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Prevalence of End Stage Cardiomyopathies in the cardiac intensive care unit and outcome of treatment

A THESIS SUBMITTED
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Abstract

This is descriptive study aims to determine prevalence and outcome of patients with end stage cardiomyopathies in the pediatric cardiac intensive care unit subjected to various inotropic support therapies in Cairo University Specialized Children Hospital over six months from 1/6/2010 to 31/12/2010.

During the duration of the study there was 20 cases admitted to PCICU diagnosed as dilated cardiomyopathy one of them non compaction type from 122 cases who were admitted in the same period with cardiac problems with prevalence 16.3% during 6 month of study. While only one case admitted diagnosed as hypertrophic cardiomyopathy with prevalence less than 1%. There were no cases admitted of restrictive cardiomyopathy.

DCM patients' outcome in our study showed that left ventricular end diastolic diameter, severity of mitral regurge and duration of stay in PCICU to be significant in prediction of outcome of cases while age, sex, fractional shortening, mural thrombus, electrolyte disturbance, different inotropic support and arrhythmias did not predict or affect the outcome of cases.

SO we recommend that more elaborated studies should be conducted on a larger number of cardiomyopathic patients to establish the true significance factors that can be used as predictorsof outcome of management of these cases of cardiomyopathy.

Keyword: cardiomyopathies , dilated , hypertrophic , restrictive , non compaction

CONTENTS

LIST OF ABBREVIATIONS

ACE	Angiotensin Converting Enzymes
AHA:	American Heart Association
ARVC	Arrhythmogenic Right Ventricular Cardiomyopathy
cAMP	cyclic Adenosine Monophosphate
CHF:	Congestive Heart Failure
DCM	Dilated Cardiomyopathy
ESC	European Society of Cardiology
HCM	Hypertrophic Cardiomyopathy
HOCM	hypertrophic Obstructive Cardiomyopathy
LV	Left Ventricle
LVOT	Left Ventricle Outlet Tract
LVEDD	Left Ventricle End Diastolic Diameter
LVNC	Left Ventricle Non Compaction
MHC	Major Histocompatibility Complex
MRI	Magnetic Resonance Image
NCCM	Noncompaction Cardiomyopathy
PCR	Polymerase Chain Reaction
PCNA	Proliferating Cell Nuclear Antigen
RCM	Restrictive Cardiomyopathy
RV	Right Ventricle
SPECT	Single Photon Emission Computed Tomography
SVT	Supraventricular Tachycardia
TNF-a	Tumor Necrotic Factor alpha
VT	Ventricular Tachycardia

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Introduction

Cardiomyopathies are conditions in which the normal muscular function of the myocardium has been altered by specific or multiple etiologies, with varying degrees of physiologic compensation for that malfunction. The degree and time course of malfunction are variable and do not always coincide with a linear expression of symptoms. Persons with cardiomyopathy may have asymptomatic left ventricular systolic dysfunction, left ventricular diastolic dysfunction, or both and can be classified into dilated, hypertrophic or restrictive cardiomyopathy ***(Maron et al., 2006).***

Dilated cardiomyopathy (DCM) is the most common type of cardiac muscle disease in children. Idiopathic DCM refers to congestive heart failure secondary to dilatation and systolic dysfunction with or without diastolic dysfunction of the ventricles (predominantly left) in the absence of congenital, valvular, or coronary artery disease or any systemic disease known to cause myocardial dysfunction. Injury to the myocardial cell is the initiating factor that leads to cell death. If considerable cell loss occurs, the myocardium fails to generate enough contractile force to produce adequate cardiac output. Three major factors have been implicated in the pathogenesis of myocardial damage in DCM; preceding viral myocarditis, autoimmunity, and underlying genetic predisposition. The exact mechanism of myocardial damage also remains unclear ***(Blauwet and Cooper, 2010).***

Management of DCM includes performing general supportive measures in patients during acute stage including endotracheal intubation and mechanical ventilation, vasoactive infusions, fluid/acid-base

management, treating chest infections and anemia. Oxygen inhalation is of benefit in presence of pneumonia or pulmonary oedema. Carnitine supplement and coenzyme Q10 have also been used in treatment of DCM ***(Senes et al., 2008).***

Cardiac transplantation is currently the optimal treatment for DCM-induced resistant chronic congestive heart failure in children ***(Sugiyama et al., 2009).*** Stem cells, particularly cardiac stem cells, and cardiac progenitor cells may represent promising types of cellular therapy to replace dead myocardial cells, but the technology is presently a research topic rather than a clinical option***(Kaushal et al ., 2009).***

Hypertrophic cardiomyopathy (HCM) is a primary cardiac disorder that results from known or suspected genetic defects in sarcomeric proteins of the cardiac myocyte. The disorder is thought to be inherited in an autosomal dominant fashion with variable penetrance and variable expressivity ***(Epstein et al., 2008).***

HCM has a complex set of symptoms and potentially devastating consequences for patients and their families. The clinical presentation and course widely varies; some children are completely asymptomatic, whereas others experience sudden cardiac death. In fact, among adolescent children, HCM is the leading cause of sudden cardiac death during exertion. Management of pediatric HCM patients involves long-term care and close observation (especially during puberty), medical or surgical treatment for symptoms, identification and treatment of those at risk for sudden death, and screening of other at-risk family members **(Colan et al ., 2007).**

Medical management of HCM in children should focus on ruling out secondary causes, following for progression of disease and

identifying those with obstruction, controlling symptoms and restricting activity (with avoidance of volume depletion), identifying those at risk for sudden cardiac death, and screening of family members. Medical and surgical therapies are used to reduce ventricular contractility or to increase ventricular compliance and outflow tract dimensions, and, in obstructive HCM, to reduce the pressure gradient across the left ventricular (LV) outflow tract. Patients with symptoms or evidence of outflow tract obstruction are generally started on a calcium channel or beta blocker therapy while surgical treatment includes left ventricular myomectomy, pace- maker implantation, catheter septal ablation and implantable cardioverter defibrillator ***(Sorajja et al., 2008***).

Restrictive cardiomyopathy (RCM) is a rare disorder in children that is characterized by restrictive filling and reduced diastolic volume of one or both ventricles with normal or near-normal systolic function and wall thickness ***(Goldfarb et al., 1998).*** Some investigators have divided restrictive cardiomyopathy into: pure restrictive form, hypertrophic-restrictive form, and mildly dilated restrictive form ***(Angelini et al., 1997).***

Most cases of RCM (including idiopathic) are not known to be inherited. However, some inherited infiltrative disorders can cause restrictive cardiomyopathy. These include Fabry disease (X-linked recessive), Gaucher disease (autosomal recessive), glycogen storage diseases, and autosomal recessive hemochromatosis. Significant progress has been made in defining the genetic causes of restrictive cardiomyopathy. These causes include mutations in the following genes: troponin I, troponin T, alpha-cardiac actin, myosin, and desmin ***(Pruszczyk et al., 2007).***

Therapy for idiopathic RCM is limited to symptomatic treatment and is often ineffective in improving outcome. Diuretics may reduce pulmonary or systemic venous congestion; however, some patients may require high ventricular filling pressures to maintain cardiac output and may actually feel worse after diuresis. Digoxin has not been shown to be beneficial with normal systolic function and should be used with caution. Anticoagulation should be considered because of significant risk of thromboembolic complications. Surgical options are limited to heart transplantation ***(Bograd et al., 2008).***

Aim of the work

The present study aims to determine prevalence and outcome of patients with end stage cardiomyopathies in the pediatric cardiac intensive care unit subjected to various inotropic support therapies in Cairo University Specialized Children Hospital over six months from 1/6/2010 to 31/12/2010.

Cardiomyopathies

Cardiomyopathies are conditions in which the normal muscular function of the myocardium has been altered by specific or multiple etiologies, with varying degrees of physiologic compensation for that malfunction. The degree and time course of malfunction are variable and do not always coincide with a linear expression of symptoms. Persons with cardiomyopathy may have a symptomatic left ventricular systolic dysfunction, left ventricular diastolic dysfunction, or both and can be classified into dilated, hypertrophic or restrictive cardiomyopathy ***(Maron et al., 2006).***

Cardiomyopathies are considered "a heterogeneous group of diseases of the myocardium associated with mechanical and/or electrical dysfunction that usually (but not invariably) exhibit inappropriate ventricular hypertrophy or dilatation and are due to a variety of causes that frequently are genetic ***(Maron et al., 2006).***

Cardiomyopathy is defined as "disease of the myocardium associated with cardiac (systolic and/or diastolic) dysfunction" ***(Richardson et al., 1996).***

The World Health Organization/International Society and Federation of Cardiology Task Force recommended that cardiomyopathies be classified by the dominant pathophysiologic mechanism or etiologic/pathogenic factor, thus the following classification: 1) dilated cardiomyopathy, 2) hypertrophic cardiomyopathy, 3) restrictive cardiomyopathy, and 4) arrhythmogenic right ventricular (RV) dysplasia or cardiomyopathy. Noncompaction of

the ventricular myocardium or left ventricular (LV) hypertrabeculation is another form of cardiomyopathy; it has been described recently and has not yet been classified as a distinct entity by the World Health Organization ***(*Alvarez *et al., 2007)***.

Cardiomyopathies are generally considered as primary (disease solely or predominantly confined to heart muscle) or secondary showing pathological myocardial involvement secondary to a systemic or multiorgan disease process. Both forms are commonly seen in children, although primary forms predominate. Cardiomyopathies and myocarditis are significant contributors to end-stage heart failure in children, accounting for over 50% of all pediatric heart transplants ***(Canter and Naftel, 2007).***

End stage cardiomyopathy may be considered when extremely poor ventricular function ,poor response to medical anticongestive therapy, multiple hospitalization for heart failure , arrhythmia , progressive deterioration in renal or hepatic function , early stage of pulmonary vascular disease or poor nutritional status***(Canter and Naftel, 2007).***

Pediatric cardiomyopathies have a reported incidence of 1.13–1.24 cases per 100,000 populations in two recent large population-based studies ***(Lipshultz et al., 2003).***

The true incidence of pediatric myocarditis is unknown. Many cases may be unrecognized and go on to experience clinical recovery. Some may be misdiagnosed as SIDS ***(Rasten et al., 2000)***. Others may present years later as chronic dilated cardiomyopathy with viral genome demonstrated in the myocardium but in the absence of active inflammation ***(Fujioka et al., 2004).***