



Original Research Article

Clinico-Etiological profile of congestive heart failure (CHF) in children

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ABSTRACT

Congestive heart failure (CHF) occurs when the heart doesn't pump blood to meet the oxygen demand of the various organs. Usually congenital heart disease (CHD) like VSD, PDA, CoA, TGA physiology, ECD, Ebstein anomaly present with CHF before U5 age. In India most common cause of CHF from 5 to 15 yrs. age is due to Rheumatic Fever / RHD. We also get cases like pericardial effusion, constrictive pericarditis, DCM, AR in rheumatic disease, iron overload causing myocardial failure in Thalassemia and anemia presenting as CHF as in more than 5-year children. CHF cases contribute to about 10% of mortality in children.

We conducted a Hospital based descriptive and cross-sectional study from November 2018 to October 2020 at Pediatric department of M.K.C.G Medical College Hospital, Berhampur. All pediatric patients with signs and symptoms of CHF as per clinical diagnosis in the age group of 1 month to 14 year were included in our study. The study population was 136. Out of the total cardiac cases, 57% were CHD, 43% were acquired. Among the total 105 cardiac cases of CHF, CHD were 60(57.2%). Out of the total CHD, acyanotic heart diseases were 46.7% and acquired heart diseases constituted 42.8%. Out of total 136 cases 87(63.2%) were discharged, 23(17.6%) died, 19 cases (14%) were referred to higher centre. After data collection detail analysis was made by SPSS software. An initiative regarding addressing the problematic Congestive heart failure along with its clinical management will definitely help the future generation and researchers.

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1. Introduction

Heart failure (HF) in children is not same as in adults in many ways. The aetiological and clinical profile may differ considerably among children of varied age groups and between children and adults. Heart failure (HF) has been defined as an abnormality of cardiac function leading to failure of the heart to deliver oxygen to different metabolizing tissues. The time of onset of HF holds the key to the etiological diagnosis with special reference to CHD. In children, the causes of HF are due to congenital malformations which usually result in high output cardiac failure. Some children suffer from low output

cardiac failure such as cardiomyopathy most commonly DCM. CHD occurs in around 8/1000 live births. HF associated with CHD occurs in approximately 20% of all patients.¹ CHF related hospitalizations occur in 11K-14K children annually in US, with an overall mortality of 7%. Overall mortality depend on associated comorbid conditions. Cardiomyopathy also contributes significantly to the number of pediatric patients who present with the symptoms of cardiac failure.²

Near about 0.8% of all live births are complicated by Congenital heart disease and HF of significant severity is present in about 20% of these CHD. The overall prevalence is expected to be about 0.3–0.5 million children.³ Another major group of diseases causing HF in children in developing countries like INDIA is rheumatic fever and

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RHD. While the incidence and prevalence of rheumatic fever and RHD are well documented, there is paucity of data on presentation with HF in this group. A significant number of acute rheumatic carditis and established juvenile mitral stenosis present with features of HF.⁴

Lack of standardized phenotyping for both CHD and HF and the diversity of causes of HF in children with CHD have contributed to difficulties in compiling accurate incidence and prevalence estimates for pediatric HF. CHF has been a major public health problem for decades. The well-established New York Heart Association (NYHA) HF classification is not applicable to most of the children. The Ross HF classification was developed to assess severity in infants and has subsequently been modified to apply to all pediatric ages. The modified Ross classification for children provides a numeric score comparable with the NYHA classification for adults.⁵

2. Diagnosis of CHF in Children

Infant and young children: The typical presentation is characterized by difficulty in feeding (suck rest suck cycle). Cyanosis, fast breathing, distress, sinus tachycardia, and diaphoresis can be present.

Older children and adolescence: Fatigue, SOB, fast breathing, and exercise intolerance are the main symptoms. Abdominal pain, oliguria, and pedal pitting edema may also be present. The severity of HF in children must be staged according to the Ross modified classification that recognizes four functional classes with increasing severity of clinical features from I to IV.⁶

2.1. Investigations

Basic investigations such as chest CXR, ECG, and 2D echocardiography are indicated in all patients with suspected HF.

3. Treatment

The principles of management include treatment of the cause, correction of any precipitating event, and treatment of systemic or pulmonary congestion. All effort must be given to find out the cause of CHF and then it should be addressed.

In large left to right shunts, early surgical intervention must be considered after initiating medical therapy. Other conditions requiring early surgery or catheter intervention include severe AS or COA, TGA, obstructed TAPVC, etc.

A precipitating event such as intercurrent infections, anemia, electrolyte imbalances, arrhythmia, rheumatic reactivation, infective endocarditis, pulmonary arterial hypertension [PAH], drug interactions, drug toxicity, or drug noncompliance should be identified and corrected if present. Acute HF patients can have symptoms related to fluid overload, underperfusion, or both. The early management of children with HF should address these multifarious

problems.

3.1. Pharmacological therapy

Drug therapy is aimed at reducing the pulmonary or systemic congestion by the use of diuretics, increasing contractility by inotropes, and reducing the disproportionately elevated afterload by vasodilators and other measures. Routinely used drugs in the management of CHF in children include diuretics, digoxin, angiotensin-converting enzyme inhibitors (ACEIs), spironolactone, beta-blockers, and inotropes. The drugs which are still investigational include natriuretic peptides, vasopressin antagonists, renin inhibitors, endothelin antagonists, oral phosphodiesterase inhibitors, anti-inflammatory molecules, nitric oxide agonists, etc.

3.2. Device therapy

Device therapy in HF predominantly includes pacemaker therapy, cardiac resynchronization therapy (CRT), and mechanical circulatory support. Advanced second- or third-degree atrioventricular block associated with ventricular dysfunction need permanent pacemaker implantation. Implantable cardioverter defibrillator (ICD) implantation is indicated for patients with a history of cardiac arrest or symptomatic sustained ventricular tachycardia in association with CHD.⁷

3.3. Cardiac transplantation

Heart transplantation remains the therapy of choice for end-stage HF in children refractory to surgical and medical therapy given for years together. There were 9,566 pediatric heart transplants reported to the international society for heart and lung transplantation from 1982 to 2009. The most common indication is the end-stage heart disease due to cardiomyopathies.⁸

4. Aim of the study

The Present study was approved by Institutional Ethical Committee, M.K.C.G Medical College, Berhampur, Odisha to study the various etiologies and clinical presentation of CHF in patients of age group of 1mo to 14 years presented to department of pediatrics

5. Materials and Methods

We conducted a hospital based prospective study in the department of pediatrics, MKCG medical college, Berhampur from November 2018 to October 2020. We included 136 children of age group 1 mo. to 14 years presented to our department with CHF during the study period.

1. Diagnosis was done clinically and by proper investigations.
2. After data collection in case report form, data was compiled.
3. Finally the cases were analyzed by SPSS statistical software.

6. Results

136 patients with signs and symptoms of CHF as per clinical diagnosis in the age group of 1 month to 14 year were included in our study.

Most of the patients in the study group for congestive heart failure were in the 1month - 1year age group(47.8%) followed by 1year - 5years (24.3%) ,then 10years- 14years and least among 5years to 10years. Most the patients were males (51.5%) than females (48.5%). Maximum cases were from rural area in 70.6% cases, 29.4% cases were from urban area. Maximum study population were from low socio-economic status (45.6%), followed by middle (36%) and upper class (18.4%). Moderate malnutrition was prevalent in 52.2% cases and severe malnutrition in 26.5% cases but 21.3% cases were normal. Most the CHF cases (55.1%) were referred from Peripheral centers like PHC, CHC, SDH and District Headquarter hospitals.

Table 1 show Most common cardiac cases causing heart failure are VSD (33.1%), followed by myocarditis (16.2%), DCM(10.2%), RHD(6.6%), TGA(5.9%).

Among the non-cardiac cases of CHF, we found severe anemia (11.7%) was the most common non cardiac cause of CHF.

Severe anemia due to sickle cell anemia and thalassemia cause CHF in significant number of cases.

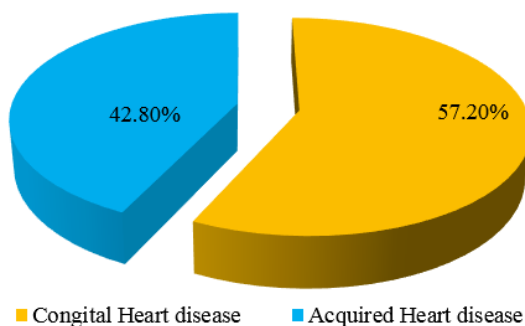


Fig. 1: A Congenital Vs Acquired Heart disease

Figure 1 shows Among the total 105 cardiac cases of CHF, congenital heart diseases were 60(57.2%).

Figure 2 shows Out of the total congenital heart diseases, acyanotic heart diseases were 82% . Acquired heart diseases constituted 18%.

Figure 3 shows most common complication due to underlying causes of CHF were pneumonia (69.5%), followed by shock (18.3%), AKI (4.8%), stroke (3.7%) and

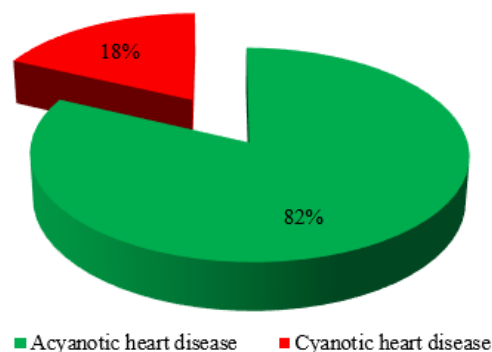


Fig. 2: Acyanotic Vs Cyanotic Heart disease

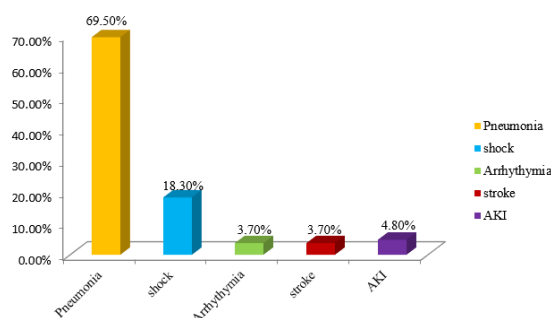


Fig. 3: No. of Complications due to underlying diseases of CHF

arrhythmia (3.7%).

Table 2 depicts Out of the total cases (N=136), 72(52.9%) had complications. Maximum complications were present in cases of VSD (25%) i.e. pneumonia, followed by myocarditis (9.6%), DCM in 7.4% cases. Comparatively complications were less in non-cardiac causes of CHF. Most of the complications in non cardiac cases of CHF were due to AGN(3.6%), followed by severe anemia due to sickle cell disease, Thalassemia and other causes like aplastic anemia, pure red cell aplasia.

Table 3 show Chi-square value is 38.956, P value <0.05. Out of total 77 cardiac cases (N=136) of CHF, 44.8% discharged, 14.7% died, 3.7% left against medical advice and 14% referred to higher centers. Out of the total 31 non cardiac causes (N=136), 18.3% discharged, 2.9% died, 1.5% were left against medical advice but no referral.

7. Discussion

& Fig.1,2, Among the total 136 cases,105 cases (77.2%) had CHF due to cardiac cause. Out of the cardiac cases of CHF, congenital heart diseases were 60(57.2%). Among the congenital heart diseases, VSD (33.1%) was the most common cause. In acquired heart diseases, myocarditis (16.2%) was the most common cause. Out of the total congenital heart diseases, acyanotic heart diseases were 46.7%. Acquired heart diseases constituted 42.8%. In

Table 1: Causes of CHF (N= 136)

	Cardiac conditions	Frequency	Percent (%)
Cardiac causes of CHF	VSD	45	33.1
	PDA	4	2.9
	DCM	14	10.3
	ECD	2	1.5
	myocarditis	22	16.2
	RHD	9	6.6
	TGA	8	5.9
	TOF	1	0.7
	Sub-Total	105	77.2
Non cardiac causes of CHF			
Severe Anemia	Sickle cell anemia	5	3.7
	Thalassemia	4	2.9
	other causes	7	5.1
	Sub-total	16	11.7
	AGN	10	7.4
	Scrub typhus	5	3.7
	Total	136	100

Table 2: Complications due to CHF (N=136)

	Cardiac disease	Complication		Total
		yes	no	
		No.(%)	No.(%)	No.(%)
Complication due to Cardiac causes	VSD	34(25%)	11(8.1%)	45(33.1%)
	DCM	10(7.4%)	4(2.9%)	14(10.3%)
	Endocardial cushion defect	1(0.7%)	1(0.7%)	2(1.5%)
	Myocarditis	13(9.6%)	9(6.6%)	22(16.2%)
	PDA	4(2.9%)	0(0%)	4(2.9%)
	RHD	4(2.9%)	5(3.7%)	9(6.6%)
	TGA	5(3.7%)	3(2.2%)	8(5.9%)
	TOF	1(0.7%)	0(0%)	1(0.7%)
	Sub-total	72(52.9%)	33(24.3%)	105(77.2%)
Non cardiac causes of CHF				
Severe anemia	Sickle cell anemia	1(0.7%)	4(2.9%)	5(3.6%)
	Thalassemia	1(0.7%)	3(2.2%)	4(2.9%)
	other causes	2(1.5%)	5(3.6%)	7(5.1%)
	Sub-total	4(2.9%)	12(8.7%)	16(11.6%)
	AGN	5(3.6%)	5(3.6%)	10(7.2%)
	Scrub typhus	1(0.7%)	4(2.9%)	5(3.6%)
	Total	82(60.3%)	54(39.7%)	136(100%)

Rashid et al.' study showed cardiac causes are 84% and non-cardiac causes are 16% of cases of CCF.⁹

Luganju et al. report 31% cardiac causes and 69% of non cardiac causes as the etiology of CHF.[16] Prevalence of congenital acyanotic heart diseases is more prevalent in India than acquired heart diseases.¹⁰

Among the non-cardiac cases of CHF, we found severe anemia (11.7%) was the most common non cardiac cause of CHF. Khan et al. in a study of 212 patients with beta Thalassemia observed clinical CHF in significant no. of patients with the age range between 8 and 21 years.¹¹

Adekanmbi et al study showed severe anaemia occurring alone (48.46%) in heart failure in children.¹²

Fig.2: Most common complication due to underlying causes of CHF were pneumonia(69.5%), followed by shock(18.3%), AKI (4.8%), stroke (3.7%) and arrhythmia(3.7%).Pneumonia was mostly due to congenital acyanotic heart diseases like VSD. Myocarditis and DCM resulted in cardiogenic shock leading to increased morbidity and mortality. Most of the acute glomerulonephritis cases resulted in AKI. Stroke was seen in rheumatic heart disease and DCM.

Shamszad P et al study showed significant comorbidities associated with CHF hospitalizations included arrhythmias in 42%, renal failure in 13%, cerebrovascular disease in 6%, and hepatic impairment in 5%.¹³

Table 3: Outcome of CHF (N=136)

Cardiac Diseases	Discharged	Death	LAMA	Referred to higher centre	Total
	No.(%)	No.(%)	No.(%)	No.(%)	No.(%)
DCM	11(8.1%)	2(1.5%)	0	1(0.7%)	14(10.3%)
Endocardial cushion defect	1(0.7%)	0	0	1(0.7%)	2(1.5%)
Myocarditis	12(8.8%)	8(5.9%)	0	2(1.5%)	22(16.2%)
PDA	1(0.7%)	1(0.7%)	0	2(1.5%)	4(2.9%)
RHD	5(3.7%)	3(2.2%)	1(0.7%)	0	9(6.6%)
TGA	4(2.9%)	2(1.5%)	0	2(1.5%)	8(5.9%)
TOF	0	1(0.7%)	0	0	1(0.7%)
VSD	27(19.9%)	3(2.2%)	4(2.9%)	11(8.1%)	45(33.1%)
Severe Anemia					
Sickle cell anemia	5(3.7%)	0	0	0	5(3.7%)
Thalassemia	3(2.2%)	1(0.7%)	0	0	4(2.9%)
other causes	5(3.7%)	0	2(1.5%)	0	7(5.9%)
Scrub typhus	4(2.9%)	1(0.7%)	0	0	5(3.7%)
AGN	8(5.9%)	2(1.5%)	0	0	10(7.3%)
Total	25(18.3%)	4(2.9%)	2(1.5%)	0	31(22.7%)
Total	86(63.2%)	24(17.6%)	7(5.1%)	19(14%)	136(100%)

Most of the complications in non cardiac cases of CHF were due to AGN(3.6%), followed by severe anemia due to sickle cell disease, Thalassemia and other causes like aplastic anemia, pure red cell aplasia.

2 Out of the total cases (N=136), 72(52.9%) had complications.

Maximum complications were present in cases of VSD(25%) i.e. pneumonia, followed by myocarditis(9.6%) , DCM in 7.4% cases.

Sadoh WE et al study showed there were 121 children with pneumonia of which 61(50.40%) were males and their mean age was 10.2 ± 10.93 months.[18] Pneumonia is a very frequent infection in congenital acyanotic heart diseases due to L- R shunt and pulmonary congestion.¹⁴

Most of the complications in non cardiac cases of CHF were due to AGN(3.6%), followed by severe anemia due to sickle cell disease, Thalassemia and other causes like aplastic anemia, pure red cell aplasia.

3 Out of total 77 cardiac cases (N=136) of CHF, 44.8% discharged, 14.7% died, 3.7% left against medical advice and 14% referred to higher centers.

Out of the total 31 non cardiac causes (N=136), 18.3% discharged, 2.9% died, 1.5% were left against medical advice but no referral.

The overall prognosis of non cardiac cases were better in comparison to cardiac causes.

Cardiac cases were associated with mortality in 14.7% cases, mostly attributed to myocarditis associated with shock. Kachaporn Nimdet et al study shows CHF cases had high rates of associated complications such as ventilator-associated pneumonia, sepsis, shock, and 30 day mortality.¹⁵

Shamszad P et al study showed heart failure related ICU hospitalizations in children with cardiomyopathy are increasing. These children are at high risk for poor outcomes with an in-hospital mortality of 11%.¹³

8. Summary

The study population is 136. Most of the patients in the study group were in the 1month - 1year age group(47.8%) followed by 1year - 5years (24.3%). Male patients were 51.5% and female patients were 48.5%. Most of the cases were from rural area in 70.6% cases, 29.4% cases were from urban area. Maximum cases were from low socio-economic status (45.6%), followed by middle (36%) and upper class (18.4%). Moderate malnutrition was prevalent in 52.2% cases and severe malnutrition in 26.5% cases but 21.3% cases were normal. Maximum number of CHF cases (55.1%) were referred from Peripheral centers like PHC, CHC, SDH and District Headquarter hospitals. Out of the total cardiac cases, 57% were congenital heart diseases, 43% were acquired. Most common cardiac cases causing heart failure are VSD (33.1%), followed by myocarditis (16.2%), DCM (10.2%), RHD (6.6%), TGA(5.9%). Among the non-cardiac cases of CHF, in our study, we found severe anemia is the most common cause, followed by AGN.

Severe anemia due to sickle cell anemia and thalassemia cause CHF in significant number of cases. Among the total 105 cardiac cases of CHF, congenital heart diseases were 60(57.2%). Out of the total congenital heart diseases, acyanotic heart diseases were 46.7%. Acquired heart diseases constituted 42.8%. Out of the total cardiac cases (N=105), 72(68.6%) had complications. Maximum complications were present in cases of VSD (25%) i.e.

pneumonia, followed by myocarditis (9.6%), DCM in 7.4% cases. Most of the complications in non cardiac cases of CHF were due to AGN(3.6%), followed by severe anemia due to sickle cell disease, Thalassemia and other causes like aplastic anemia, pure red cell aplasia. Most common complication due to underlying causes of CHF were pneumonia (69.5%), followed by shock (18.3%), AKI (4.8%), stroke (3.7%) and arrhythmia (3.7%). Duration of stay in most cardiac cases of CHF were 7-10 days. Longer durations (>10 days) of stay were mostly due to DCM, followed by VSD, TGA, RHD. The duration of stay in most non cardiac cases were <7days.

The prognosis of CHF due to non cardiac causes of CHF were better in comparison to cardiac diseases. Maximum deaths due to cardiac cases were due to myocarditis (5.9%).

Maximum deaths in myocaditis were due to complications like shock. Out of total 136 cases 87(63.2%) were discharged, 23(17.6%) died, 19 cases (14%) were referred to higher centre and 5.1% cases left against medical advice.

9. Conclusion

It is concluded that pediatric heart failure cases are around ten 10% of total case load in our tertiary care hospital. Most of the cases were in infancy age group where symptoms and signs can obscure the underlying disease. Those cases contribute good number to the pediatric emergency[ED]. Early intervention in referral centers like early diagnosis, giving first aids like O2 supplementation, diuretics can save many lives and prevent future complications. All cases of respiratory distress especially in infancy, congenital heart diseases must be ruled out. Measurement of blood pressure will pick up AGN cases pointing towards early management and better survival. In tertiary care centers, early intervention like shifting the cases to pediatric ICU can intervene best prognosis.

After establishing CHF diagnosis, detail examination along with specific investigation should be done to explore out the causality of CHF. The pediatric ICU set up in tertiary care centers should be well equipped for proper diagnosis and treatment of CHF cases due to complex cardiac diseases. The community health programmes like RBSK should be strengthened for early diagnosis, referral and treatment of CHF cases especially due to congenital heart diseases.

10. Conflict of Interest

The authors declare that there are no conflicts of interest in this paper.

11. Source of Funding

None.

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