Robotic Beating Heart Totally Endoscopic Coronary Artery Bypass: Impact of Chronic Kidney Disease on Post-operative Outcomes

Tatsuya Watanabe, Hiroto Kitahara, Charocka Coleman, Brooke Patel, Husam H Balkhy
Section of Cardiac Surgery, Department of Surgery, University of Chicago, Chicago, IL;

THE UNIVERSITY OF CHICAGO MEDICINE & BIOLOGICAL SCIENCES

Objective

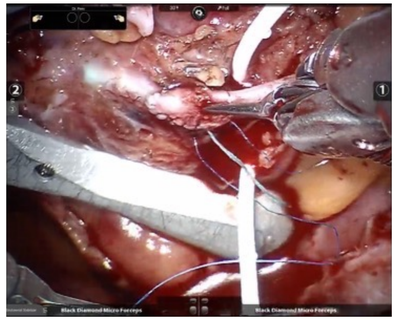
Chronic kidney disease (CKD) is a risk factor for postoperative acute renal insufficiency in patients undergoing coronary bypass (CABG). Avoiding cardiopulmonary bypass during Off-pump (OPCAB) has not mitigated this risk; possibly due to the need for vasopressors to avoid hemodynamic instability during OPCAB. In robotic beating heart totally endoscopic coronary artery bypass (TECAB), the hemodynamics during surgery are usually stable without vasopressors because this procedure does not necessitate aggressive heart displacement. Our study aims to explore the impact of different stages of CKD on the outcomes of patients undergoing robotic TECAB and specifically in regards to the development of post-operative acute renal insufficiency.

METHODS

We retrospectively reviewed patients undergoing robotic TECAB from July 2017 to October 2021 at our institution.
Patients were classified based on the Kidney Disease Global Outcomes 2012 clinical practice guideline (eGFR; Stage1:>90, Stage2: 60-89, Stage3A: 45-59, Stage3B: 30-44, Stage4:15-29, Stage5:<14)
We compared the outcomes between patients with normal renal function, mild CKD, and moderate to severe CKD.
CKD 1: Normal renal function, CKD 2: mild CKD,
CKD3-5: moderate-severe CKD

Analysis of Variance was used to compare the means between the 3 groups. Fisher's exact analysis and chi-square test were used to compare the categorical data. R 3.6.0 (the R Foundation for Statistical Computing, Vienna, Austria) was used.

PROCEDURE



All cases were performed by a single experienced robotic cardiac team with the da Vinci Si surgical robot (Institutive Surgical Inc, CA, USA) and the EndoWrist Stabilizer(Institutive Surgical Inc) without cardio-pulmonary bypass.

RESULTS

Baseline patients characteristics

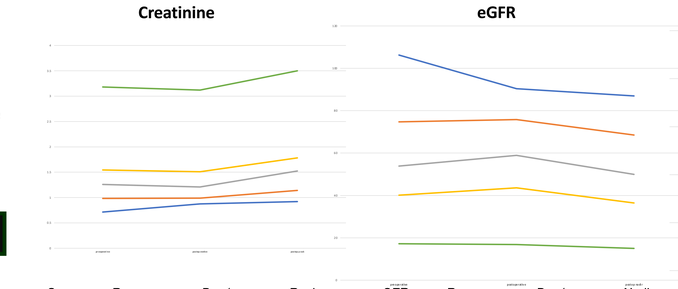
	Normal renal function(n=88)	mild CKD (n=159)	moderate-severe CKD(n=85)	P value
Age(year)	61.01±11.45	65.74±9.63	70.67±8.30	4.00×10^{-9}
Sex(male)	77/88 (87.5%)	130/159 (81.7%)	55/85 (65.8%)	8.10×10^{-4}
BMI (kg/m2)	30.17±6.47	29.58±5.49	30.54±6.65	0.47
DM	28/88 (31.8%)	56/159 (35.2%)	32/85 (38.8%)	0.72
Hypertension	64/88 (72.7%)	115/159 (72.3%)	67/85 (82.3%)	0.51
Dyslipidemia	57/88 (64.7%)	103/159 (64.7%)	51/85 (62.3%)	0.53
PVD	3/88 (3.4%)	8/159 (5.0%)	7/85 (9.4%)	0.39
COPD	3/88 (3.4%)	13/159 (8.1%)	3/85 (3.5%)	0.21
Unstable angina	11/88 (12.5%)	25/159 (15.8%)	16/85 (22.3%)	0.53
LVEF (%)	52.35±12.39	51.99±11.58	51.13±13.39	0.88
Albumin (g/dL)	4.27±0.33	4.34±0.40	4.12±0.37	7.30×10^{-4}
Hemoglobin (g/dL)	13.84±3.73	13.71±1.78	12.38±1.67	1.80×10^{-4}
Creatinine (mg/dL)	0.71±0.14	0.98±0.14	1.48±0.50	9.90×10^{-50}
eGFR (mL/min/1.73m2)	110.29±18.62	74.73±8.85	46.17±10.74	2.00×10^{-106}

Data presented as mean ±SD or n(%). BMI, body mass index; DM, diabetes melitus; PVD, peripheral vessel disease; COPD, chronic obstructive pulmonary disease; LVEF, left ventricular ejection fraction; eGFR, estimated glomerular filtration rate

Postoperative outcomes

	Normal renal function(n=88)	mild CKD (n=159)	moderate-severe CKD(n=85)	P value
30-day mortality	0/88 (0%)	2/159 (1.2%)	1/85 (1.1%)	0.62
Reoperation for bleeding	0/88 (0%)	2/159 (1.2%)	0/85 (0%)	0.49
Prolonged ventilation (>48hrs)	1/88 (1.1%)	4/159 (2.5%)	1/85 (1.1%)	0.76
Postoperative hospital stay	2.15±2.65	2.42±2.73	2.22±1.56	0.85
Prolonged hospital stay (>1week)	3/88 (3.4%)	5/159 (3.1%)	2/85 (2.3%)	1
Postoperative AF	4/88 (4.5%)	19/159 (12.2%)	11/85 (12.9%)	0.095
Postoperative AKI	2/88 (2.2%)	7/159 (4.4%)	6/85 (7.0%)	0.29
Blood transfusion	4/88 (4.5%)	14/159 (8.8%)	9/85 (10.5%)	0.3

Data presented as mean ±SD or n(%).
AF, atrial fibrillation; AKI, acute renal insufficiency, 1.5 times higher than preoperative value

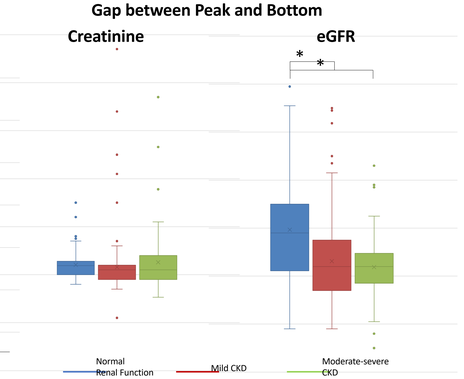


Cre	Preop	Day1	Peak
Stage1	0.71±0.14	0.84±0.24	0.92±0.26
Stage2	0.98±0.14	0.97±0.28	1.14±0.57
Stage3A	1.25±0.13	1.20±0.27	1.52±0.73
Stage3B	1.54±0.19	1.58±0.39	1.78±0.47
Stage4,5	3.18±0.75	3.16±0.83	3.50±0.73

eGFR	Preop	Day1	Nadir
Stage1	106.2±11.2	93.6±17.7	86.9±18.7
Stage2	74.7±8.8	78.0±16.7	68.5±18.1
Stage3A	53.8±3.9	59.8±14.5	49.9±15.5
Stage3B	40.1±3.8	41.4±10.8	36.4±10.5
Stage4,5	17.2±6.9	17.8±6.7	15.0±5.23

Data presented as mean ±SD.

Gap between Peak and Bottom



Gap	Normal renal function	Mild CKD	Moderate-severe CKD
Cre	0.20±0.28	0.15±0.56	0.25±0.59
eGFR	19.2±21.1	6.2±16.3	3.7±12.5

Data presented as mean ±SD.

CONCLUSION

Moderate to severe CKD was not associated with worse postoperative outcomes or reduction in renal function and the risk of AKI after robotic TECAB. We suspect the limited usage of vasopressors in robotic TECAB might be the reason why the risk of AKI was not different between the groups.