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CORRELATION OF CLINICAL AND ECHO-CARDIOGRAPHIC SCORES WITH BLOOD "BRAIN NATRIURETIC PEPTIDE" IN PAEDIATRIC PATIENTS WITH HEART FAILURE
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CORRELATION OF CLINICAL AND ECHO-CARDIOGRAPHIC SCORES WITH BLOOD "BRAIN NATRIURETIC PEPTIDE" IN PAEDIATRIC PATIENTS WITH HEART FAILURE

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ABSTRACT

***Background*: Recently brain natriuretic peptide (BNP) level has been introduced as a screening test for congestive heart failure (CHF) in children. The current CHF assessment scores are not satisfactory as they use a large number of variables.**
***Objective*: To evaluate two CHF scores: a modified clinical score and an echo-cardiographic score and compare them to BNP in paediatric patients.**
***Design*: Prospective, hospital based study.**
***Setting*: Two paediatric cardiac referral centres in Khartoum from April to July 2010.**
***Subjects*: All patients one month to 18 years of age with the clinical diagnosis of CHF were included.**
***Results*: Sixty seven patients were enrolled, 39 (58%) had congenital heart disease (CHD), 27 (32%) had rheumatic heart disease (RHD), and seven (10%) had dilated cardiomyopathy (DCM).Twenty four younger children (88%) and 29 older children (85%) had a high clinical score (severe CHF). Twenty one out of 23 younger children with high echo score (91%) had a high clinical score as well (p-value 0.001). In patients with RHD (all with a high clinical score), 81 % had a high echo score. (p-value 0.001). All younger children with a high clinical score (n=24) had a high level of BNP (p-value 0.00). In older children with a high clinical score 28 out of 29 (96%) had a high BNP level (p-value 0.00). Of patients with RHD and a high echo score (21), 16 (76.2%) patients had high BNP level and five (23.8%) had low level of BNP. All patients with DCM had high echo score and all of them had high levels of BNP (100%) (p-value.0.00).**
***Conclusion*: We tested clinical and echo scores and proved their value in assessment of CHF in children. The scores correlated well with BNP level. We recommend the use of these scores as well as BNP level in clinical practice.**

INTRODUCTION

Congestive heart failure (CHF) is an important problem in the paediatric age. Historically, the diagnosis of CHF depends on clinical and chest X ray findings; however there are many limitations to these methods especially in the young infants where many diseases can simulate CHF. The current CHF assessment scores are not satisfactory as they use a large number of variables (1). Recently brain natriuretic peptide (BNP) level has been introduced as a reliable screening test for CHF in children (2). In this study we evaluated two CHF scores: a modified clinical score and an echo-cardiographic score and compared them with BNP in paediatric patients.

MATERIALS AND METHODS

The study was prospective, cross sectional, hospital based carried at two paediatric cardiac referral centres in Khartoum from April to July 2010.All patients one month to 18 years of age with the clinical diagnosis of CHF were included. Patients with major extra-cardiac diseases were excluded. Patients were divided into two age groups: younger children (one month to two years) and older children (2-18 years).History, cardio-vascular examination, echo-cardiography and blood BNP were done and a data sheet was filled.

1. A clinical score was designed that consists of the heart rate, respiratory rate, liver size and degree of growth failure in younger children (mild, moderate and severe growth failure are defined as weight for age below one, two and three standard deviations below the mean respectively) . For older children, the degree of growth failure was replaced with exercise intolerance (Table 1). According to these variables the maximum score is 12. Patients with scores more than six are considered to have severe CHF.

Table 1

Clinical score: (out of 12)
A: Age: 1-24/12

	Score		
Sign	1	2	3
Heart rate	<120	120-140	>140
Respiratory rate	<40	40-60	>60
Liver span	<4 cm	4-6 cm	>6 cm
Growth failure	Mild	Moderate	Severe

B: Age: >24/12-18 y

	Score		
Sign	1	2	3
Heart rate	<100	100-120	>120
Respiratory rate	<20	20-30	>30
Liver span	<6 cm	6-8 cm	>8 cm
Exercise Intolerance	On severe exertion	On mild exertion	At rest

2. Echo-cardiographic (echo) scores were designed according to the type of cardiac disease (Table2). The maximum score is six. A score of four or more is considered high. LV(d) scores were derived from those published by Lipshultz *et al* (3)

Table 2
Echo-cardiographic Scores: (out of 6)
2-A: Valvular Heart Disease echo score

	Score	
Echo finding	1	2
Valve lesion echo severity	Moderate	Severe
Pulmonary hypertension (% of pulmonary to systemic blood pressure)	50- 75%	>75%
LV (d) Z score	1-3	>3

2-B: CHD Echo score

	Score	
Echo finding	1	2
Size of the defect (VSD/PDA)	3 mm or less	>3 mm
Doppler gradient (mmHg)	40-60	<40
LV (d) Z score	1-3	>3

C: DCM Echo score

	Score	
Echo finding	2	3
Ejection fraction (%)	30-55	<30
LV (d) Z score	1-3	>3

I. For congenital heart disease (CHD) the score consists of:
   i. The size of the defect.
   ii. Doppler gradient across the defect.
   iii. The left ventricle diastolic dimension (LVd) Z-score.

   Complex congenital heart disease and complete atrio-ventricular septal defect (AVSD) are considered to have a high score. Partial AVSD is evaluated according to the valve regurgitation (Table 2-B)

II. For valvular heart disease the score consists of:
   i. The echo severity of the valvular lesion.
   ii. Pulmonary hypertension (PHTN).
   iii. LV(d) Z-score

   Combined moderate lesions are given a high score.

III. For dilated cardiomyopathy (DCM) the score consists of:
   i. Ejection fraction (EF)
   ii. LV (d) Z-score

3. Blood level of BNP was done for all patients. A qualitative method was used where a level above 200 nanogram/ml is considered significant.

RESULTS

The study included 67 children, 33 of them (49%) were in the age group one month to two years (younger children), while 34 (51%) were older than two years (older children).

Diagnosis: Of 67 patients, 39 (58%) had CHD. The most common lesion was ventricular septal defect (VSD) (56%). Twenty one patients (32%) had rheumatic heart disease (RHD), the most common lesion was combined mitral and aortic regurgitation (47%). DCM was diagnosed in seven patients (10%).

Clinical and echo scores: Twenty four younger children (88%) and 29 older children (85%) have a high clinical score (severe CHF). Of the 39 patients with CHD, 29 had a high echo score, while all the patients with RHD and DCM had a high echo score. Twenty one out of 23 younger children with high echo score (91%) had a high clinical score as well (p-value 0.001) (Table 3) In patients with RHD (all with a high clinical score), 81 % had a high echo score (p-value 0.001).

Table 3
The correlation of clinical score with echocardiographic score in younger children with CHD

	Clinical score		
Echo score	High (%)	Low (%)	Total (%)
High	21 (65.6)	2 (6.2)	23 (71.9)
Low	2 (6.3)	7 (21.9)	9 (28.1)
Total	23 (71.9)	9 (28.1)	32 (100.0)

Correlation between BNP level with clinical and echo scores: All younger children with a high clinical score (n=24) had a high level of BNP (p-value 0.00) (Table 4). In older children with a high clinical score 28 out of 29 (96%) had a high BNP level (p-value 0.00). Of the 29 patients with CHD and a high echo score, 27 (93%) had a high level of BNP, while in the ten patients who had a low echo-score, two had high level of BNP and eight had low level of BNP, p-value 0.00 (Table 5). Of patients with RHD and a high echo score (21), 16 (76.2%) patients had high BNP level and five (23.8%) had low level of BNP. All patients with DCM in this study had high echo-cardiographic score and all of them had high levels of BNP (100%) P-value 0.00.

Table 4
The correlation of clinical score and BNP level in younger children

		BNP		
		Positive (%)	negative (%)	Total (%)
Clinical score	High	24 (72.2)	0 (0)	24 (72.7)
	Low	0 (0)	9 (27.3)	9 (27.3)
	Total	24 (72.7)	9 (27.3)	33 (100.0)

Table 5
The correlation of CHD echo score and BNP level

		BNP level		
		Positive (%)	Negative (%)	Total (%)
CHD-echo score	High	21 (69.2)	2 (5.1)	29 (74.4)
	Low	2 (5.1)	8 (20.5)	10 (25.6)
	Total	29 (74.4)	10 (25.6)	39 (100.0)

DISCUSSION

BNP is now coming up as a routine screening test for CHF in paediatric and adult patients as the evidence from the current literature is rapidly accumulating (4,5). The diagnosis of CHF can be challenging especially in young children where common problems like pneumonia and bronchiolitis can have similar clinical pictures. Therefore, BNP can have a valuable role in the acute care setting (6). Grading the severity of CHF is important for clinical as well as research purposes. The previous clinical scores used in infants like Ross score included up to ten variables, therefore they were not frequently used in clinical practice. Research in the field of paediatric CHF is often limited because of the lack of reliable and practical CHF score. In this study we used a simplified score which proved to have a good correlation with the BNP level. We also tested an echo score which, to our knowledge, has not been previously used. This echo score proved to have a good correlation with clinical scores as well as BNP level. This finding supports the validity of the proposed clinical and echo scores especially in young children. This correlation was not found in older patients with CHD, most likely because in this age group the severity of the clinical signs decreased due to the development of pulmonary vascular obstructive disease (Eisenmenger's syndrome), however, the value of this test in older children is less than in infants as clinical diagnosis is usually reliable.

There was a strong correlation between clinical and echo-cardiographic severity of patients with RHD with BNP level in our patients which was also found by Ribeiro *et al*.(7).

In conclusion we tested clinical and echo scores and validated their value in evaluation of CHF in children. The scores correlated well with BNP level. We recommend the use of these scores as well as BNP level in clinical practice.

Limitations: the BNP level was done using qualitative rather than quantitative methods therefore the actual levels in patients with different scores could not be assessed.

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