

ABSTRAK

Latar Belakang: *Acute Kidney Injury* (AKI) merupakan komplikasi pascaoperasi bedah jantung yang penting dan paling umum terjadi. Salah satu patofisiologi AKI pascaoperasi bedah jantung adalah penggunaan mesin *Cardiopulmonary Bypass* (CPB) yang dapat menyebabkan hemolisis dan diikuti oleh pelepasan *free* Hemoglobin (fHb) ke plasma. Meskipun mekanisme dan hubungan antara kadar fHb plasma dengan kejadian AKI telah diketahui pada pasien sepsis dan pasien dengan sirkulasi ekstra-korporeal, masih belum banyak diteliti hubungan antara kadar fHb plasma dengan kejadian AKI pada pasien pascaoperasi bedah jantung.

Tujuan: Mengetahui hubungan antara kadar fHb plasma perioperatif dengan kejadian AKI pascaoperasi bedah jantung di RSUP Dr. Sardjito Yogyakarta.

Metode: Penelitian observasional rancangan kohort prospektif dilakukan di RSUP Dr. Sardjito. Variabel bebas adalah kadar fHb plasma perioperatif dan rasio fHb pasca/pa-CPB. Variabel terikat adalah kejadian AKI pascaoperasi berdasarkan kriteria KDIGO 2012. Analisis komparatif dilakukan dengan uji *Independent T-test*. Rasio fHb pasca/pa-CPB ditentukan keakuratan diagnostik dan nilai *cut-off* optimalnya dengan kurva *Receiver Operating Characteristic* (ROC) untuk menghitung *Area Under Curve* (AUC) dan sensitivitas-spesifisitas. Analisis bivariat dan multivariat dilakukan untuk mengetahui penyebab independen kejadian AKI pascaoperasi. Perbedaan dianggap bermakna secara statistik apabila nilai $p < 0,05$.

Hasil: Sebanyak 21% (10/47) subjek mengalami AKI pascaoperasi. Rerata kadar fHb plasma perioperatif lebih tinggi secara bermakna pada subjek kelompok AKI dibandingkan non-AKI pada periode CPB menit ke-60 ($p < 0,001$), 90 ($p = 0,002$), dan pasca-CPB menit ke-30 ($p = 0,003$). Rerata rasio fHb pasca/pa-CPB lebih tinggi secara bermakna ($p = 0,027$) pada subjek kelompok AKI dibandingkan non-AKI. Rasio fHb plasma memiliki AUC 0,751, $p = 0,016$ dengan *cut-off* optimal 1,86. Analisis bivariat menunjukkan rasio fHb pasca/pa-CPB $\geq 1,86$ ($p = 0,010$), riwayat hipertensi ($p = 0,032$), riwayat *diabetes mellitus* ($p = 0,025$), jenis operasi ($p = 0,043$), durasi CPB ($p = 0,004$), waktu *aortic cross clamp* ($p = 0,007$), dan rerata MAP ($p = 0,037$) adalah faktor risiko kejadian AKI pascaoperasi. Analisis multivariat menunjukkan durasi CPB ($p = 0,014$, OR=1,06) dan rerata MAP ($p = 0,007$, OR=1,45) sebagai penyebab independen kejadian AKI pascaoperasi.

Kesimpulan: Terdapat hubungan positif antara kadar fHb plasma perioperatif dengan kejadian AKI pascaoperasi bedah jantung di RSUP Dr. Sardjito Yogyakarta. Kadar fHb plasma perioperatif pada periode CPB menit ke-60, menit ke-90, pasca-CPB menit ke-30, dan rasio fHb pasca/pa-CPB lebih tinggi pada subjek kelompok AKI dibandingkan non-AKI.

Kata kunci: *acute kidney injury*; *Cardiopulmonary Bypass*; *free Hemoglobin plasma*; hemolisis; pascaoperasi bedah jantung

ABSTRACT

Background: Acute Kidney Injury (AKI) is an important and most common postoperative complication of cardiac surgery. One of the pathophysiology of AKI post-cardiac surgery is the use of Cardiopulmonary Bypass (CPB) machine which can cause hemolysis and is followed by the release of free hemoglobin (fHb) into plasma. Although the mechanism and relationship between plasma fHb levels and the incidence of AKI has been known in sepsis patients and patients with extra-corporeal circulation, the relationship between plasma fHb levels and the incidence of AKI in post-cardiac surgery patients has not yet been studied.

Objective: To determine the relationship between perioperative plasma fHb levels and the incidence of AKI post-cardiac surgery at RSUP Dr. Sardjito Yogyakarta.

Methods: A prospective cohort design observational study was conducted at RSUP Dr. Sardjito. Independent variables were perioperative plasma fHb levels and post/pre-CPB fHb ratio. The dependent variable was the incidence of postoperative AKI based on the KDIGO 2012 criteria. Comparative analysis was carried out using the Independent T-test. The post/pre-CPB fHb ratio was determined for diagnostic accuracy and optimal cut-off values using Receiver Operating Characteristic (ROC) curves to calculate Area Under Curve (AUC) and sensitivity-specificity. Bivariate and multivariate analyzes were performed to determine the independent causes of postoperative AKI. Differences were considered statistically significant if the p value <0.05.

Results: A total of 21% (10/47) of subjects experienced postoperative AKI. The mean plasma fHb level was significantly higher in AKI group compared to non-AKI at the 60th (p<0.001), 90th (p=0.002), and 30th minute post-CPB (p=0.003). The mean fHb ratio post/pre-CPB was significantly higher (p=0.027) in AKI group compared to non-AKI. The plasma fHb ratio had an AUC of 0.751, p=0.016 with an optimal cut-off of 1.86. Bivariate analysis showed post/pre-CPB fHb ratio ≥ 1.86 (p=0.010), history of hypertension (p=0.032), history of diabetes mellitus (p=0.025), type of surgery (p=0.043), duration of CPB (p= 0.004), aortic cross clamp time (p=0.007), and mean MAP (p=0.037) were risk factors for postoperative AKI. Multivariate analysis showed duration of CPB (p=0.014, OR=1.06) and mean MAP (p=0.007, OR=1.45) as independent causes of postoperative AKI.

Conclusion: There is a positive relationship between perioperative plasma fHb levels and the incidence of AKI after cardiac surgery at RSUP. Dr. Sardjito Yogyakarta. Plasma fHb levels at 60 minutes, 90 minutes, 30 minutes post-CPB, and post/pre-CPB fHb ratio were higher in AKI group compared to non-AKI.

Keywords: acute kidney injury; Cardiopulmonary Bypass; hemolysis; plasma free-hemoglobin; post-cardiac surgery