Diagnostic Performance Of Brain Natriuretic Peptide, Bioelectrical Impedance Analysis, And Left Ventricular End-Diastolic Diameter In Determination Of Fluid Overload And Mortality On Pediatric Sepsis

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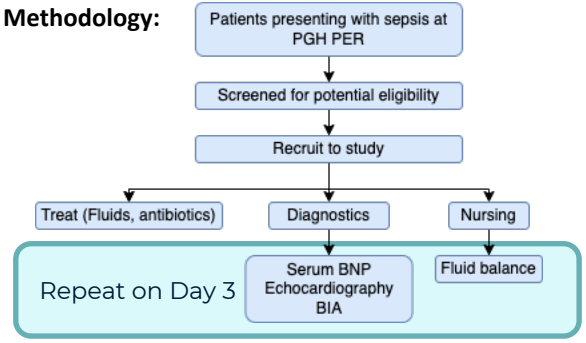
Background: Infection is one of top causes of pediatric mortality. Fluid overload may lead to increased risk of mortality in pediatric sepsis. There is a trend towards point-of-care modalities to predict outcomes.

Objective: This pilot study investigated whether serum Brain Natriuretic Peptide (BNP), Bioelectrical Impedance Analysis (BIA) components Total Body Water (TBW) and Absolute Fluid Overload (AFO), and Left Ventricular End-Diastolic Diameter (LVEDD) can be used to predict clinical outcomes and fluid overload.

Design and setting: Pilot prospective cohort observational study of pediatric patients at a government tertiary hospital.

Methodology:



Results: 22 patients were recruited in this study, 3 out of the 22 expired. Both expired and survivors had similar baseline demographic characteristics. The median Glasgow Coma Scale of the expired was significantly lower (6 vs 15, p = 0.02). All expired patients used vasopressors. The median diastolic blood pressure of expired patients was much lower (48 vs 65 mmHg, p = 0.05). There were no differences in the fluid balances between survivors and non-survivors.

Day 3 BNP was higher in non-survivors (9241 vs 682.2 pg/mL, p=0.04) and day 3 LVEDD Z-score of non-survivors was lower (-3.51 vs -0.01, p=0.023). There were no significant differences in the bioimpedance analysis between groups. Cumulative fluid balance had strong correlation to BIA and LVEDD (r = 0.65, p = 0.001; r = 0.74, p < 0.001 respectively). Admission BNP >670.34pg/mL predicted vasopressor use with a sensitivity 85.71%, specificity 86.67% while ΔBNP >5388.13pg/mL has predicted mortality with 100% sensitivity. Day 3 LVEDD <22mm could predict mortality with a sensitivity of 94.74%.

Table 1. Correlation of Cumulative Fluid balance to ΔBNP, LVEDD, TBW, and AFO.

Parameters	Correlation coefficient	P-value
ΔBNP	0.43	0.04
LVEDD on Day 3	0.65	0.001
TBW on Day 3	0.74	<0.001
AFO on Day 3	0.11	0.56

Table 2. Diagnostic Performance on Clinical Outcomes

Parameter	Sensitivity	Specificity	PPV	NPV
BNP on admission >670.34 pg/mL (AU-ROC 0.91)				
Vasopressor use	85.71%	86.67%	75%	92.86%
BNP on admission >1211.86 pg/mL (AU-ROC 0.81)				
Mech vent use	71.43%	86.67%	71.43%	86.67%
Δ BNP >5388.13 pg/mL (AU-ROC 0.95)				
Mortality	100%	94.74%	66.67%	100%
LVEDD Day 3 < 22mm (AU-ROC 0.86)				
Mortality	94.74%	50%	94.74%	50%

Conclusion: BNP is independent of fluid overload, reflecting cardiac dysfunction and fluid non-responsiveness. LVEDD and BIA are good estimates of cumulative fluid balance but not as predictors of other clinical outcomes THUS the utility of these tests is limited as a guide to fluid therapy. These results were limited due to the small sample size.

Sources:
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