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BNP as Predictor of Pediatric Severe Sepsis Fluid Responsiveness in Limited Resource Setting Country

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Abstract Fluid responsiveness is an important aspect in severe sepsis management, assessed by static and dynamic parameter tools. Unfortunately, they are not widely used in limited resource setting. Brain natriuretic peptide is cardiac hormone correlated with CVP measurement as one of the static parameter, but its associations with dynamic parameter has not studied yet. **Objective:** To investigate whether BNP might predict fluid responsiveness based on clinical and inferior vena cava index criteria. **Study Design:** A cross sectional study was conducted on 59 severe sepsis subjects aged 1–14 years who met the inclusion criteria enrolled through consecutive sampling during October 2013 to March 2014. Patients were given fluid resuscitation based on 2012 Surviving Sepsis Campaign. BNP measurements were performed at 0 and 1 hour after fluid resuscitation. Responder and non-responder groups were classified based on clinical and IVC index criteria. Ultrasound using M Mode was performed to calculate IVC index. Unpaired t test and receiver operating characteristic curves were generated for BNP to predict fluid responsiveness. **Results:** Baseline characteristics between responder and non-responder groups were almost similar. Initial BNP between groups using both criteria were not significantly different ($p>0.05$). The area under curve of BNP_0 was 0.04. The best cut off values of log BNP to predict fluid responsiveness was 1.9pg/mL. BNP ≤1.9 pg/mL has a sensitivity, specificity, negative predictive value and positive predictive value of each were 50%, 50%, 50%, 50%, respectively. **Conclusion:** BNP cannot reflect and accurately predict fluid responsiveness due to multifactorial factors of raising BNP and mostly subject were spontaneous breathing which more difficult to predict.

Keywords: *BNP, severe sepsis, fluid responsiveness*

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1. Introduction

Sepsis was a leading cause of mortality in pediatric critically ill and a major health problem among children in both developing and industrialized countries. Improvement of treatment could have a substantial effect on survival and quality of life of all children, that including fluid resuscitation as the most important aspect of pediatric sepsis management. [1,2,3] Unfortunately, only 50% of critically ill patients will respond to volume expansion by significant increase of cardiac output. [4] Giving more fluid in this group might be deleterious, ineffective, and cause fluid overload. These emphasized the need for accurate determination of fluid responsiveness in pediatric severe sepsis. [5,6] Static and dynamic parameter tools are available to assess fluid responsiveness but they are not widely used in pediatric sepsis group particularly in limited resource setting.

Brain natriuretic peptide is a neurohormone released mostly from the cardiac ventricle in response to volume expansion and increased wall tension. A halflife of 20 minutes, changes in serum BNP level might rapidly reflect the effect of volume resuscitation on ventricular preload. [7] Brain natriuretic peptide is also a reliable biomarker for left ventricle dysfunction. Measurement of BNP is increasingly performed in adult patients especially as a tool in the management of heart failure for diagnosis, risk stratification, and monitoring response of therapy. [8,9] Brain natriuretic peptide level and its changes have good correlation with static parameter such as central venous pressure and global end diastolic volume index. [9] Decision to give fluid resuscitation in the presence of high plasma BNP level that suggest having cardiac dysfunction and absence of fluid responsiveness is challenging especially in physician face in daily basic in pediatric severe sepsis. [5] The study to assess cardiac dysfunction and fluid responsiveness in pediatric sepsis group was limited, even though studies in adult critical care with circulatory failure showed that sonographic evaluation of the inferior vena cava (IVC) diameter might be a good predictor of intravascular volume status. [10] Further investigation should be taken to confirm these findings especially in pediatric sepsis.

Point of care ultrasound (POCUS) to determine diameter, collapsibility index, and distensibility index of inferior vena cava (IVC) were non-invasive techniques that reflect central venous pressure as surrogate marker of adequacy of fluid resuscitation and volume status. [11] The use of