43993 - PHYSIOLOGY OF RENAL FAILURE POST CARDIAC SURGERY

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INTRODUCTION: Acute renal failure (ARF) following cardiac surgery is strongly correlated with increased morbidity and mortality. While acute tubular necrosis (ATN) may be the final pathology, we hypothesized that tubular function is preserved, at least in the early stages of ARF. **CLINICAL FEATURES:** The study was approved by the institutional Human REB. Consent was obtained from patients preoperatively or from the family postoperatively. The study was an open, prospective observational study of patients following cardiac surgery. Patients were entered into the study when they demonstrated ARF as defined by any of the RIFLE criteria [1] where (R) is risk of renal failure (increase creatinine $\times 1.5$), (I) is renal injury (increase creatinine $\times 2$ or urine output < 0.5 ml/kg/h $\times 24$ h) and (F) is renal failure (increase creatinine $\times 3$ or urine output < 0.3 ml/kg/h $\times 24$ or anuria for 6 hr). Additional study entry criteria were that ARF was not secondary to low cardiac output, hypovolemia or the presence of renal toxic drugs. Renal function indices of fractional excretion of Na and urea (FENa, FEUr), osmotic and free water clearance (Closm, ClH₂O), as well as cardiovascular and volume status (daily weight, fluid in/out balance) were followed while in the ICU. A total of 20 patients were entered into the study. Table 1 summarizes urine Na (UNa), FENa, FEUr, plasma and urine osmolality (PIosm, Uosm), Closm and ClH₂O on the postoperative day (POD) of study entry. Also shown is the POD and renal indices at the time dialysis was initiated for 6 of the 20 patients. Dialysis was needed for an average of 3.5 days in 4 of the six-dialysis patients; one patient required permanent dialysis and one patient died on dialysis.

CONCLUSION: The patients in this study demonstrate a syndrome characterized by increasing creatinine and urea, decreasing urine output but low UNa, FENa and FEUr, all suggesting preservation of tubular function. In addition, as a consequence of plasma hyperosmolality, ClH₂O was universally negative in all patients. In view of the increase in third space fluid that can occur following cardiac surgery, we hypothesize that these results may be explained by renal edema such that glomerular filtration is reduced but tubular function is preserved, at least until renal blood flow is compromised.

Reference: Critical Care 2005; 8;R204-R212

Table 1. Summary of renal indices for patients at study entry, and for the 6 patients that subsequently required dialysis.

Category	No.	POD	UNa	FENa	FEUr	PIosm	UOsm	CLOsm	CLH ₂ O
(R)isk	5	1.8	11	0.3	10	293	391	70	-16
(I)njury	8	2	24	0.3	25	296	523	62	-27
(F)ailure	7	2	5	0.05	11.7	300	406	18	-6
(D)ialysis	6	6.7	5	0.11	14.8	316	377	96	-26