Prognostic indices in childhood heart failure

*S. I. Omokhodion and I. A. Lagunju

*Department of Paediatrics, University College Hospital, Ibadan, Nigeria.

Summary

Objectives: **To evaluate the short term prognosis of childhood heart failure and highlight the factors that affect outcome among cases of heart failure admitted into the paediatric wards, University College Hospital, Ibadan.**

Background: **Childhood heart failure remains a major cause of morbidity and mortality in the developing world. The advent of open heart surgery, use of better myocardial preservative techniques, and the introduction of newer, more effective drugs in the treatment of heart failure have greatly improved the outcome of children with heart failure in the developed world. The outlook of such children in the developing world however remains poor.**

Methods: **One hundred consecutive cases of heart failure admitted into the Paediatric wards of the University College Hospital, Ibadan with a diagnosis of heart failure over a 10-month period were studied prospectively. Diagnosis of heart failure was based on the presence of at least three of the four cardinal signs of heart failure: tachypnoea, tachycardia, tender hepatomegaly and cardiomegaly. All cases were followed up daily till a definite outcome was determined.**

Results: **The predominant underlying causes of heart failure were acute respiratory infections (36%), severe anaemia (28%), and congenital heart disease (25%). There was a case-fatality rate of 24% among the study population. Poor prognostic indices identified were age below one year or above 5 years, presence of underlying acute respiratory infections, rheumatic heart disease and renal disorders.**

Conclusion: **Heart failure in Nigerian children though mostly due to preventable causes, are associated with an unacceptably high mortality.**

Key-words: *Prognosis, Heart failure, Childhood*

Résumé

Objectifs: Evaluer le prognostic à court terme du cardiaque d'enfance et souligner des facteurs qui touchent le résultat parmi les cas des cardiaques admis dans la salle d'hôpital pédiatrique, collège hospitalier universitaire, Ibadan.

Introduction: Le cardiaque d'enfance demeure une cause principale de la morbidité et mortalité dans les pays en voie de développement. L'avenement de la chirurgie à coeur ouvert, l'utilisation de meilleurs techniques du préservateurs du myocarde, et l'arrivée de nouveau et des médicaments plus efficace dans la prise en charge du cardiaque sont fortement amélioré le résultat chez des enfants atteints du cardiaque dans les pays développés malheureusement, le cas des enfants pareils dans les pays en voie de développement demeure mauvais.

Méthodes: Cent cas consécutifs des cardiaques admis dans la salle d'hôpital pédiatrique du Collège hospitalier Universitaire, Ibadan avec un diagnostic du cardiaque au cours d'une période de 10 mois ont été étudié en perspective.

Le diagnostic du cardiaque était fondé sur la présence du moins, trois des quatre signes principaux du cardiaque: tachypnée, tachycardie, hépatomégalie tendre et cardiomégalie. Tous les cas ont été suivi chaque jour jusqu'au moment ou on a pu décider un résultat bien arrêté.

Résultats: Les causes de base prédominantes du cardiaque étaient infections respiratoire intense 36%, anémie grave 28%, et maladie congénitale du coeur 25%. Il y avait un taux de cas fatalité de 24% parmi la population d'étude. Signes prognostiques mauvais identifiés étaient âges moins d'un an ou plus de 5 ans, présence des infections respiratoire grave de base, rhumatismal maladie du coeur et troubles rénaux.

Conclusion: Le cardiaque chez des enfants nigérians quoiqu'il soit principalement attribuable aux causes évitat les sont liés à un niveau de la mortalité inadmissible.

Introduction

Heart failure remains a major cause of childhood morbidity and mortality in Nigeria.[1] Prior to the advent of open heart surgery, use of better myocardial preservative techniques, and the introduction of newer, more effective drugs in the treatment of heart failure, mortality rates recorded from childhood heart failure was as high as 50-80%, even in the developed countries.[2,3] Early surgical correction has been shown to improve prognosis in children with congenital heart disease.[4,5] However, the prognosis remains poor in patients with left heart obstructive lesions, despite the recent advances in the medical and surgical management of cardiac defects.[7] Heart failure in patients with cardiomyopathies generally has a poor prognosis, even in the developed world[8-10], but the introduction of newer drugs in the medical management of heart failure has in recent years been found to prolong survival in patients with idiopathic dilated cardiomyopathy.[11] On the whole, improvement in living standard, advances in medical and surgical management of affected children have all led to a tremendous reduction in morbidity and mortality from this disease in the developed world.[12]

About two-thirds of the cases of heart failure in Nigerian children result from preventable causes such as bronchopneumonia, severe anaemia and rheumatic heart disease.[1,13-15] This study was undertaken to evaluate the factors affecting prognosis among Nigerian children presenting with cardiac failure.

Materials and methods

The study was prospective. All consecutive cases of heart failure aged 12 years and below, admitted into the Paediatric wards of the University College Hospital (UCH), Ibadan, over a ten-month period, August 2000 –May 2001, were recruited into the study.

The diagnosis of heart failure was based on the presence of three or all of the cardinal signs of heart failure in childhood, namely, tachypnoea, tachycardia, tender hepatomegaly and

cardiomegaly.

The name, age, sex, and the history of the illness were documented. Thorough physical examinations were carried out on admission and daily. Packed cell volume estimation and chest radiographs were undertaken in all patients. Other relevant investigations such as electrocardiography, echocardiography, anti-streptolysin O titre and erythrocyte sedimentation rate estimation, throat swab culture were also carried out as required. All the patients were followed up until a definite outcome was determined.

Results

A total of one hundred patients were admitted with a diagnosis of heart failure during the study period. There were 54 males and 46 females, giving a male/female ratio of 1.2:1. The underlying causes of heart failure were acute lower respiratory infections in 36 (36%) patients, severe anaemia in 28 (28%), congenital heart disease in 25 (25%) patients, acquired heart disease in 6 (6%), renal disorder in 3 (3%) patients and septicaemia in 2 (2%) patients. Infants constituted 56% of the study population, with two neonates inclusive. Twenty eight (28%) were aged 1-5 years while sixteen (16%) were between the ages of 5 and 12 years. Table 1 shows aetiology of heart failure in the various age groups.

The duration of heart failure in the group of 100 children studied ranged from one to thirty four days, median 3days. The mean duration of heart failure was shortest in patients with severe anaemia, acute respiratory infections (ARI) and septicaemia, while it was longest in patients with structural heart defects and renal disorders.

There was a statistically significant difference in the mean duration of heart failure in the various aetiological groups (Krustal – Wallis H = 3.74, P < 0.001).

Table 1 Aetiology of heart failure in the different age groups

Diagnosis	Neonate (n = 2) %	1 - 12 Mo (n = 54)%	1 - 5yrs (n = 28)%	>5 - 12 yrs (n = 16)%
ARI	0.0 (0)	48.0 (26)	35.7(10)	0.0 (0)
Severe anaemia	50.0 (0)	15.0 (8)	50.0(14)	31.2 (5)
CHD	50.0 (1)	37.0 (15)	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)
Total	100.0	100.0	100.0	100.0

Table 2 Mortality from heart failure in the different age groups

Age group	No with HF	No. Dead/ (%) Mortality
Neonates	2	2 (100.0)
1 - 12 months	54	13 (24.0)
> 1 - 15 years	28	4 (14.0)
> 5 years	16	5 (31.0)

HF = Heart failure
(Percentage mortality in parentesis)

Table 3 Mortality from heart failure in various aetiological groups

Aetiology	No of Patients	No. Dead/ (%) Mortality
Septicaemia	2	2 (0.0)
Severe anaemia	28	4 (14.2)
CHD	25	4 (16.0)
ARI	36	11 (30.6)
AHD	6	2 (33.3)
Renal disorders	3	3 (100.0)

CHD - Congenital Heart Disease
AHD - Acquired Heart Disease
ARI - Acute Respiratory Infections

Seventy six (76%) patients were discharged home. Of these were 25 (32.9%) patients with structural heart defects and all of them remained dependent on the use of oral diuretics with or without digoxin for the control of heart failure. All the other 51(67.1%) patients had complete resolution of heart failure and did not require further medication as at the time of discharge.

Twenty four (24%) of the patients died giving a case fatality rate of 24%. The two neonates in the study died, giving a fatality rate of 100% in this age group. Mortality was lowest in the preschool (1-5years) age group, 14% of them died. Thirty one percent of the older children (aged > 5years) and 24% of the infants died. There was a statistically significant difference in mortality from heart failure in the different age groups ($\chi^2 = 8.24$, $\delta_f = 3$, p = 0.0411).
Table 2 shows the mortality from heart failure in the different age groups.

Mortality from heart failure in the various aetiological groups is shown in Table 3.The highest mortality was recorded in the group of patients with renal disorders, all the three patients died giving a case fatality rate of 100%. Mortality rates of 33% and 31% were found in patients with rheumatic heart disease and acute lower respiratory tract infections respectively. Lower mortality rates were found in patients with severe anaemia (14%) and congenital heart disease (16%). None of the patients with heart failure secondary to

septicaemia died.

There was no statistically significant difference in the mean duration of illness before presentation between the patients that died and those that survived (Mann-Whitney $U= 816.5$, p = 0.63). Late presentation to the hospital was a common finding amongst all the patients. The mean (± SD) duration of symptoms prior to presentation was 37.2 ± 101 days in the 76 patients that survived, and 41.3 ± 129.7 days in the 24 patients that died.

There was a greater than two fold increased risk of mortality from heart failure when compared with mortality from other causes of admission without heart failure during the study period. This difference was statistically significant ($\chi^2= 15.897, \delta_f= 1, p < 0.001$)

Discussion

Heart failure in children in the developing countries has been shown to be associated with considerable morbidity and mortality.[13-15] The leading causes of heart failure in these areas are preventable causes such as bronchopneumonia, severe anaemia and rheumatic heart disease.[1,13-15]

The study recorded a case fatality rate of 24% amongst the children with heart failure. This was lower than the figures previously reported from this centre.[13] It is however noteworthy that, children who had their illnesses complicated by heart failure had a greater than two fold increased risk of mortality. The presence of heart failure thus worsens the prognosis of the primary illness.

Late presentation was a common finding in the group of patients studied. However, there was no statistically significant difference in the mean duration of illness before presentation between the patients with a fatal outcome and those who survived.

Age was found to be an important prognostic factor with increased mortality associated with heart failure in the neonatal period, infancy and the older age group, i.e. above the age of 5 years. The high mortality observed in the neonatal period can be attributed to the fact that the majority of congenital cardiac defects that present in the neonatal period tend to be the severe forms, e.g. obstructive left sided cardiac defects, transposition of the great arteries, while the less severe forms like ventricular septal defects, patent ductus arteriosus present later in infancy.[16,17] The infant heart has also been shown to be less compliant than the adult.[18] Infants also have a high resting cardiac output which limits diastolic reserve. The combined effects of these are an increased susceptibility to and as well as an increased mortality from heart failure in infancy.[18]

The higher mortality in infancy and the older age group can also be related to the aetiology of heart failure in these age groups. The study showed a higher mortality in patients with acute respiratory infections, rheumatic heart disease and renal disorders. Peak incidence of acute respiratory infections is seen in infancy and 72.2% of the patients with heart failure secondary to ARI in the study were infants. Johnson et al[15] and Fagbule and Adedoyin[16] also reported mortality rates of 50% and 20% respectively in patients with cardiac failure secondary to ARI in Ibadan and Ilorin.

Rheumatic heart disease, another cause of heart failure

associated with increased mortality is a disease of the older age group, usually seen above the age of 5 years. Previous studies in Africa have documented the fact that most cases of rheumatic carditis present at the advanced stages of the disease and in chronic heart failure, leading to increased mortality.[19,20] The late presentation has been attributed to the problems of poverty, ignorance, lack of easy access to medical care, and poor cultural beliefs and practices. The increased mortality seen in the age groups highlighted may therefore also be a function of the underlying causes and the conditions responsible for heart failure in these age groups.

Mortality amongst patients with severe anaemia was 14% in the study. Mortality/survival in patients with anaemic heart failure depends mainly on the prompt availability of donor blood for transfusion. A previous study at the same centre recorded a mortality rate of 25% amongst patients with anaemic heart failure and one-third of the cases that died succumbed to the illness. The improved survival in this study can thus be partly attributed to the prompt availability of donor blood for transfusion as all the patients with anaemic heart failure received blood within the first two hours of admission.

The mean duration of heart failure was longest in patients with congenital heart defects, rheumatic heart disease and renal disorders. Even though, a relatively lower mortality (16%) was recorded amongst the patients with congenital heart disease, the mean duration of heart failure was longer in these patients. All of them remained dependent on the use of anti-failure medications – oral diuretics with or without digoxin. Congenital heart disease was thus associated with prolonged morbidity in the affected children. Early surgical intervention has been shown to reduce morbidity and mortality in infants with congenital heart disease.[12,21]

Heart failure in Nigerian children though mostly due to preventable causes, are associated with an unacceptably high mortality. Poor prognostic indices include heart failure in infancy and the older age group, presence of underlying acute respiratory infections, rheumatic heart disease and renal disorders.

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