Idiopathic Dilated Cardiomyopathy in Children: A Single Medical Center's Experience

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Background: The prognosis of patients with idiopathic dilated cardiomyopathy (DCM) is poor. Most patients die while waiting for cardiac transplantation because of the small number of donors in Taiwan. The purpose of this study was to review our experience with pediatric patients diagnosed with idiopathic DCM and attempt to discover prognostic factors.

Methods: Eighteen patients with idiopathic DCM presenting between 1990 and 2004 were identified. They were classified into 2 groups according to outcome: group 1 comprised 13 patients who died; group 2 comprised 5 who survived. Clinical findings and laboratory investigations were compared between the 2 groups.

Results: The age at initial diagnosis for the 18 patients (11 males, 7 females) ranged from fetus to 13 years (median, 3 months). The follow-up period ranged from 12 days to 44 months (median, 7 months) in group 1, and from 1 to 48 months (median, 39 months) in group 2. Of the 18 patients, 13 (72%) died: 11 died from severe heart failure while waiting for cardiac transplantation. The cumulative survival rate was 50% at 1 year and 28% at 4 years. The presence of arrhythmia and low left ventricular ejection fraction were predictive of a poor outcome.

Conclusion: The diagnosis of idiopathic DCM in children is associated with a generally poor prognosis. The lack of available donors results in significant mortality for pediatric patients awaiting transplantation. Advocating organ donation to increase the size of the organ donor pool is needed to significantly reduce the mortality rate in such patients. [*J Chin Med Assoc* 2005;68(8):368–372]

Key Words: arrhythmia, heart transplantation, idiopathic dilated cardiomyopathy

Introduction

Idiopathic dilated cardiomyopathy (DCM) is characterized by a dilated and poorly contracting heart and is of ill-defined cause.[1,2] The prognosis for patients with idiopathic DCM is poor.[2–6] There is still no effective medical therapy, and some patients progress rapidly to death. Cardiac transplantation has become a more successful treatment for idiopathic DCM in children than conventional treatment.[7] However, most patients die while waiting for cardiac transplantation because there are few donors in Taiwan. The purpose of this study was to review our experience with pediatric patients diagnosed with idiopathic DCM and attempt to discover prognostic factors.

Methods

Study population

The records of pediatric patients diagnosed with idiopathic DCM at Kaohsiung Veterans General Hospital between October 1990 and July 2004 were reviewed. Patients with endocardial fibroelastosis, congenital heart defects, chronic arrhythmia, valvular heart disease, coronary artery disease, acute myocarditis,

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and heart disease as a result of renal, endocrine, metabolic or collagen vascular disorders, were excluded from the study. Eighteen patients met our criteria for a diagnosis of idiopathic DCM and were classified into 2 groups according to outcome: group 1 comprised 13 patients who died; group 2 comprised 5 patients who survived. Age at diagnosis, symptoms, treatment, and clinical course were assessed. Laboratory studies included chest radiographs, electrocardiograms (ECGs), Holter monitor findings, echocardiograms, cardiac catheterization, and endomyocardial biopsy data. Patients were included in the arrhythmia category if they had documented arrhythmia (supraventricular tachycardia, ventricular tachycardia) or extrasystoles > 30/hour detected by 12-lead ECG or Holter monitoring.

Statistical analysis

Data were expressed as mean ± standard deviation, or as median (range). Cumulative survival was determined by life-table methods. Differences in continuous variables were analyzed by unpaired Student's *t* test. Differences in categoric variables were evaluated by Fisher's exact test. A *p* value of less than 0.05 was considered statistically significant.

Results

The age at initial diagnosis for the 18 patients (11 males, 7 females) ranged from fetus to 13 years (median, 3 months). The follow-up period ranged from 12 days to 44 months (10.1 ± 13.3 months; median, 7 months) in group 1, and from 1 to 48 months (26.8 ± 19.1; median, 39 months) in group 2. Thirteen of the 18 patients (72.2%) initially presented with clinical features of congestive heart failure. Eight patients (44.4%) had a history of a viral syndrome within 8 weeks before presentation. Palpitation occurred in 2 patients (11.1%) and syncope was reported in 1 (5.6%); none had a family history of death from DCM.

At initial diagnosis, chest X-ray showed cardiac enlargement. The mean cardiothoracic ratio was 64.2 ± 7.6%, and mean echocardiographic left ventricular ejection fraction (LVEF) was 24.3 ± 5.3%. On follow-up, chest X-ray and echocardiography showed that 15 patients (13 in group 1; 2 in group 2) had no documented improvement, whereas 3 patients in group 2 had documented improvement. LVEF was 21.5 ± 7.4% after a mean of 9 months of follow-up in group 1, and 30.4 ± 7.6% after a mean of 24 months of follow-up in group 2.

ECGs were available for all patients. They demonstrated left ventricular hypertrophy and ST or T changes in 16 patients (88.9%), left axis deviation in 4 (22.2%), intraventricular conduction delay in 5 (27.8%), and premature ventricular complexes in 3 (16.7%). Holter monitoring was performed in 15 patients (83.3%) at presentation, and again at follow-up in 12 (66.7%). In group 1, arrhythmias were found during illness in 10 (76.9%) patients: atrial flutter/fibrillation (n = 2); supraventricular tachycardia (2); frequent premature atrial complexes (1); nonsustained ventricular tachycardia (< 30 seconds; 1); ventricular couplet (2); and frequent premature ventricular complexes (2). In group 2, an arrhythmia was noted in only 1 patient, who had frequent premature ventricular complexes.

Cardiac catheterization was performed in 10 of the 13 patients in group 1, and in all 5 patients in group 2. In 15 cases, catheterization was not done at diagnosis but after a period of medical treatment, a median of 10 days after diagnosis. No patient had evidence of anomalous coronary arteries. Left ventriculography demonstrated global ventricular dilation and decreased wall motion in all 15 patients. Mild to moderate mitral regurgitation was found in 7 patients. Hemodynamic data for group 1 patients revealed a mean pulmonary artery pressure (PAP) of 26.5 ± 8.8 mmHg, pulmonary capillary wedge pressure (PCWP) of 21.1 ± 5.7 mmHg, left ventricular end diastolic pressure (LVEDP) of 19.2 ± 6.9 mmHg, and cardiac index of 2.4 ± 0.5 L/min/m^2. In group 2, patients had a mean PAP of 29.4 ± 15.6 mmHg, PCWP of 19.3 ± 10.1 mmHg, LVEDP of 18.1 ± 9.3 mmHg, and cardiac index of 2.8 ± 0.8 L/min/m^2. Right ventricular biopsy in 5 patients (3 in group 1; 2 in group 2) demonstrated various degrees of myocardial fibrosis without active inflammation (Figure 1).

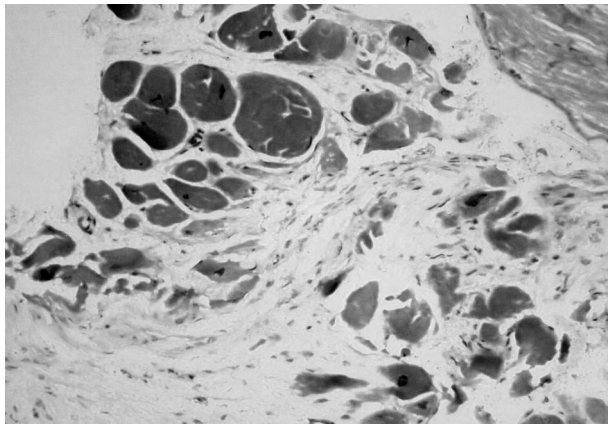

Figure 1. Cardiac biopsy in a 12-year-old male patient showing cardiac fibrosis (hematoxylin & eosin, original magnification × 20).

Medical therapy included diuretics, vasodilators, beta-blockers, anticoagulants, antiarrhythmic agents, digitalis, and inotropic agents. Eleven patients died from severe heart failure while waiting for cardiac transplantation. One 14-year-old patient underwent successful cardiac transplantation, but died suddenly 2 years later. Partial left ventriculectomy was used as a treatment in a 9-month-old patient, but failed. Of 5 survivors, 3 showed improvement in cardiac status while 2 deteriorated and required cardiac transplantation. In total, 13 patients died, 9 of whom died within 1 year of the initial diagnosis. The cumulative survival rate was 50% at 1 year and 28% at 4 years (Figure 2).

Table 1 shows the results of the between-group statistical analysis. Gender, age at initial diagnosis, mean PAP, PCWP, LVEDP, and cardiac index were not predictive of a poor outcome, but the presence of arrhythmia and low LVEF were.

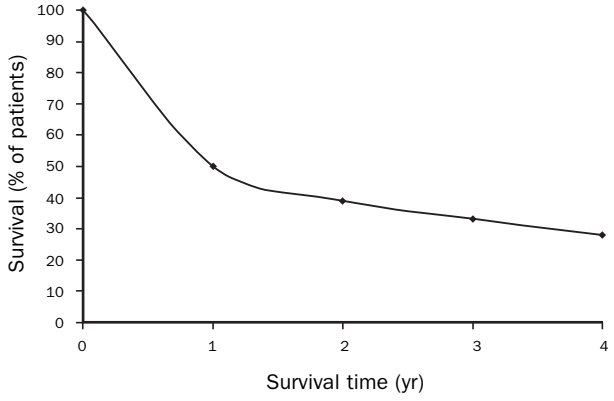

Figure 2. Survival curve in 18 patients with idiopathic dilated cardiomyopathy. The highest mortality occurs within 1 year of initial diagnosis, with a gradual decline in the cumulative survival rate over the next 3 years.

Discussion

Outcomes for pediatric patients with idiopathic DCM have varied greatly in previous reports because of different patient populations and various treatment programs.[4–6,8–10] In this study, clinical diagnoses were confirmed by echocardiography, cardiac catheterization data or biopsy. Careful definition of the study group focused on patients with idiopathic DCM and excluded those with myocarditis or endocardial fibroelastosis. Our data showed that half of the patients died within 1 year of the initial diagnosis. This survival rate was lower than that in the setting of endocardial fibroelastosis,[11] but was similar to those in previous studies that focused on pediatric patients with idiopathic DCM.[4–6]

Factors predicting patient outcome have been analyzed in many previous studies, and include family history,[4,9,12,13] cardiothoracic ratio,[3,4,6] age at onset,[3,4] presence of arrhythmia,[3,10,14,15] cardiac index[3,11] and left ventricular shortening or ejection fractions.[6,9,11] Arrhythmia and low LVEF were significant predictors of early death in this series. However, hemodynamic data were not measured before therapeutic intervention, and it is likely that the administration of inotropic agents and vasodilators would have substantially changed these data. Lastly, regarding the relatively small number of patients, we would require more data to make further conclusions about the clinical value of these potential predictive factors.

The presence of significant atrial or ventricular arrhythmias may be related to death.[4,5,10] Griffin et al[4] reported that 71% of their patients who died had known complex atrial or ventricular arrhythmias or both. The high mortality rate in their patients may have been due to the development of arrhythmias. Our finding that 76.9% of patients who died had a documented arrhythmia is compatible with these

Table 1. Comparison of prognostic factors in children with idiopathic dilated cardiomyopathy

	Group 1 (mortality)	Group 2 (survival)	*p*
Male/female (*n*)	8/5	3/2	NS
Age at diagnosis (mo)	33.7 ± 56.3	18.2 ± 25.2	NS
Follow-up period (mo)	10.1 ± 13.3	26.8 ± 19.1	< 0.05
Arrhythmias (*n*)	10/13	1/5	< 0.05
LVEF (%)	21.5 ± 7.4	30.4 ± 7.6	< 0.05
Mean PAP (mmHg)	26.5 ± 8.8	29.4 ± 15.6	NS
PCWP (mmHg)	21.1 ± 5.7	19.3 ± 10.1	NS
LVEDP (mmHg)	19.2 ± 6.9	18.1 ± 9.3	NS
Cardiac index (L/min/m^2)	2.4 ± 0.5	2.8 ± 0.8	NS

Data shown are mean ± standard deviation (except for gender distribution and arrhythmias). LVEDP = left ventricular end diastolic pressure; LVEF = left ventricular ejection fraction; NS = not statistically significant; PAP = pulmonary artery pressure; PCWP = pulmonary capillary wedge pressure.

observations. Thus, attempts to control arrhythmias with conventional and newer antiarrhythmic agents are justified. The appearance of symptomatic arrhythmias may be a clinical marker of deteriorating myocardial function, and may therefore be useful in selecting patients who might benefit from cardiac transplantation. Holter monitoring is recommended in all patients with idiopathic DCM.

There is no medical treatment that significantly improves the natural course of idiopathic DCM. However, intensive afterload reduction,[16,17] beta-blockade,[18,19] carnitine,[20] coenzyme Q10,[21,22] and intermittent dobutamine and primacor[23,24] may lead to symptomatic control. Appropriate treatment to improve left ventricular function and control arrhythmias may benefit such patients while they await cardiac transplantation as it offers the hope of prolonged survival. Currently, the survival of patients who have undergone transplantation is almost 90% at 1 year and 75% at 5 years postoperatively.[25]

Several limitations need to be specified in this study. Firstly, this was a retrospective study of patients seen over a period of more than 10 years. Secondly, various treatment programs were used, and Holter monitoring and cardiac catheterization were not performed in all patients. Thirdly, the patient population was small and from a tertiary referral center, thus resulting in possible bias towards children with the worst degrees of idiopathic DCM.

The diagnosis of idiopathic DCM in children is associated with a generally poor prognosis. When medical therapy fails, heart transplantation is effective and can provide good medium-term survival. However, the likelihood of cardiac transplantation is limited because of the small number of donors in Taiwan. Such a lack of available donors results in significant mortality among pediatric patients awaiting transplantation. Advocating organ donation to increase the size of the organ donor pool is needed to significantly reduce the mortality rate in such patients.

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