Echocardiographic Profile of Children with Congenital Heart Disease Presenting as Bronchopneumonia in a Tertiary Center in Telangana

Poorna Chandra Rao L.[1], Shashikala Velampalli[2], Srinivas Kalyani[3]

[1]Community Health Center, Korutla, Karimnagar, Telangana, Hyderabad, India. [2, 3] Department of Paediatrics Niloufer Hospital, Osmania Medical College, Koti, Hyderabad, India.

ABSTRACT

BACKGROUND

CHD is characterized by structural and functional heart defects which affect the quality of life of the person and can lead to premature death if not controlled through appropriate interventions. Early detection, diagnosis, and timely intervention result in substantial morbidity and mortality declines. We wanted to evaluate the echocardiographic profile of the children with CHD admitted with bronchopneumonia aged 1 month to 5 years and assess the pattern, age and gender specific distribution of CHD.

METHODS

This is a descriptive study performed over a period of two years. It included 200 children of either sex, between 1 month and 5 yrs. of age. Known cases of Congenital Heart Disease (CHD) (including Cyanotic and Acyanotic) who were diagnosed with bronchopneumonia and surgically corrected CHD diagnosed as Bronchopneumonia, were included in the study.

RESULTS

A total of 200 children with CHD were admitted with bronchopneumonia of whom 121 were males and 79 children were females. The mean age of presentation was 9.54 months. 85 % of the children presented below one year of age, with 50.58 % of children presenting below 6 months of age. 179 children were diagnosed to have ACHD, while 21 children had CCHD. The average duration of stay in the hospital was 7.81 days, the children with CCHD stayed longer than those with ACHD. Children less than 6 months of age stayed longer in the hospital compared to those from other age groups. Mortality was 7.82 % in ACHD category, while it was 19.05 % in CCHD category; 10.95 % of the children in ACHD presented with chamber dilatation in the age group of < 6 months. 11.27 % of children with ACHD presented with CCF, most of whom were less than 6 months old. 43 % of children with CCHD presented with CCF mostly in the age group of 6 months to one year. Most of the children less than 6 months of age presented with pulmonary hypertension both in the ACHD and CCHD groups.

CONCLUSIONS

Early diagnosis of CHD in the neonatal period can help reduce the morbidity associated with bronchopneumonia in infancy and help reduce the incidence of failure to thrive and recurrence of respiratory tract infections.

KEYWORDS

Bronchopneumonia, Congenital Heart Diseases, Congestive Cardiac Failure

Corresponding Author:
Dr. Shashikala Velampalli
Plat No. 203, HNO 16-11-20/6/1/6,
TNR'S Ragupathi Sadaurm
Saleemnagar, Malakpet,
Hyderabad, Telangana-500036,
India.
E-mail: docvsk@gmail.com

DOI: 10.18410/jebmh/2020/562

How to Cite This Article:
Rao PCL, Velampalli S, Kalyani S, et al. Echocardiographic profile of children with congenital heart disease presenting as bronchopneumonia in a tertiary center in Telangana. J Evid Based Med Healthc 2020; 7(46), 2735-2740. DOI: 10.18410/jebmh/2020/562

Submission 28-07-2020,
Peer Review 11-08-2020,
Acceptance 18-09-2020,
Published 16-11-2020.

BACKGROUND

In the under-5 age group, bronchopneumonia is one of the leading causes of morbidity and mortality. It accounts for almost fifteen percent of the deaths below 5 years of age. It has been accounted for 808,694 deaths in 2017 alone. It can be caused by bacteria, viruses and fungi. On the other hand, CHD are the commonest congenital defects globally accounting for almost 6 - 8 per 1000 live births.[1] Studies have shown that there is increased risk of mortality in children with CHD presenting as bronchopneumonia. Various factors have contributed for the increasing incidence of bronchopneumonia in children with CHD including increased vasculature, alterations in the immune system reflected with change in lymphocyte population and difference in serum zinc levels. Several predisposing factors have been reported for recurrent respiratory tract infections, including malnutrition, congenital or acquired immune deficiency conditions, some children with CHD may have respiratory problems triggered by enhanced pulmonary blood flow causing pulmonary oedema, or airway obstruction due to enlarged or dilated vascular and heart structures. Patients with CHD have a high prevalence of abnormal ciliary motion, which is associated with an increased risk of respiratory symptoms.[2]

A predisposing factor for recurrent respiratory tract infections is congenital heart disease which causes increased pulmonary blood flow. Ventricular Septal Defect (VSD), Atrial Septal Defect (ASD), Patent Ductus Arteriosus (PDA) are typical acyanotic congenital heart disease predisposed to recurrent respiratory tract infections in childhood. Shunting from left to right induces increased flow of pulmonary blood and pulmonary oedema. Pulmonary oedema progresses to congestive heart failure and becomes a nidus for lower respiratory tract infection. Pneumonia and congestive cardiac failure may be the early symptoms of congenital heart disease underlying it. The age at which symptoms begin in children with congenital heart disease depends on the severity of the defects. Large-scale ventricular septal defects and patent ductus arteriosus arise early and have more serious diseases resulting in CCF.[3] It has been documented that the mortality rate caused by uncontrolled heart failure in children with CHD and pneumonia receiving conservative medical care is 11.9 % to 56 %. Controversial care for children with left to right shunt CHD concomitant with chronic pneumonia is still present. Increased pulmonary blood flow, pulmonary arterial pressure, right ventricle afterload, and cardiac dilatation increase the probability of pulmonary congestion, and with imperfect development of immune system function, the infants are more susceptible to pneumonia.[2]

These infants generally manifest with recurrent pneumonia, will be less responsive to medical therapy alone, and have recurrent pulmonary infections that will be difficult to eradicate. Pneumonia is difficult to treat, or may progress into serious pneumonia, and then heart and respiratory failure will occur. Assessment of cardiac function in children with CCF is based on electrocardiogram, ultrasonic cardiogram, and clinical data that is not precise. CCF's clinical characteristics include weight gain or oedema, dysphoria, cyanosis, poor reaction, light skin and milk intake reduction. All those features can be used to diagnose CCF early. These symptoms can also be seen in children with CHD, however. Thus, these clinical results were not unique to CCF and inadequate for correct diagnosis. Increased heart rate, pneumonia, or infection of the respiratory tract which often accompanies CHD can induce CCF. Although many studies have shown that there is increased risk of bronchopneumonia in children suffering from CHD, studies looking at the pattern of CHDs presenting as bronchopneumonia have not been completely available. Through this prospective cohort study we would like to look into the pattern of CHDs presenting as bronchopneumonia. We will also get additional information about the subpopulation of CHDs landing in congestive cardiac failure or those associated with high mortality or morbidity.

This will help us in assessing various prognostic factors in predicting the clinical outcome of bronchopneumonia in CHD. In this study clinical severity, chest radiographic abnormalities, echocardiographic diagnosis, presence / absence of CCF will be noted. Eventual use of ionotropes / diuretics / mean days, dependence on oxygen inhalation will be evaluated and correlated with the type of CHD lesion. Our study is to evaluate the echocardiographic profile of the children with CHD admitted with bronchopneumonia aged 1 month to 5 years and assess the pattern, age and gender specific distribution of CHD and study the various prognostic factors in predicting the clinical course of bronchopneumonia in children with CHD.

METHODS

This is a descriptive study performed in Tertiary Care Centre in Telangana over a period of two years and includes 200 children of either sex, from 1 to 60 months of age who are admitted from December 2017 to December 2019. Institutional Ethical Committee approval was obtained before the study.

Inclusion Criteria

Age group 1 m - 5 yrs., known case of congenital heart disease including cyanotic and acyanotic who are diagnosed with bronchopneumonia and surgically corrected CHD diagnosed as bronchopneumonia.

Exclusion Criteria

Children aged more than 5 yrs., associated co-morbid conditions like rheumatic heart disease, bronchial asthma, viral myocarditis, congenital lung deformities and tuberculosis.

Congenital heart disease has been diagnosed with some significant anatomical abnormality of the heart or intrathoracic blood vessels of functional importance except the large arteries and veins of the system. To diagnose the

CHD, M-mode, two dimensional and colour Doppler, pulse, and continuous wave echocardiogram was performed. Complete blood count, ECG and X Ray chest are performed in all patients. Thyroid profile and serum electrolytes are done in selected patients as and when required. A chest X ray was done for each patient. Bronchopneumonia was diagnosed based on clinical and radiological findings. All cases underwent transthoracic 2 Dimensional (2D) and Doppler echocardiography done by the cardiologist. Type of congenital heart disease so found was noted. The type and size of the defects were noted.

Heart failure was diagnosed when the patient fulfilled the clinical diagnostic criteria of heart failure outlined as significant tachycardia, significant tachypnoea, cardiomegaly and tender hepatomegaly of at least 3 cm size below the right costal margin.

RESULTS

Of the 200 children enrolled in the study, 79 (38.49 %) were females and 121 (61.51 %) were males. Age of the boys was 10.9 months while that of the girls was 7.47 months. Of the 200 children enrolled, 179 (88.16 %) children had acyanotic congenital heart disease while 21 (11.84 %) had cyanotic heart disease. The mean age of presentation of all the cases was 0.8 years.

	Female		Male	
Age Group	**Count**	**Percentage**	**Count**	**Percentage**
< 6 Months	46	25 %	49	28 %
6 m – 1 y	19	11 %	38	22 %
1 - 2	4	2 %	9	5 %
2 - 3	2	1 %	5	3 %
3 - 4	0	0 %	2	1 %
4 - 5	1	0 %	4	2 %
Grand Total	**72**	**40 %**	**107**	**60 %**
Cyanotic Congenital Heart Diseases				
< 6 months	4	21 %	3	15 %
6 m – 1 y	2	6 %	9	45 %
1 - 2	0	0 %	1	4 %
2 - 3	1	3 %	0	0 %
4 - 5	0	0 %	1	6 %
Grand Total	**7**	**30 %**	**14**	**70 %**
Acyanotic Congenital Heart Diseases				

Table 1. Distribution of Cyanotic and Acyanotic Congenital Heart Diseases

Of the 179 acyanotic congenital heart diseases, 40 % of the diseases were seen in females. 60 % were seen in males. Combined males and females put together, more than 50 % of the children were less than 6 months old. Of the 21 cyanotic congenital heart diseases, 30 % of the diseases were seen in females. 70 % were seen in males. Combined males and females put together, more than 90 % of the children were less than 1 year old.

Among ACHD, VSD constituted 63 cases which was 37 % of the total ACHD cases. Among cyanotic CHD, 8 cases each of TOF (Tetralogy of Fallot) and TAPVC (Total Anomalous Pulmonary Venous Connection) were observed (44 %), two cases each of DORV (Double Outlet Right Ventricle) and single ventricle and one case of AP (Aorto-Pulmonary) window were noted.

Row Labels	Count	Percentage
VSD	63	37 %
ASD	52	28 %
TR	19	9 %
PFO	15	9 %
PDA	14	8 %
MR	9	4 %
PR	3	2 %
AR	2	1 %
MVP	1	1 %
COA	1	1 %
Grand Total	179	100 %
Cyanotic Congenital Heart Diseases		
TAPVC	8	44 %
TOF	8	35 %
DORV	2	11 %
Single Ventricle	2	8 %
AP Window	1	1 %
Grand Total	21	100 %

Table 2. Types of all Congenital Heart Diseases

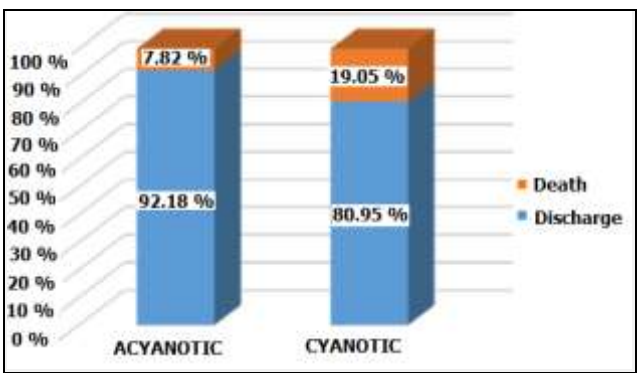

Figure 1. Mortality of Cyanotic and Acyanotic Congenital Heart Diseases

The average duration of stay of the children from the present study was 7.81 days. Among ACHD, 165 children were discharged and there were 14 deaths, amounting to 7.82 % mortality. Among CCHD, 17 children were discharged while there were 4 deaths with a mortality of 19.05 %. There was an overall mortality of 9 % in the entire study population. The p value was 0.103, which is statistically not significant.

Row Labels	Diagnosis	Average of Duration of Stay (days)
Acyanotic	AR	5.50
	ASD	7.65
	COA	8.00
	MR	6.78
	MVP	2.00
	PDA	6.14
	PFO	7.27
	PR	7.33
	TR	12.16
	VSD	7.38
Acyanotic Total		**7.78**
Cyanotic	AP Window	2.00
	DORV	4.00
	Single Ventricle	4.50
	TAPVC	8.75
	TOF	10.00
Cyanotic Total		**8.05**
Grand Total		**7.81**

Table 3. Average Duration of Stay According to Congenital Heart Disease

Among ACHD, 49 (27 %) children presented in CCF, while 130 (73 %) had no features of CCF. The incidence of CCF in CCHD from higher to lower was TAPVC, TOF, DORV. P-value 0.0102 (< 0.05). Pulmonary Hypertension was seen in 19 % of the children in both ACHD and CHD groups. P value = 1, which is not significant.

Category	No CCF	%	CCF	%	Grand Total
Acyanotic	130	73 %	49	27 %	179
AR	2	100 %	0	0 %	2
ASD	38	73 %	14	27 %	52
COA	1	100 %	0	0 %	1
MR	7	78 %	2	22 %	9
MVP	1	100 %	0	0 %	1
PDA	11	79 %	3	21 %	14
PFO	10	67 %	5	33 %	15
PR	3	100 %	0	0 %	3
TR	12	63 %	7	37 %	19
VSD	45	71 %	18	29 %	63
Cyanotic	9	43 %	12	57 %	21
AP Window	1	100 %	0	0 %	1
DORV	1	50 %	1	50 %	2
Single Ventricle	2	100 %	0	0 %	2
TAPVC	2	25 %	6	75 %	8
TOF	3	38 %	5	63 %	8
Grand Total	139	70 %	61	31 %	200
CHD Presenting with Pulmonary Hypertension	NO PHN	%	PHN	%	Grand Total
Cyanotic	17	81 %	4	19 %	21
AP Window	1	100 %	0	0 %	1
DORV	2	100 %	0	0 %	2
Single Ventricle	0	0 %	2	100 %	2
TAPVC	6	75 %	2	25 %	8
TOF	8	100 %	0	0 %	8
Acyanotic	145	81 %	34	19 %	179
AR	0	0 %	2	100 %	2
ASD	38	73 %	14	27 %	52
COA	1	100 %	0	0 %	1
MR	4	44 %	5	56 %	9
MVP	1	100 %	0	0 %	1
PDA	12	86 %	2	14 %	14
PFO	15	100 %	0	0 %	15
PR	3	100 %	0	0 %	3
TR	14	74 %	5	26 %	19
VSD	57	90 %	6	10 %	63
Grand Total	162	81 %	38	19 %	200

Table 4. Type of CHD Presenting with Congestive Cardiac Failure

DISCUSSION

Of the 200 children enrolled in the study, 79 (38.49 %) were females and 121 (61.51 %) were males. A total of 200 children who satisfied the inclusion and exclusion criteria as discussed earlier were enrolled in the study. The mean age of the children was 9.54 months. The mean age of the boys was 10.9 months while that of the girls was 7.47 months. The age was stratified as five groups, namely, less than 6 months, 6 months to 1 year, 1 - 2 years, 2 - 3 years, 3 - 4 years and 4 - 5 years. The percentage of children belonging to these five categories was 50.58 %, 34.80 %, 6.84 %, 3.76 %, 0.95 % and 3.07 % respectively.

Of the 200 children enrolled, 179 (88.16 %) children had acyanotic congenital heart disease while 21 (11.84 %) had cyanotic heart disease. The data obtained is similar to the results found in the study of Saleh HK[4] where the mean age of presentation was around four years with 48 % males and 52 % females. 85 % of the cases were acyanotic and 15 % cyanotic. Cyanotic defects presented in the first year of life, most of them being neonates. Acyanotic defects presented after 3 years of age. Most common acyanotic lesion was VSD, followed by PS (Pulmonary Stenosis) and PDA. Most common acyanotic lesion being TOF. In the study conducted by Y O Sahan[5] 24 percent was cyanotic and 76 percent of 50 children with CHD admitted with lower respiratory tract infection were acyanotic. Which is also in line with Shah GS et al.[6] studies 69 % and 31 %, Pate et al.[7] 60.6 % and 38.6 %, and Sani et al.[8] 68.9 % and 31.1 %. Although few studies vary from our results, those studies include Wanni et al.[9] 88.6 % and 11.4 %, Saxena et al.[10] 79.88 % and 20.12 %, and Bakhtyar Zahid et al.[11] 52.8 % and 47.2 %. The most popular CHD was the VSD (30.01 percent), followed by ASD (20.70 percent), TOF (16.05 percent) and PDA (10.23 percent). VSD was the most prevalent acyanotic CHD while TOF was the most frequent cyanotic CHD. Most literature studies reported similar observations from India and other countries;[7,8,9,10] however, few studies recorded a higher incidence of PDA compared to ASD.[7,9] Among other cyanotic CHD studies, our results are comparable to Saxena et al. and Abquari et al,[12] whereas Wani et al.[9] documented a higher incidence of large tube, single ventricle, complete anomalous pulmonary transposition.

Of the 179 acyanotic congenital heart diseases, 40 % of the diseases were seen in females. 60 % were seen in females. Combined males and females put together, more than 50 % of the children were less than 6 months old. Females less than 6 months of age constituted 25 % while males less than 6 months old constituted 28 %. Female children from 6 months to one year constituted 11 % while male children in the same age group constituted 22 %. 1 4 % of the cases were seen in children more than 1 year of age, both sexes put together.

Of the 21 cyanotic congenital heart diseases, 30 % of the diseases were seen in females. 70 % were seen in females. Combined males and females put together, more than 90 % of the children were less than 1 year old. Females less than 6 months of ager constituted 21 % while males less than 6 month sold constituted 15 %. Female children from 6 months to one year constituted 6 % while male children in the same age group constituted 45 %. 13 % of the cases were seen in children more than 1 year of age, both sexes put together. Shah et al[5] in 2006 have observed that VSD constituted the most cases in ACHD group followed by ASD. Among CCHD, TOF was the most common lesion. Similar results were seen in study conducted by Chadha et al[13], who studied the prevalence of CHD in random sample of 11833 children in Delhi.

Among ACHD, VSD constituted 63 cases which was 37 % of the total ACHD cases. There were 52 ASD cases (28 %), 19 cases of TR (Tricuspid Regurgitation) (9 %), 15 cases of PFO (Patent Foramen Ovale) PDA-COA (9 %), PDA 14 (8 %), MR 9 (4 % 0, PR 3 (2 %). There were 2 cases of AR (1 %) and one each of MVP (Mitral Valve Prolapse) and COA (Coarctation of Aorta) (1 %).

Among cyanotic CHD, 8 cases each of TOF and TAPVC were observed (44 %), two cases each of DORV and single ventricle and one case of AP window were noted.

The results are in line with Harish GV et al[14] who have conducted a study to evaluate the underlying CHD in recurrent bronchopneumonia in a tertiary centre over a period of 6 months. The incidence of CHD in recurrent bronchopneumonia was 10 % among the 40 children selected out of 370 PICU (Paediatric Intensive Care Unit) admissions. 2 cases were large size ASD, one PDA and the

other peri membranous VSD. There was also a significant increase in the mean duration of stay among the children with CHD. Heart failure and murmurs should be evaluated for CHD with a strong index of suspicion.

The mean age of presentation of all the cases was 0.8 years. Among ACHDs, COA presented the earliest at 0.17 years of age. ASD presented at 0.87 years of age. AR presented late at 2.13 years of age. Among cyanotic CHDs, AP window, DORV and TAPVC presented around 6 months of age. TOF had a delayed presentation compared to other diseases at 1.5 years of age.

The average duration of stay of the children from the present study was 7.81 days. The duration of stay of ACHD children was, on an average, 7.78 days, out of whom the average duration of stay was shortest for the children with MVP and longest for the children with TR. The duration of stay of cyanotic CHD was 8.05 days out of whom those with AP window stayed the shortest and the duration of stay was the longest with those diagnosed with TOF.

Among the children with ACHD, children from 4 - 5 years of age stayed the longest in the hospital with an average stay of 11 days, children from 2 - 3 years age group stayed the shortest. In the CCHD group, children from 1 - 2 years of age stayed for one day while the longest duration of hospital stay was from the less than 6 months age group.

Among ACHD, 165 children were discharged and there were 14 deaths, amounting to 7.82 % mortality. Among CCHD, 17 children were discharged while there were 4 deaths with a mortality of 19.05 %. There was an overall mortality of 9 % in the entire study population. The p value was 0.103, which is statistically not significant.

In this study we have seen that the children presenting with bronchopneumonia in the infancy have associated chamber dilatation compared to the children more than 1 year of age. 95 children with ACHD presented with chamber dilatation in the age group of less than 6 months. Among the CCHD children, the age group of 6 months to 1 year have the most number of children with chamber dilatation. Among ACHD, 49 (27 %) children presented in CCF, while 130 (73 %) had no features of CCF. Among them, children with MR, PFO, VSD children presented with CCF proportionately in higher numbers compared to others. Among CCHD, 9 (43 %) children had features of CCF while 12 (57 %) children had no features of CCF. The incidence of CCF in CCHD from higher to lower was TAPVC, TOF, DORV. Overall, 31 % of the children in the study presented with features suggestive of CCF.

Among the children with ACHD presenting with CCF, most of the children presented at an age group less than 6 months (31). 14 cases were from the age group of 6 months to one year. The highest incidence of CCF in CCHD group was form the 6 months to 1 year group, followed by the less than 6 months age group. Pulmonary hypertension was seen in 19 % of the children in both ACHD and CHD groups. Single ventricle in CCHD category and AR in ACHD category presented with pulmonary hypertension in all of the cases. The overall incidence of pulmonary hypertension in the study was also 19 %. The p-value is 1, which is not statistically significant. 14 children who presented with PHN (Pulmonary Hyper-Tension) in the ACHD group were from the less than 6 months of age group 9 children were from the 6 months to 1 year of age group. 3 children out of 4 from CCHD group were from the less than 6 months of age group and the other case was from the 1 -2 years age group. The duration of stay among ACHD was the longest for the 4 - 5 year category, lowest for 2 - 3 years category. Among CCHD, duration of stay was longest for the 2 - 3 years category. Children less than 1 year stayed on an average for 8 days in hospital among ACHD. This is in line with the higher incidence of CCF and chamber dilatation among the age group.

CONCLUSIONS

Most of the children less than 6 months of age presented with pulmonary hypertension both in the ACHD and CCHD group. According to the study, if a child with CHD presents with bronchopneumonia, there is high likelihood that the child might end up in CCF and pulmonary hypertension with a prolonged stay in the hospital. It can be concluded that early diagnosis of CHD in the neonatal period can help reduce the morbidity associated with bronchopneumonia in infancy and help in reducing the incidence of failure to thrive and recurrence of respiratory tract infections.

Data sharing statement provided by the authors is available with the full text of this article at jebmh.com.
Financial or other competing interests: None.
Disclosure forms provided by the authors are available with the full text of this article at jebmh.com.

REFERENCES

[1] Healy F, Hanna B, Zinman R. Pulmonary complications of congenital heart disease. Paediatr Respir Rev 2012;13(1):10-15.
[2] Harrison MJ, Shapiro AJ, Kennedy MP. Congenital heart disease and primary ciliary dyskinesia. Paediatr Respir Rev 2016;18:25-32.
[3] Hoving PMF, Brand PLP. Causes of recurrent pneumonia in children in a general hospital. J Paediatr Child Health 2013;49(3):208-212.
[4] Sadoh WE, Sadoh AE. Serum zinc values in children with congenital heart disease. Afr Health Sci 2013;13(3):601-606.
[5] Saleh HK. Pattern of congenital heart disease in Southern Yemeni children referred for echocardiography. Saudi Med J 2009;30(6):824-828.
[6] Sahan YO, Kilicoglu E, Tutar ZU. Evaluation of children with congenital heart disease hospitalized with the diagnosis of lower respiratory tract infection. The Journal of Pediatric Research 2018;5(1):32-36.
[7] Pate N, Jawed S, Nigar N, et al. Frequency and pattern of congenital heart defects in a tertiary care cardiac hospital of Karachi. Pak J Med Sci 2016;32(1):79-84.

[8] Sani MU, Mukhtar-Yola M, Karaye KM. Spectrum of congenital heart disease in a tropical environment: an echocardiography study. J Natl Med Assoc 2007;99(6):665-669.
[9] Wanni KA, Shahzad N, Ashraf M, et al. Prevalence and spectrum of congenital heart diseases in children. Heart India 2014;2(3):76-79.
[10] Saxena A, Mehta A, Sharma M, et al. Birth prevalence of congenital heart disease: a cross-sectional observational study from North India. Ann Pediatr Cardiol 2016;9(3):205-209.
[11] Zahid BS, Jan ZA, Ahmed S, et al. Spectrum of congenital heart disease in children admitted for cardiac surgery at Rehman Medical Institute, Peshawar, Pakistan. Pak J Med Sci 2013;29(1):173-176.
[12] Abqari S, Gupta A, Shahab T, et al. Profile and risk factors for congenital heart defects: a study in a tertiary care hospital. Ann Pediatr Cardiol 2016;9(3):216-221.
[13] Chadha SL, Singh N, Shukla DK. Epidemiological study of congenital heart disease. Indian J Pediatr 2001;68(6):507-510.
[14] Harish GV, Priyanka K. Study of prevalence of underlying congenital heart disease in children with recurrent respiratory tract infections. Perspectives in Medical Research 2017;5(3):20-23.