THE RELATIONSHIP BETWEEN RENAL RESISTIVE INDEX AND CENTRAL VENOUS PRESSURE WITH THE INCIDENCE OF ACUTE KIDNEY INJURY IN CRITICALLY ILL PATIENTS AT RISK OF ACUTE KIDNEY INJURY IN ICU

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Background

Acute Kidney Injury (AKI) is a common and serious complication in critically ill patients, often leading to increased mortality, prolonged hospital stays, and long-term kidney damage. The incidence of AKI has been rising due to factors such as an aging population, increased comorbidities, and the use of nephrotoxic drugs or invasive procedures. Early detection and accurate prediction of AKI are crucial for timely intervention, which can potentially reduce the severity of the condition and improve patient outcomes.

Currently, there are several biomarkers used to detect AKI, such as serum creatinine and urea levels. However, these markers may not detect AKI early enough to prevent kidney damage. Recent studies have highlighted the potential of the Renal Resistive Index (RRI), measured through Doppler ultrasonography, as an early predictor of AKI. RRI reflects changes in renal blood flow, making it a valuable non-invasive tool for assessing kidney function.

Similarly, Central Venous Pressure (CVP) is commonly used in critical care settings to monitor fluid status and cardiac function, but its role in predicting AKI remains unclear. While CVP provides important insights into circulatory status, its effectiveness in diagnosing or predicting AKI is still debated.

This study aims to evaluate the relationship between RRI and CVP as potential predictors for AKI in critically ill patients, specifically in the Intensive Care Unit (ICU) of RSUP Dr. Wahidin Sudirohusodo, Makassar. Understanding how these parameters relate to AKI could enhance early detection and improve management strategies for critically ill patients.

Objective

To explore whether RRI and CVP can predict AKI in critically ill patients and to evaluate effectiveness in diagnosing AKI.

Method

This was an analytical observational study using a prospective cohort design conducted in January 2025. The study included both primary data and secondary data obtained from medical records of ICU patients. A total of 54 patients who met the inclusion criteria were enrolled, comprising 17 with AKI and 37 without AKI. The main parameters assessed were RRI and CVP, both evaluated for their potential predictive value in the early identification of AKI. In addition, serum urea and creatinine concentrations were measured as standard biochemical indicators of renal function.

Result

A strong correlation was found between RRI and AKI, with RRI values above 0.75 significantly associated with the occurrence of AKI (p < 0.001). In contrasr, CVP showed no significant correlation with AKI (p > 0.05). RRI demonstrated excellent diagnostic accuracy, with an AUC of 0.96, sensitivity of 94.1%, and specificity of 94.6%. Conversely, CVP had limited predictive value, with an AUC of 0.63 (p = 0.103). These results indicate that RRI is a more reliable marker for predicting AKI in critically ill patients.

Tabel 1. Comparison of Relative Risk Ratio and Accuracy RRI and CVP in Predicting Incidence of Acute Kidney Injury in Critically ill Patient in ICU RS Wahidin Sudirohusodo

Variable	AKI		P-value	RR	Accuracy
	Yes (n=17)	No (n=37)			
Renal Resistive Index					
RRI >0.75	16 (94.1%)	3 (8.1%)	<0.001	29,4	92,60%
RRI <0.75	1 (5.9%)	34 (91.9%)			
Central Venous Pressure					
CVP >10.5	9 (52.9%)	13 (35.1%)	0,216	1,64	61,10%
CVP <10.5	8 (47.1%)	24 (64.9%)			

Note : Values are n (%), categorial variables with Pearson Chi-square test. *p<0.05

Conclusion

The study highlights the RRI as a reliable and accurate predictor for AKI in critically ill patients. RRI values above 0.75 were strongly associated with the occurrence of AKI, demonstrating high sensitivity and specificity. In contrast, CVP showed limited predictive ability for AKI in this patient population. These findings suggest that RRI can serve as an important non-invasive tool for early detection of AKI, enabling timely interventions and improving patient outcomes in the ICU. Further studies are warranted to better understand the role of CVP in AKI prediction and its potential clinical applications.

Key words: Acute kidney injury, renal resistive index, central venous pressure, ICU.