

ABNORMALITIES IN HEPATIC VEIN FLOW PATTERNS ARE ASSOCIATED WITH DEVELOPMENT OF ACUTE KIDNEY INJURY AFTER CARDIAC SURGERY

Abstract

The contemporary definition of the diagnosis of acute kidney injury (AKI) is neither time-sensitive, nor specific. AKI is notoriously multifactorial in origin and found to occur more commonly in cardiac surgery patients when compared to non-cardiac surgery patients.

Cardiac surgery associated acute kidney injury (CSA AKI) carries substantial morbidity and mortality. Pursuits to timeously diagnose CSA AKI have, to date, not been actualized. We investigated the use of hepatic venous and right heart ultrasound parameters in predicting CSA AKI.

Methods

The study was a prospective contextual and descriptive two-center study. The sites of the study were Johannesburg, South Africa, and Aarhus, Denmark. Adult patients that satisfied inclusion criteria, between August 2019 and January 2020 were included, with a total of 152 participants. Blood tests, clinical and ultrasound data were obtained pre-operatively, day-1 and day-4 post-operatively. Hepatic vein, Inferior vena cava and right heart Doppler ultrasound parameters were obtained and analysed for abdominal venous hypertension and the development of AKI.

Results

The median (IQR) age of patients was 68 (55-73) years, predominantly male and the majority were hypertensive. Of 152 patients analysed, 54 (35 %) patients developed AKI. Among these, 37 (69 %) were classified as KDIGO stage I, 11 (20 %) in stage II, whilst 6 (11 %) were in stage III. Age [AOR 1.05, 95%CI 1.00-1.10 P=0.031], EuroSCORE II [AOR 1.43, 95%CI 1.14-1.80, P=0.005] and pre-operative serum creatinine [AOR 1.04, 95%CI 1.01-1.08, P = 0.013] were predictive of AKI. Those who developed AKI had experienced longer cardiopulmonary bypass (CPB) times (P<0.001). Pre-operatively hepatic vein S wave measurements were significantly higher in patients with AKI (P<0.05). On post-operative day-1, hepatic vein flow ratios of patient with AKI were significantly decreased, driven by low S waves and high D waves, accompanied by significantly elevated central venous

pressure (CVP) levels. CVP levels on day-1 (D1) post-operatively were predictive of AKI [AOR 1.31, 95%CI 1.11-1.55, P = 0.001].

Conclusion

Pre-operative hepatic vein S waves were higher in those who developed AKI. This phenomenon seemed to precede the decrease in D1 hepatic flow ratios driven by low S waves and high D waves. The element of venous congestion was reflected by significantly elevated CVP values which were independently associated with AKI on D1. These parameters may reflect peri-operative circumstances including prolonged CPB times, and potential fluid management aspects that can be modified peri-operatively.

Keywords: Cardiac surgery associated acute kidney injury, ultrasound, venous hypertension, venous congestion, hepatic vascular ultrasound, goal directed fluid therapy, IVC