Indian Heart Journal xxx (2017) xxx–xxx

Contents lists available at ScienceDirect

Indian Heart Journal

journal homepage: www.elsevier.com/locate/ihj

Applicability of the Cleveland clinic scoring system for the risk prediction of acute kidney injury after cardiac surgery in a South Asian cohort

Shobhana Nayak Rao[a,*], Pradeep Shenoy M[b], Mundayat Gopalakrishnan[b], Amith Kiran B[a]

[a] Deptartment of Nephrology, K.S.Hegde Medical Academy, Derlakatte, Mangalore, Karnataka, India
[b] Department of Cardiothoracic Surgery, K.S.Hegde Medical Academy, Derlakatte, Mangalore, Karnataka, India

ARTICLE INFO

Article history:
Received 21 March 2017
Accepted 26 November 2017
Available online xxx

Key Words:
Cardiac surgery
Acute kidney injury
Mortality
Risk scoring
Statins

ABSTRACT

Background: Acute Kidney Injury (AKI) after cardiac surgery is a frequent post-operative complication associated with an increased risk of mortality, morbidity and hospital costs. Preoperative risk scores such as the Cleveland Clinic Scoring Tool (CCST) have been validated in Western population group to identify patients at higher risk of AKI and may facilitate preventive strategies. However the scoring tool has not been validated systematically in a South Asian cohort. We aimed to evaluate the applicability of the CCST in prediction of AKI after open cardiac surgery in a South–Indian tertiary care centre.

Materials and methods: A retrospective study of all patients who underwent elective open cardiac surgery over a 4 year period from Jan 2012 to Dec 2015 at a single centre were included and relevant details extracted from a comprehensive chart review. The primary outcome was AKI as defined by the K-DIGO criteria. Patients were risk stratified as per the CCST to assess for prediction of AKI into low risk (0–2), intermediate risk (3–5) and high risk (>6) groups.

Results: A total of 276 patients underwent open cardiac surgery with mean age of 51.5+/− 13.06 yrs. This included 177 (64.1%) males and 99 females (35.8%). Overall incidence of AKI was 6.88%.Mean age, gender, BMI, preoperative serum creatinine, diabetes mellitus, chronic obstructive pulmonary disease, cardiopulmonary bypass time was similar in patients who developed AKI vs those who did not have AKI postoperatively. The mean CCST scores were 1.6 in those without AKI, 1.5 in stage 1, 3.0 in stage 2 and 3.4 in stage 3 AKI. Higher risk scores predicted greater risk of AKI. A total of 106 patients (38.4%) were on ACE/ARB, 119 patients (43.1%) received beta-blockers, 110 (39.8%) received diuretics while 144(52.1%) had received preoperative statins. Comparison of drug use between the two groups revealed that preoperative use of ACEI/ARB was associated with highest risk of AKI (P = 0.006). Mortality rate was also high at 15.7% in those with AKI compared to 3.1% in non-AKI group (p = 0.04).

Conclusion: The modified Cleveland Clinic Scoring Tool was valid in risk identification of patients with severe stage of AKI but did not have strong discrimination for early AKI stages. Preoperative statin use did not protect against AKI in our study, however preoperative ARB/ACEI use was significantly associated with occurrence of postoperative AKI.

1. Background

Acute Kidney Injury (AKI) after cardiac surgery is a serious complication. Depending on the definition used, upto 30% of cardiac surgery patients develop some form of AKI post surgery[1–3] and 1–5% develop severe kidney injury necessitating dialysis AKI-D.[2,4–5] The mortality following AKI-D has been reported to be very high in the range of 50–80%.[6,7] Even milder forms of AKI can have an impact on short term and long term morbidity and mortality. AKI associated with cardiac surgery increases infectious risk, extends the length of stay in the intensive care unit thereby increasing the utilization of health care resources and independently predicts death.[8] Recent advancements have led to less invasive surgical techniques and off–pump coronary artery bypass procedures have reduced mortality, however the incidence of renal dysfunction has more or less remained the same.[9] The accurate prediction of patients who are likely to develop AKI, application of measures to prevent AKI and the early recognition and the

* Corresponding author.
E-mail address: nayak_shobhana@rediffmail.com (S.N. Rao).

https://doi.org/10.1016/j.ihj.2017.11.022

treatment of AKI are goals for nephrologists involved in the care of these patients.

There are few externally valid tools for risk stratification for AKI-D such as the Cleveland Clinic scoring tool, Mehta score etc.[3] The Cleveland Clinic Scoring tool tested a large cohort of patients (n = 15,838) to identify patients at risk of developing AKI after open heart surgery.[10] Multiple comparison studies have found that the Cleveland Clinic Score has the highest discriminative power in a Western population,[11] however as the authors themselves have stated the model needed to be tested prospectively at multiple centres and heterogenous population to substantiate its broad applicability.[12] A key limitation of this risk score is also that it does not predict milder forms of AKI, which may have significant and long term effects. The purported reasons for AKI following cardiac surgery include renal ischemia-reperfusion injury, inflammation and atheroembolism, neurohormonal activation and oxidative stress.[13,14] The role of statins to reduce inflammation and oxidative stress and thereby lowering the risk of renal dysfunction after cardiac surgery has been investigated and some studies have found lower incidence of AKI in patients in whom statins were started or continued into the early post-operative period[15,16] though this is not equivocal. Most of this data again has been from the Western literature in a predominantly white, Caucasian population with essentially no available data in a South Asian patient population who may exhibit different clinical outcomes. The Indian population is probably the best suited to test the applicability of the scoring tool given that India has one of the highest rates of diabetes and cardiovascular disease in the developing world. The purpose of our study was to assess the applicability of the Cleveland Clinic Scoring tool in prediction of AKI in a South Indian patient population and to assess the effect of preoperative statin use on the risk of AKI following open cardiac surgery.

2. Methods

Data collection and Study Cohort: We conducted a retrospective chart review of all adult patients (≥18 yrs) who underwent elective open cardiac surgery from Jan 2012 to Dec 2015 at our institute. All study data including intra-operative and post-operative details were abstracted after a thorough in-patient chart review. Predictors of AKI in the Cleveland Clinic scoring tool: gender, co-morbidities including diabetes mellitus, chronic obstructive pulmonary disease (COPD), congestive cardiac failure, type of cardiac surgery and preoperative and postoperative serum creatinine (mg/dl) were included. We were not able to sub classify diabetics into Type 1/2 and hence included all patients with diabetes as a parameter. Since our study included only patients undergoing elective surgery, emergency surgery as a parameter was not included in the score. Information about the exact numerical value of the Left ventricular ejection fraction was not accurately available from records and hence it was included as a dichotomous variable as either LVEF<35 or >35% in the scoring system.

Types of surgery included coronary artery bypass graft (CABG), aortic valve replacement or repair (AVR), mitral valve repair or replacement (MVR), tricuspid valve repair or replacement (TVR) and combinations of CABG and AVR, MVR or TVR as well as other cardiac surgery such as atrial septal defect closure (ASD), ventricular septal defect closure (VSD), ventricular aneurysm repair, pericardiectomy etc. In addition, we collected data on other preoperative variables such as age, BMI, preoperative diagnosis of chronic kidney disease (CKD), presence of significant proteinuria (>300 mg/day), pre-operative use of drugs including statins, ACEI/ARB, beta–blockers and diuretics. The class of statins used included simvastatin, rosuvastatin, atorvastatin or others. Dosage used and continuation/stoppage of drug during the peri and post-operative period was recorded. Peri-operative variables include the length of

Table 1
Pre and periop risk variables associated with AKI.

Risk factors (n = 276)	Total N = 276		No AKI N = 257		AKI N = 19		
Preop Continuous							
	Mean	SD	Mean	SD	Mean	SD	P value
Age	51.5	13.06	50.8	12.9	62.93	8.66	0.35
BMI	21.62	4.02	21.64	4.09	21.3	2.72	0.63
Preop creatinine	0.93	0.24	0.92	0.23	1.06	0.29	0.98
Preop categorical							
	N	%	N	%	N	%	P value
Male	177	64.10	164	63.8	12	63.1	0.69
Female	99	35.80	94	36.5	5	26.3	
Diabetes mellitus							
Absent	196		186		10		0.58
Present	80		71		9		
Chronic obstructive pulmonary disease							
No	258		247		16		0.2
Yes	18		10		3		
Types of surgery							
CABG only	173	62.6	163	63.40	10	52.60	NS
Valve only	63	22.8	56	21.70	7	36.80	NS
CABG + valve	8	2.9	6	2.33	2	10.50	NS
Other cardiac surgery	32	11.5	32	12.40	0	0.0	NS
Medication							
Cardiopulmonary bypass time in mins	Mean	SD	Mean	SD	Mean	SD	P value
	125.1	39.40	124.6	39.4	133	42.5	0.99
Statin (n = 144)			124	48.20	10	52.6	0.419
ACEI/ARB (n = 106)			**90**	**35.0**	**16**	**84.20**	**0.006**
β Blockers (n = 119)			111	43.10	8	42.10	0.39
Diuretics (n = 110)			102	39.60	8	42.10	0.58

Please cite this article in press as: S.N. Rao, et al., Applicability of the Cleveland clinic scoring system for the risk prediction of acute kidney injury after cardiac surgery in a South Asian cohort, Indian Heart J (2017), https://doi.org/10.1016/j.ihj.2017.11.022