study, blood culture was positive in 25 cases (21.9%) with *Streptococcus pneumoniae* being the commonest organism isolated (n=16). Medrano C et al. [36]. a similar study observed infectious agents in 37 cases (35.2%) with the respiratory syncytial virus in 25, *Streptococcus pneumoniae* in 5, and *Haemophilus influenzae* in 4 cases. Srinivasa S et al. [37]. in their study observed the most common pathogen was *streptococcus pneumoniae* followed by *klebsiella*.

Diagnosis: Among LRTI in children, most of the cases were bronchopneumonia followed by bronchiolitis and lobar pneumonia. In the present study, out of the total 114 studied cases, bronchopneumonia was diagnosed in 57.9% of cases while Bronchiolitis and lobar pneumonia was diagnosed in 33.3% and 8.8% cases respectively. Gabriela K et al. [24]. in their study of 149 children with CHD observed Bronchopneumonia (86.6%) as the commonest type of ALRTI followed by Bronchiolitis (10.7%).

Our study results were also comparable to Srinivasa S et al. [37]. bronchopneumonia was diagnosed in 42% of cases while Bronchiolitis and lobar pneumonia was diagnosed in 17% and 14% cases respectively. This is also comparable with the study done by Reddaiah et al. where they reported bronchopneumonia as a major LRTI [38]. Mungala VK et al. also reported bronchopneumonia as the commonest LRTI in their study [39].

Conclusion

Bronchopneumonia was the commonest LRTI in children with the predominance of VSD. We thus conclude that respiratory infections in children with congenital heart disease is common, however they have a good outcome. The majority of CHD lesions are Ventricular Septal defects while Bronchopneumonia was the most common diagnosis.

Contribution by different authors

Dr. Afsal conceptualized and designed the study, interpreted data, revised the manuscript and approved the final version to be published. He will act as the guarantor of the study. Dr. Sandeep acquired the data, drafted the article and helped in the final approval of the manuscript. Dr. Manjunath Babu analyzed the data, revised contents and helped in final approval.

What does this study add to the existing Knowledge?

Earlier it was believed that respiratory infections especially lower Respiratory Tract infections in a child with CHDs worsens the prognosis and outcome of these children but now with this study and similar studies it can be seen that Lower Respiratory Tract infections especially ones like Pneumonia can coexist with CHDs and can be diagnosed and treated early and in an efficient way and the outcome of these children is also good.

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