

Childhood heart failure in Ibadan

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Summary

One hundred consecutive admissions of children with a diagnosis of congestive cardiac failure to the paediatric department of the University College Hospital, Ibadan were evaluated during a 10-month period. They were aged 8 days to 12 years. They constituted 5.8% of the total paediatric admissions during the study period. The most frequent underlying causes of heart failure were acute lower respiratory tract infections (36%), intrinsic heart disease (31%) and severe anaemia (28%). Other less common causes of heart failure were renal disorders (3%) and septicemia (2%).

Heart failure remains a common problem encountered in emergency paediatric practice in Nigeria, with the majority of cases resulting from preventable causes.

Keywords: *Childhood, Congestive Heart Failure.*

Résumé

Cent cas consécutifs des enfants atteints de la congestion d'arrêt cardiaque et admis au département de la Pédiatrie du Collège Hospitalo-Universitaire, Ibadan, ont été évalués au cours d'une période de 10 mois. Ils sont âgés de 8 jours à 12 ans. Ils constituent 5,8% de tous les patients atteints de la pédiatrie et admis pendant la période d'étude.

Les causes les plus fréquentes attribuables pour l'arrêt cardiaque sont: l'infection du sentier respiratoire inférieur 36%, la maladie de coeur intrinsèque 31%, et l'anémie grave 28%. D'autres causes qui sont plus fréquentes d'arrêt cardiaque étaient troubles rénaux 3% et la septicémie 2%.

Arrêt cardiaque demeure un problème très fréquent éprouvé dans l'exercice de la pédiatrie d'urgence au Nigeria, avec la majorité des cas attribuables aux causes évitables.

Introduction

Cardiac failure is defined as a state in which the heart becomes unable to deliver an adequate cardiac output to meet the metabolic requirements of the body¹. It is a common problem encountered in emergency paediatric practice^{2,4}. Previous studies in Nigeria have highlighted acute lower respiratory tract infections and severe anaemia, which are major causes of childhood morbidity and mortality in our environment, as common causes of heart failure in affected children^{2,3}. It is also known that, failure to carefully seek for evidence of heart failure in children admitted on account of severe anaemia, bronchopneumonia and other illnesses known to predispose to heart failure, has led to failure to recognise, diagnose and promptly treat heart failure in such children. The end result often is increased mortality from many of these treatable conditions⁵.

Heart failure is also a frequent complication and a major presentation of congenital and acquired heart diseases in Nigeria^{4,6}. The majority of the children with congenital heart defects in Nigeria and other developing countries have been noted to present in advanced cardiac failure with the end result of increased morbidity and mortality⁶. The high mortality recorded

in patients with rheumatic heart disease in these areas have also been largely attributed to chronic cardiac failure⁸. On the other hand, heart failure as a sequelae of infectious diseases and severe anaemia is now rarely seen in the developed countries⁹. The availability of adequate, accessible health care delivery systems, modern diagnostic and therapeutic modalities have paved the way for prompt diagnosis of congenital heart defects and the institution of appropriate intervention before complications set in, thus reducing the high levels of morbidity and mortality which formerly resulted from these diseases^{10,11}. In developing countries however, where scarce resources and poor resource management preclude the acquisition of similarly advanced healthcare delivery setups, that goal has so far remained elusive. Hence a regular update in knowledge of the prevalence and causes of heart failure in children will remain a necessity for their appropriate management.

Thus one hundred cases of congestive cardiac failure have been prospectively studied as a means of describing the prevalence and aetiology of the disease amongst children admitted into the University College Hospital, Ibadan, with a view to identifying any changing patterns in the locality.

Materials and methods

All consecutive admissions aged 1 day to 12 years, admitted into the paediatric wards of the UCH, Ibadan over a 10 month period, (August 2000 – May 2001) were carefully evaluated for evidence of heart failure. The criteria for the diagnosis of heart failure were the simultaneous presence of 3 or all of the following, with number 1 inclusive

- (1) Tender hepatomegaly – with the liver edge palpable at least 3cm below the right costal margin along the mid clavicular line³.
- (2) Significant tachycardia – defined as a resting heart rate greater than the upper limit of normal for age; that is, greater than 160 beats/minute in infancy, 140 beats/minute at 2 years, 120 beats/min at 4 years and 100 beats/minute at 6 years and above^{2,3}. In patients with fever, an allowance of 10 beats/minute was made for every degree centigrade rise in temperature above normal³.
- (3) Tachypnoea – defined as a resting respiratory rate above the normal for age, that is, 60 breaths/minute and above in infants less than 2 months of age, 50 breaths/minute and above in infants aged two to twelve months, 40 breaths/minute and above in children above the age of 1 year³.
- (4) Cardiomegaly – defined as a cardiothoracic ratio greater than 60% in the first five years of life and greater than 50% in children above age 5 years³.

All the children who satisfied the criteria were recruited consecutively into the study until the number 100 was attained. The name, age sex, presenting complaints and duration of symptoms were recorded in the purpose designed case record forms. A thorough physical examination was performed on each patient on admission and repeated daily till heart failure resolved. Packed cell volume estimation was done and chest radiographs taken in all the patients. Patients with suspected structural heart

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defects in addition, had electrocardiography performed on them using the commercially available 6 channel Mac VU electrocardiogram machine capable of simultaneous 12 lead acquisition. These patients also had two dimensional, M-mode and colour-coded Doppler echocardiography done using a HP Sonors 4500 machine using S3 and S8 ultraband transducers.

Blood cultures were performed on patients with suspected septicaemia and infective endocarditis, while throat swabs were cultured, and anti streptolysin O titres (ASOT) and the erythrocyte sedimentation rate (ESR) measured in all patients with

Table 1 Age and sex distribution of the children studied

Age group	Male	female	%
Neonates	1	1	2
1 – 12 months	26	28	54
> 1 – 5 years	20	8	28
> 5 – 12 years	9	7	16
	56	44	100

suspected rheumatic carditis.

All the patients were followed up till discharge or (as was

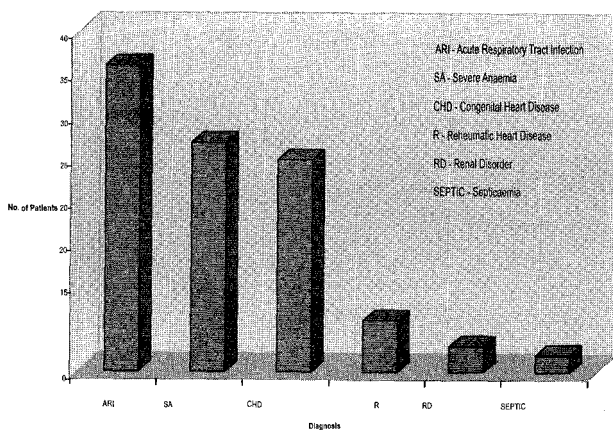


Fig 1 Bar diagram showing the frequency of the various causes of heart failure

the case in some till death) and the outcomes were recorded.

Results

Of the 1,713 children admitted during the period of the study, 100 had cardiac failure, thus giving a prevalence rate of 5.8%. The ages of the children ranged between 8 days and 12 years, with a median age of 10 months. There were 54 males and

Table 2 Pattern of congenital heart defects in the study group

Type of CHD	No. of patients	% Total
VSD	11	44
VSD + ASD	5	20
TGA	4	16
PDA	2	8
AVCD	2	8
HLHS	1	4
Total	25	100

- VSD -- Ventricular septal defect
- ASD -- Secundum atrial septal defect
- TGA -- Transposition of the great arteries
- PDA -- Patent ductus arteriosus
- AVCD -- Atrio-ventricular canal defect
- HLHS -- Hypoplastic left heart syndrome
- CHD -- Congenital heart disease
- HF -- Heart failure

* one case of AVCD was complicated by infective endocarditis.

46 females, giving a male : female ratio 1.2:1. Table 1 shows the age and sex distribution of the patients. Heart failure occurred more commonly in infancy with infants constituting a larger proportion (56%) of the study population. The major causes of heart failure identified in the 100 patients studied were acute lower respiratory tract infections (36%), severe anaemia (28%), congenital heart defects (25%) and acquired heart disease (6%). Other less common causes of heart failure seen were chronic renal failure (3%) and septicaemia (2%).

Fig. 1 is a bar diagram showing the frequencies of the various causes of heart failure in the children studied.

Bronchopneumonia was the most frequent lower respiratory tract infection seen and was responsible for heart failure in 24(66.7%) of the 36 patients with ARI. Other acute respiratory disorders causing cardiac failure were pneumonia complicated by empyema thoracis in 6(16.6%) patients, lobar pneumonia in 4(11.1%) patients and one case (2.8%) each of pneumonia complicated by pyopneumothorax. All the patients with ARI induced cardiac failure were aged 3 years and below.

The mean PCV in the 28 patients with anaemic heart failure was 12.3 ± 3.8% while it was 31.6 ± 7.0% in those patients in whom cardiac failure resulted from causes other than severe anaemia. The underlying causes of anaemia in these patients were malaria 16 ± 57.1% patients, sickle cell disease in 5 (17.9%) patients, septicaemia in 5(17.9%) patients, prematurity 1(3.6%) patient and acute lymphoblastic leukaemia 1(3.6%) patient.

The pattern of congenital heart defects seen in the patients is shown in Table 2.

Ventricular septal defects was the most common form of congenital heart defect seen. Congenital heart defects precipitated heart failure mainly in infancy. Thus 21(84%) of the 25 patients with congenital heart defects complicated by heart fail-

Table 3 Aetiology of heart failure in the different age groups

Diagnosis	Neonate (n = 2) %	1 – 12 Mo (n = 54) %	1 – 5 yrs (n = 28) %	>5 yrs (n = 16) %
ARI	0.0(0)	48.0 (26)	35.7 (10)	0.0 (0)
Severe Anaemia	50.0(1)	15.0 (8)	50.0 (14)	31.2 (5)
CHD	50.0(1)	37.0 (20)	10.7 (4)	6.3 (1)
RHD	0.0(0)	0.0 (0)	0.0 (0)	37.5 (6)
Renal disorders	0.0(0)	0.0 (0)	0.0 (0)	18.7 (3)
Septicaemia	0.0(0)	0.0 (0)	3.6 (1)	6.3 (1)

(Absolute number of patients in parenthesis).

ure were infants.

Rheumatic heart disease was the only form of acquired cardiopathy seen in this study. The commonest valvular lesion in affected patients was mitral incompetence and this was seen in all the patients with RHD. Mitral stenosis was seen in three patients and tricuspid incompetence in one patient. No case of cardiomyopathy, tuberculous or pyogenic pericarditis was encountered in this study.

There was a statistically significant difference in the aetiology of heart failure across the age groups ($P < 0.001$). The major causes of heart failure in infancy were acute lower respiratory tract infections and congenital heart defects. Severe anaemia and acute lower respiratory tract infections constituted the major causes of heart failure in the pre-school age while acquired heart disease, severe anaemia and renal disorders were the predominant causes of heart failure in the older age group (i.e. above 5 years). An increasing role of anaemia as a cause of heart failure was noted with advancing age and rheumatic heart disease was confirmed to the older age group.

Discussion

Congestive cardiac failure remains a common problem encountered in paediatric practice in this environment. The 5.8% prevalence of heart failure amongst the paediatric admission during the study period is higher than the 3.3% reported from the same centre more than a decade ago². While the latter study was limited to children admitted into the children's emergency ward of the UCH, Ibadan, the present study involved all the paediatric patients admitted into the hospital, with the children's emergency wards, the neonatal wards and all the children's wards inclusive. This finding thus suggests that cardiac failure occurs more frequently than was previously appreciated and thus contributes significantly to childhood morbidity and mortality in Nigeria.

Infants have been known to be more susceptible to and to suffer more adversely from cardiac failure^{12,13}. There are some compensatory mechanisms utilised by the heart in coping with an increased volume or pressure load imposed on it. These include ventricular dilatation, ventricular hypertrophy, and increased sympathetic stimulation^{10,14}. Ventricular dilatation allows for stretching of the myocardial fibres up to a certain limit, with a resultant increase in the force of myocardial contractility and adequate ventricular emptying such that increased ventricular filling does not result in an increase in ventricular end diastolic pressure and damming back of blood in the pulmonary and systemic circulation. This compensatory mechanism is however limited in infants because of the high resting cardiac output which results in some degree of stretching of the myocardial fibres even at rest^{10,14}. As a result, the limit of stretching of these myocardial fibres is readily attained even when there is a small increase in ventricular filling. The end result of this is an increase in the ventricular end – diastolic pressure and subsequent development of the symptoms and signs of cardiac failure. In addition, the young heart has been found to be less compliant than that of the adult and to contain fewer myofilaments with which to shorten during contraction^{14,15}. The combined effects of these are impaired diastolic filling (diastolic dysfunction) and impaired ventricular emptying (systolic dysfunction). Infants therefore more readily develop features of cardiac failure whenever an increased load is imposed upon the myocardium or its contractility is impaired. It is therefore important that those conditions predisposing to cardiac failure in infants be promptly recognised and adequately treated in order to prevent the devel-

opment of the cardiac failure in these vulnerable infants.

The aetiology of cardiac failure as found in this study, bears several similarities but few differences to what had been previously documented in Nigeria^{2,3,16,17}. The leading causes of cardiac failure in Nigerian children remain acute lower respiratory tract infections, severe anaemia, congenital heart defects and rheumatic heart disease. It is interesting that the majority of these causes are largely preventable and it is doubtful that the impact of primary health care has been felt by the majority of Nigerian children in this regard. Acute respiratory infection (ARI) and more importantly, bronchopneumonia, is one of the leading causes of death among children under the age of five years in the developing countries^{17,18}. Cardiac failure has been reported as the most common non-respiratory complication of bronchopneumonia and whenever this occurs, the prognosis of the disease is adversely affected^{16,17}. There is therefore the need to strengthen the currently existing ARI – control measures in order to reduce the incidence and prevalence of cardiac failure in our children and ultimately the under 5 morbidity and mortality.

The utilization of two dimensional, M mode and colour-coded Doppler echocardiography in this study has facilitated the diagnosis of more cases of CHD and the description of the precise anatomical defects in these children. Ventricular septal defect, as widely reported¹⁹, remains the most common form of CHD encountered amongst these children. The larger number of patients with CHD seen in the present study is also believed to be related to the increased awareness generated about CHD and the availability of facilities for corrective heart surgery in Israel provided by the Save a Child's heart, Nigeria²⁰. Obstructive aortic lesions have been reported by some authors to be rare among African children^{6,19}. Chauvet *et al*²¹ however believe that the reported rarity of these lesions may be more apparent than real. The majority of births in Nigeria take place outside of the hospitals. Facilities for diagnosis of these cardiac defects are lacking in most centers and also these conditions are lethal at a very early age. It is therefore possible that children are born with these defects but fail to come to medical attention. For those that do so, the diagnosis is not made till death. One such case, a case of hypoplastic left heart syndrome was encountered in the present study. This diagnosis could have been missed in the absence of the standard echocardiographic facilities.

Rheumatic heart disease remains the major acquired cardiopathy affecting Nigerian children^{7,8}. The incidence of rheumatic fever and rheumatic heart disease in the developed countries has on the other hand shown a steady decline in the last 70 years^{22,23}. Data from Denmark showed that this decline was concomitant with an improvement in the standard of living, a reduction in overcrowded living conditions and also increased access to medical care²⁴. Rheumatic fever has been described as a disease of poverty, overcrowding and filth which are the prevailing situation of the Nigerian populace. There is thus a need for an improvement in the health care delivery system, the living conditions, and socio economic status of the people to reduce the morbidity and mortality associated with this disease.

No case of cardiomyopathy was encountered in this study. The reason for this is not quite clear or could it be that this disease is fast disappearing from our territories?

Cardiac failure is a frequently encountered condition in the paediatric practice in this environment. It is important that evidence for heart failure be carefully sought for in all children presenting with ARI, severe anaemia, congenital and acquired heart disease and septicaemia, and appropriate measures instituted if found, to reduce the attendant morbidity and mortality.

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