

Minimizing Acute Kidney Injury after Cardiac Surgery: the Importance of Temporal Correlation between Coronary Angiography and Surgery

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Despite ongoing efforts to decrease its occurrence, Acute Kidney Injury (AKI) remains a frequent and vexing complication of cardiac surgery [1]. Postoperative AKI incidence stubbornly ranges from 5 to 40% [1-3].

Its incidence varies depending on the definition used, the mode of monitoring, and the clinical profile of patients [1]. Several studies have sought to identify predictors of AKI after cardiac surgery, and their number is testament to the failure to prevent this complication by prophylactic measures in unselected patients [1-3]. Due to its impact on patient outcome, new classification criteria have been recently proposed, facilitating comparison across studies and populations [4,5]. The RIFLE (an acronym for risk, injury, failure, loss, end-stage kidney disease) criteria and the Acute Kidney Injury Network (AKIN) criteria have emerged as diagnostic tools for monitoring the severity and progression of postoperative AKI [4,5]. The RIFLE classification defines three grades of severity (risk, injury, and failure) and two outcome classes (loss of kidney function and end-stage kidney disease) [4]. Similarly, the AKIN system defines three progressive AKI stages, without outcome classes [5].

However, postoperative AKI has been demonstrated as consequence of interplay of different pathophysiologic mechanisms, with patient-related factors and Cardiopulmonary Bypass (CPB) as major causes. In addition, specific preoperative risk factors have recently gained popularity [1-3].

In this setting, exposure to contrast agent is a relevant contributing factor for AKI development [1,6-16]. Therefore, to identify the optimal time interval between coronary angiography and operation in patient undergoing cardiac surgery is a concrete possibility for minimizing AKI. Encouraging results have been recently proposed by the SCORE (Surgical and Clinical Outcome Research) Group [10]. It aimed to investigate AKI risk in patients undergoing coronary angiography and surgery on the same day, enrolling a total of 4440 consecutive patients. It was observed that surgery on the same day of angiography increases the risk of AKI, and limiting this temporal correlation resulted in a significant 30% decrease of AKI [10].

Why is it important the above-mentioned observation? First, it should be stressed that postoperative AKI has been shown to be a harbinger of poor prognosis early and late after cardiac surgery [1-3]. Patients with small fluctuations on renal function are characterized by reduced survival [1-3,17,18]. Hobson and colleagues [17] also detailed the association between long-term mortality and AKI, showing that the proportion of survivors was 89% and 95% at 1 year and 44% and 63% at 10 years for patients affected by AKI and patients without it, respectively. Second, the impact of postoperative AKI on hospital resources is substantial. Chertow et al. [2] reported a 3.5-day increase in hospital stay for patients affected by AKI and an increase of \$ 8,900 in unadjusted total costs also for a small increase in sCr (≥ 0.3 mg/dL). Patients with AKI also incurred higher intensive care unit costs (1.7-fold), pharmacy (2.3-fold), and laboratory costs (1.6-fold) [18].

Therefore, delaying cardiac operations beyond 24 hours of exposure to contrast agents is simple, easy and effective.

Is this sufficient to abolish AKI after cardiac surgery? The answer is certainly negative, since other important aspects merit considerations. First, several circumstances do not permit to hospitalize patients several days before the operation, and more importantly, emergent/urgent cases are inevitably excluded from such preventive approach. The latest are most often older patients, suffering from deteriorated preoperative cardiac and renal function; both AF risk factors as demonstrated in several studies. As a matter of fact, Medalion et al. [8] reported a three times higher rate of urgent operations in patients with an interval of 1 day or less between coronary angiography and surgery compared with a longer period. Second, the specific impact of the type of operation on postoperative AKI needs to be specifically addressed. It should be underlined that predictors of AKI differ among different type of surgery [1,6-16]. Patients undergoing isolated Coronary Artery Bypass Grafting (CABG) usually present the lowest incidence of AKI compared with those undergoing valve surgery with or without concomitant CABG [1-3,6-16]. Complex operations require prolonged surgery times, and prolonged CPB determines unavoidable renal alterations in blood flow by ischemia-reperfusion injury and inflammatory phenomena [1]. The longer is the CPB duration, the greater is the detrimental effect on renal function. Therefore, delaying cardiac operations beyond 24 hours of exposure to contrast agents is mandatory in patients with complex operations (i.e. valve surgery with concomitant CABG or thoracic aorta surgery).

Are all authors consonant with this approach? The effect of coronary angiography timing on postoperative AKI has yielded conflicting results, and the notion of delaying cardiac surgery for the purpose of renal recovery is not commonly recognized [6-16]. Some studies suggest delaying surgery >1 days of exposure to contrast agent, others extend the risk period to 5 days after angiography, and some others claim that risk of AKI is not influenced by this temporal relationship [6-16]. The above-mentioned discrepancies accounted for the heterogeneity of the enrolled populations, with reference to clinical presentations and cardiac pathologies. However, agreement exists for delaying cardiac operations beyond (at least) 24 hours of exposure to contrast agents.

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In conclusion, AKI after cardiac surgery is certainly a harmful and vexing complication, leading to increased morbidity and mortality. Since delaying cardiac operations beyond 24 hours of exposure to contrast agents seems to be effective, this simple approach should be pursued.

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