Reseach the Value of the Type B Diuretic Peptide (Nt-Probnp) In the Assessment of Heart Failure in Children

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Abstract: *Heart failure is a disease which causes many serious complications, even death, without early diagnosis and on-time treatment. Quantitative serum NT-proBNP is a valuable tool in the diagnosis of heart failure in children. Objective: To study the value of the type B diuretic peptide (NT-proBNP) in diagnosis of heart failure in children.*

Study method: *A prospective case-control study was carried out. Study patients: 80 children were diagnosed with heart failure and they were also classified into different degrees of heart failure according to modified Ross Heart Failure Classification. The control group had 80 patients without cardiovascular disease. Quantitative serum NT-proBNP concentrations and cardiac ultrasound data were analyzed and compared between the treatment group and the control group.*

Results: *NT-proBNP concentration in a disease group (HF) was 1125.26 ± 1823.40 pg/ml. The concentration level in the control group was 26.74 ± 38.79 pg / ml. The difference between the two groups is statistically significant (p <0.01). NT-proBNP concentration increases with the severity of heart failure and changes in cardiac function.*

Conclusion: *NT-proBNP is valuable in the diagnosis of heart failure in children.*

Keyword: *NT-ProBNP, heart failure, children*

I. Introduction

Heart failure is a common disease in children which causes many serious complications, even death, without early diagnosis and on-time treatment. Diagnosis of heart failure relies on clinical symptoms in children but clinical signs are often difficult to diagnose. Sub-clinical methods of diagnos such as ECG, CXR and echocardiography are of no specific value in the diagnosis of heart failure. Currently, NT-proBNP quantitative serum has been widely adopted and is useful in diagnosing heart failure in countries around the world. However, so far this method has not been applied in the diagnosis of heart failure in children in Vietnam. To contribute to the early diagnosis of heart failure in children we proceed with the targeted theme: *"Research diuretic value type B peptide (NT-proBNP) serum in the diagnosis of heart failure in children".*

## II. Patients And Methods:

Patients :

A treatment group of 80 pediatric patients with heart failure are diagnosed and classified according to the modified Ross Heart Failure Classification, and a control group of 80 children without cardiovascular disease of the same age and sex as the sick children at the National Children's Hospital from April 2014 to July 2015. Quantitative NT-proBNP serum concentrations and echocardiographic parameters of the group were assessed and compared to controls.

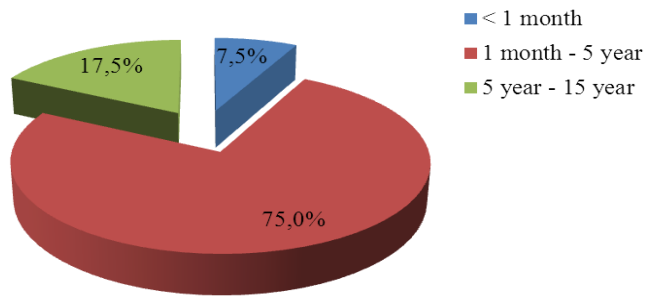**2. Study method:** A prospective case-control study was carried out.

III. Result

General characteristics of the study group
Sex:
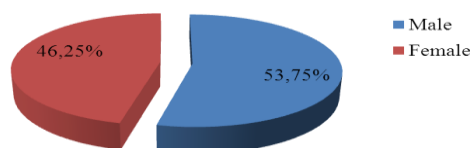
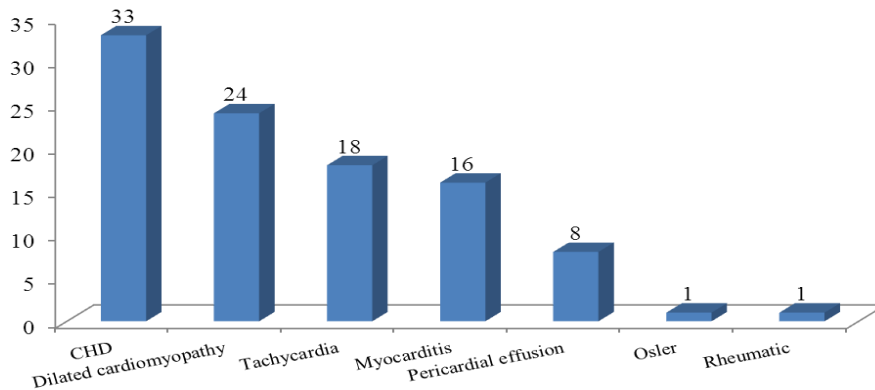**Graph 1. Distribution of patients by sex**

Age:

Graph 2. The distribution of patients by age

Comment:
Ages disease encountered most 1 months - 5 years old. Average age: 45.32 ± 26.37 months
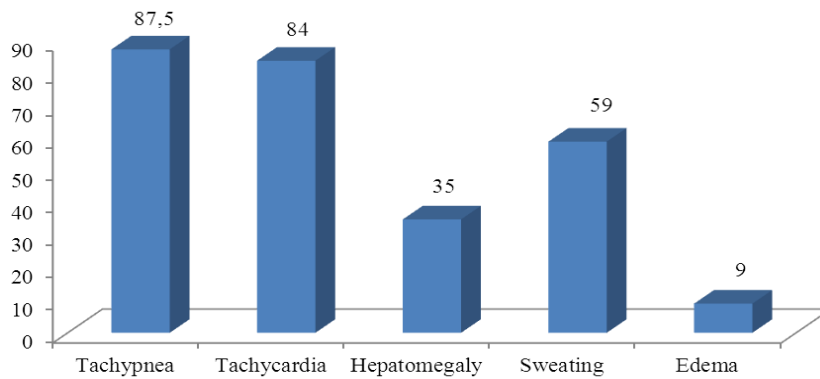
The causes of heart failure

Graph 3. The causes of heart failure

CHD: Congenital heart desease

The clinical symptoms of heart failure

Comment: Tachypnea and tachycardia are common symptoms
Graph 3. The clinical symptoms of heart failure

NT-proBNP results of serological study groups
NT-proBNP concentrations by age in the group with heart failure

Table 4.1. Comparison NT-proBNP concentrations with age

Age group	Heart failure (n =80)	
	n	$\overline{X} \pm SD$
< 1month	6	2915
>1 month – 5 year	60	1312
5years - 15 year	14	1124
p		< 0,05

Comment: NT-proBNP concentrations vary significantly between age groups and decrease with age (p<0,05).

4.2. The correlation between NT-proBNP concentrations with the degree of heart failure

Table 4.2. NT-proBNP concentration on the extent of heart failure

Heart failure	NT-proBNP concentration (n=80)	
	n	$\overline{X} \pm SD$
Ross I	10	462,91 ± 390,12
Ross II	19	968,26 ± 732,22
Ross III	29	1349,04 ±1214,36
Ross IV	22	1715,09 ± 1637,23
p		< 0,05

Comment: comparison between NT-proBNP concentrations with the degree of heart failure: p < 0,05

4.3. Comparison of echocardiographic parameters NT-proBNP and between groups and heart failure status

Table 4.3. The echocardiographic parameters of heart failure vs. no heart failure

Echocardiographic	heart failure	no heart failure	p
EF ejection fraction (%)	34,2± 2,43	43 ±4,78	<0,05
Index Dd contractile muscle fibers (%)	48,5 ± 5,61	54 ± 7,32	<0,05
Pulmonary artery pressure systolic (mmHg)	35,32 ±12,34	14,71 ±7,21	<0,05

Comment: The parameters of ultrasound difference between 2 groups, p<0,05

Table 4.4. NT-proBNP concentrations of heart failure group vs. heart failure

NT-ProBNP	Heart failure (n=80)	No heart failure (n = 80)	P
X±SD (pg/ml)	1125,26 ± 1823,40	26,74 ± 38,79	<0,001

Comment: NT-ProBNP concentrations in heart failure group higher control group

4.4. The correlation between NT-proBNP concentrations and echocardiographic parameters of heart failure group
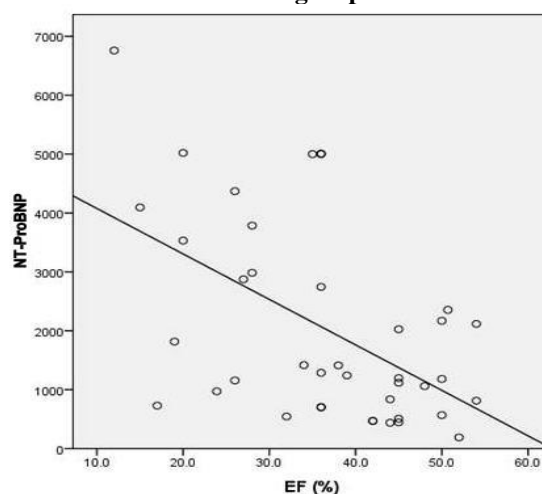
Figure 1. Dimensional inverse linear correlation between NT-proBNP levels and left ventricular ejection fraction in heart failure patients
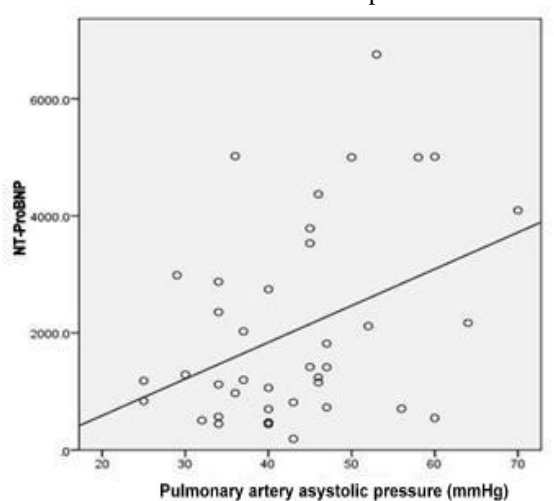

Figure 2. A positive correlation between the concentration of NT-proBNP and pulmonary artery asystolic pressure in patients with systolic heart failure

IV. Discussion

General characteristics of the study group

1.1.Age, sex:

Age: age group from 1 month to 5 years old accounted for 75% of the treatment group. This is also the age group where disease is most common in children.

Sex: males more than females, the result is equivalent to study results by BB Dass [2].

The causes of heart failure: Congenital heart diseases were majority with 32.5% rate. We encountered one case of heart Osler and low proportion of 1.25%. This also shows that today in Vietnam early diagnosis by echocardiography made Osler and rheumatic heart diseases are rare.

The clinical symptoms: The common symptoms in the treatment group is the tachypnea and tachycardia, this is the classic symptoms of heart failure. However in our study with breastfeeding sweating are symptoms accounted for 58.75% is typical. So this is an important sign for the diagnosis of
heart failure in children on breastfeeding.

NT-proBNP values in the diagnosis of heart failure in children:

Correlation between NT-proBNP parameters with age

NT-proBNP increases with age: When comparing NT-proBNP levels between age groups in heart failure group we see there is a difference between age groups. The results showed that in younger age groups NT-proBNP concentrations are higher, especially among neonates, and this concentration decreases with age. (Table 4.1)

2.2.NT-proBNP increases in heart failure group:

When comparing NT-proBNP concentrations between two groups of with and without heart failure we see this parameters in heart failure group higher 1823.40 ± 1125,26 control group was 26.74 ± 38.79 pg/ml, the difference is significant with p <0.001 (Table 4.4). This suggests that NT-proBNP levels in serum have diagnostic value in children with heart failure. This result is consistent with a study by Thang Pham and colleagues on the research parameters in heart failure in adults [1].

2.3.NT-proBNP concentrations increased in comparison to NT-proBNP plasma levels between mild to severe heart failure:

Level I: control group (without heart failure), Lavel II (mild heart failure), Level III (medium HF), level IV (severe HF), we see these parameters increases with the degree of heart failure in clinical practice and the difference between the degree of heart failure is statisticaly significant (Table 4.2). This proves that with increasing levels of heart failure, NT-proBNP concentrations are higher NT-proBNP is therefore a valid marker to assess the severity of heart failure in children. This result is consistent with the study author Sugimoto on 181 children with heart failure and 232 healthy children [5].

2.4. Changes in echocardiographic parameters in patients with heart failure:

An echocardiogram is an important method to assess cardiac function. The main parameters of ultrasound in the evaluation of cardiac function is EF (left ventricular ejection fraction), %D (left ventricular contractility index), pulmonary systolic arterial pressure. When evaluating these parameters to determine the function of the heart change in children with heart failure in the study, the results showed that the EF and %D parameters in HF

group decreased more with the heart failure group p <0.05. This proves that children with heart failure function of the heart is reduced. Besides evaluating pulmonary systolic artery pressure between the two groups, the results showed that parameters in the heart failure group were higher than the control group. It also showed the group of heart failure right ventricular function was affected even more. (Table 4.3)

2.5.NT-proBNP parameters have assessment the role of left ventricular function

When evaluating the correlation between NT-proBNP concentrations with function of the heart on an ultrasound, we examined the correlation between NT-proBNP concentrations in serum and left ventricular ejection fraction (EF) in group heart failure. Results showed that the left ventricular ejection fraction decreases NT-proBNP concentrations are higher and between 2 parameters are negatively correlated (Figure 1). This also shows that NT-proBNP indicates the parameter is valid for assessment of cardiac contractile function. This result is consistent with results from a study by YM Law when studied in children [4].

Survey correlation between NT-proBNP concentrations in serum with pulmonary systolic arterial pressure NT-proBNP we see increases with increasing levels of pulmonary systolic arterial pressure (positive correlation) (Fig 2). pulmonary artery systolic pressure indirectly through the right ventricular hemodynamic changes, NT-proBNP thus also contribute assess right ventricular function.

V. Conclusion

NT-proBNP serum parameters are valuable in the diagnosis of heart failure in children:

NT-proBNP concentration of children with heart failure is higher than children without heart failure.

NT-proBNP levels increased with the severity levels of heart failure in clinical practice.

NT-proBNP concentrations are valuable parameters evaluated the change of function of the heart

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