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Particular Aspects in Pediatric Congestive Heart Failure

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Congestive heart failure (CHF) assumes high material costs and a significant death rate. In the U.S., CHF is a major public health problem, with more than 900.000 hospitalizations per year and more than 250.000 deaths annually. Most CHF cases occur in adults, so that the statistics presented, primarily interested in the adult population. In children, the scope of the problem is less well defined. Data from the American Registry of pediatric cardiomyopathy suggest an annual incidence of 1.13 per 100.000 children cardiomyopathy, most developing CHF. The mortality rate at 2 years after diagnosis is 13.6 % in the forms of dilated cardiomyopathy [1].

CHF in children presents important charactersitic features from the adult congestive failure, from the physiopathological and mostly from the etiopathogenical point of view. While the congestive heart failure at adult age is due to ischemia in 60-70 % of cases, congestive heart failure at children is, in most cases, a consequence of either congenital heart diseases (CHD) which remained unoperated, undergone a palliative operation or presented postsurgery complications or of one cardiomyopathy. Chronic CHF may occur in children with biventricular circulation (systolic or diastolic dysfunction), into cardiac structural abnormalities with right ventricle as systemic ventricle and in the so-called univentricular heart.

We mark the fact that the incidence of the congenital heart diseases is of 8/1000 alive new-born children and that, in Romania, are born, annually, between 800 and 1300 children having a CHD. Out of these more then 20 % develop at least once congestive cardiac failure during their first childhood, in accordance with our information.

So far have been developed excellent guidelines for CHF diagnosis and therapy in adult patients, but the same can not be said about pediatric CHF. Given the significant differences between adults, children and adolescents with CHF, there is little reason to believe that the adult guidelines are directly applicable to children. However, many attitudes in the diagnosis and therapy of pediatric CHF are extrapolated from adult. Most of the studies concerning the paediatric CHF diagnosis and therapy are extended to adult cardiac failure although it is proven the absence of complet propinquity.

Diagnosis and prognosis issue: So far there are few criterions to clearly define the paediatric CHF, especially at small age; its assessment and prognosis evaluation. At present, the pediatric CHF diagnosis is based especially on clinical assessment, and on ultrasound functional findings. The latter, is mainly used to evaluate the left ventricular (LV) functional parameters since the diastolic disorder is difficult to assess

Clinically, the functional evaluation of CHF at children age is made accordind to the Ross classification (an adaptation of the NYHA classification for children). Ross classification allows the evaluation of the state of severity at infant and small child. It is used on daily basis by the Canadian Cardiovascular Society as the official CHF evaluation system in the case of pediatric patients and it has been assumed by numerous pediatric cardiologists, including us. It is important to emphasize that this classification system includes, also, the growth failure, as another indicator in the assessment of the child's CHF.

The echocardiographic parameters most frequently used for the global evaluation of the left ventricular systolic function are: the shortening fraction, the ejection fraction measured in TM and 2D or through Doppler examination. These indicators depend on the cardiac loading conditions and do not reflect the myocardic fibre intrinsic value.

The increasing filling pressures in the left ventricule represents the common path towards CHF, no matter its etiology. For this reason, the left ventricle diastolic function is an important step in the diagnosis and therapy assessment process. The 2D and TM findings have a low specificity and, as a result, are no loger in use. During the last years, the Doppler ultrasound examination has proved to be very useful in noninvasive evaluation of the left ventricular diastolic function and it is, in the same time, very accesible in the adult cardiology as well. Nowadays, most of the information regardind the left ventricular protodiastola is drawn from the transmitral tide and the myocardic velocity evaluation using tissuue Doppler [2,3]. The tissue Doppler is still rarely used in paediatrics and the physiological standards have not been established yet. However, the few publications on this subject consider tissue Doppler imaging as rewarding in paediatric cardiology [4,5] and , for all that, one of our research objectives is to evaluate, using tissue Doppler, the left ventricular diastolic function in children with CHF. Various biological markers have been considered, during the past few years, as possible indicators of CHF. The most important of them are the compounds derived from compensatory neurohumoural activity such as natriuretic peptides. Its blood concentration level varies in correlation with the overloading volume or pressure degree in the heart.

Natriuretic Peptides in Paediatric Practice

The plasmatic natriuretic peptides concentration is normally high during the first days of life and its values decrease then, gradually, remaining relatively constant during childhood [6].

Children having a congenital heart disease which leads to increased intracardiac volumes and pressures, also present levels of the mentioned neurohormones and these values are inverse proportional to the heart's functional capacity. Limited studies suggest that these hormones may even be markers in the paediatric cyanotic, obstructive and inflamatory diseases, as well as paediatric heart failure [10]. They could also be used in the postoperative evaluation of CHD in infants [11,12].

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Authors	Nornal values of NT-proBNP (pg/ml)
Mir et al. [7]	103,1 (0-9 years; n = 79)
Dulac et al. [8]	< 100 (5 days-11 years; n=34)
Wu et al. [9]	556,5 (2 months-2 years; n=20)
Butnariu ş.c.	148 (0-3 years; n=16)

Legend: n-number of patients

Table 1: Natriuretic peptide normal values in pediatrics.

Myocardic injury markers: In paediatrics, ischemia is not suspected at a patient with CHF, in contrast with the adult's situation. Increased cardiac troponin is a specific marker of the myocardic injury at both children and adult pacients, but, in paediatrics, it is not currently used [13]. At some children the troponin level should be determined since some of the cardiomyopathies associated with CHF and even some congenital heart diseases are accompanied by injuries of the myocytes.

Inflammatory markers: It has been proven the release of different inflammatoty markers in CHF [14,15]. Their correlation with the CHF etiology, with NYHA functional class and with the left ventricle function echocardiographic paramaters is not well studied in children.

Therapeutical Issues in the Paediatric CHF

There is a large literature addressing CHF treatment for adult patients, with a much smaller literature concerning CHF therapy in children. Excellent guidelines for adult patient have been published, but given the significant differences between adult and pediatric patient with HF, there is little reason to believe that these guidelines are directly applicable to children [16]. Most pediatric patients with CHF can be treated with a combination of three types of drugs: an inhibitor of angiotensin converting enzyme (ACEI), a loop diuretic and a antialdosteronic. The angiotensin conversion enzyme inhibitors along with the diuretics represent the first line medication. If needed, digitalics can be associated. Beta-blokers such as carvedilol are recommended in paediatric CHF which does not improve under conventional therapy with ACEI, diuretics, digitalics. For special situations, generally using other drugs or circulatory support devices. Drug therapeutic attitude should take into account the type of HF, chronic or acute and also the etiological aspects and hemodynamics [17,18].

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