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Original Article

Acute Kidney Injury Following Elective Open Aortic Repair with Suprarenal Clamping

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Objective: To investigate predictors of acute kidney injury (AKI) following open aortic repair (OAR) requiring suprarenal clamping.

Methods: The study included 833 nonhemodialysis patients who had undergone elective OAR (with suprarenal clamping, n=73; with infrarenal clamping, n=760). We evaluated AKI as defined by the criteria of the Kidney Disease Improving Global Outcomes (KDIGO) and compared in-hospital outcomes between the two groups. We also investigated the effects of AKI on outcomes, factors related to post-suprarenal clamping AKI, and efficacy of hypothermic renal perfusion (HRP) in the suprarenal clamping group.

Results: For the suprarenal vs. infrarenal clamping group, in-hospital mortality was 0% (0/73) vs. 0.5% (4/760). The incidence of AKI was greater in the suprarenal clamping group (37% vs. 15%, P<0.001), and the hospital stay for patients with AKI was longer than for those patients without AKI (median, 21 days vs. 16 days; P=0.005). Renal ischemia time and bleeding volume >1,000 mL were associated with post-suprarenal clamping AKI. Renal ischemia time was longer with HRP (n=15) than without HRP (n=58) (median, 51 min vs. 33 min; P=0.011), and HRP did not decrease the incidence of AKI (40% vs. 36%; P=0.78).

Conclusion: Prolonged renal ischemia and substantial intraoperative bleeding are associated with postoperative AKI following suprarenal clamping.

Keywords: abdominal aortic aneurysm, suprarenal clamping, acute kidney injury

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Introduction

Recently, the indications for endovascular aortic repair (EVAR) have been expanded; however, juxtarenal aortic aneurysm with a short proximal neck and suprarenal aortic aneurysm in which renal arteries and/or other splanchnic arteries are involved in the aneurysm are nonanatomical indications for standard EVAR, with open aortic repair (OAR) with suprarenal aortic clamping being feasible for such aneurysms. According to the 2012 annual report of the Japanese Society for Vascular Surgery, suprarenal clamping and renal artery reconstruction were performed in 1,175 (14.2%) and 302 (3.7%) patients, respectively, out of 8,250 patients in Japan who underwent OAR for abdominal aortic aneurysm (AAA).[1)] Suprarenal clamping implies renal ischemia, which may increase in-hospital mortality[1)] and the incidence of postoperative acute kidney injury (AKI).[2–7)] Postoperative AKI is a common, but serious, complication of aortic repair for AAA because it may increase early mortality[8,9)] and patients' hospital stay[10,11)]; it may also affect late survival.[8,12,13)]

Although much attention to date has been given to this complication, research into AKI following AAA repair remains challenging due to the fact that AAAs differ from each other morphologically and clinically. For example, some aneurysms are ruptured and some unruptured, and some involve visceral vessels whereas others do not. Furthermore, AKI classification systems vary widely, making comparison between studies difficult. Consensus classification systems for AKI include the Risk, Injury, Failure, Loss of kidney function, and End-stage kidney disease (RIFLE) classification system[14)]; the Acute Kidney Injury Network classification system[15)]; and the most recently

developed Kidney Disease Improving Global Outcomes (KDIGO) classification system.[16] We recently reported the impact and predictors of AKI (defined by the KDIGO criteria), following elective OAR with infrarenal clamping.[17]

We here conducted a retrospective study to determine the incidence and predictors of KDIGO-defined AKI following OAR performed with suprarenal clamping. Several renal protection techniques have been reported for use with suprarenal clamping[18–20]; however, their efficacies in terms of renal function have not yet been fully clarified. Thus, we also investigated the efficacy of hypothermic renal perfusion (HRP), which we applied for renal protection in patients undergoing OAR with suprarenal clamping.

Materials and Methods

Patients

The study group comprised 833 patients who underwent elective surgery for AAA at our hospital between January 2008 and May 2019. These patients were identified from among 1,195 patients who underwent elective surgery for AAA during this time period, none of whom had a thoracoabdominal aortic aneurysm requiring reconstruction of the superior mesenteric artery or celiac artery, and none of whom had a solitary common aneurysm or internal iliac aneurysm. Three hundred and forty of the patients had undergone EVAR, and 855 had undergone OAR. Sixteen of the 855 patients who had undergone OAR were excluded from our study because they had chronic kidney disease requiring hemodialysis, and six patients who had undergone OAR were excluded because, based on the recent AKI study from the Vascular Quality Initiative (VQI) group, they underwent temporary renal arterial bypass via a conduit from the subclavian artery.[3] AAA was diagnosed in all patients on the basis of computed tomography (CT) findings. The ethics committee of the Saitama Medical Center, the Jichi Medical University, approved the study (Reg. No. S19–031), and the need for individual informed consent was waived.

Exposure variables

This study consisted of two parts (**Fig. 1**). Firstly, the area of interest was whether suprarenal aortic clamping was used during the OAR, or whether infrarenal aortic clamping was applied. Secondly, and including only patients who underwent OAR with suprarenal aortic clamping, the exposure of interest was whether HRP was performed. Inter-renal aortic clamping was considered suprarenal aortic clamping.

Outcomes analyzed

We here reviewed patients' medical records and the computerized aortic surgery database of our institution to obtain the following outcome data: in-hospital mortality; length of hospital stay; and incidence of AKI (defined according to the KDIGO criteria). The assessment of postoperative AKI on the basis of the KDIGO criteria was as reported previously.[16,17,21] Briefly, each patient's estimated glomerular filtration rate was determined preoperatively and postoperatively by means of the Modification of Diet in Renal Disease study equation for Japanese patients,[22] and patients' preoperative serum creatinine concentration was used as the baseline value. Detailed information regarding the KDIGO criteria is shown in **Supplementary Material**. Resolution of AKI was defined as an increase of <0.3 mg/dL in the patient's serum creatinine concentration at discharge over the concentration on admission.[17]

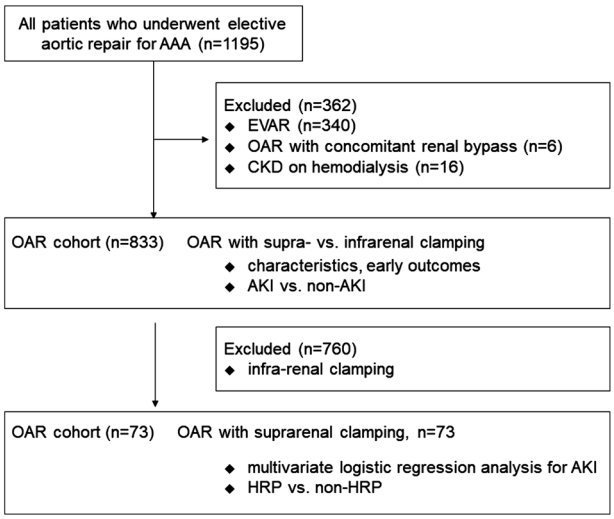

Fig. 1 Flow diagram of the study design and the number of patients.
AAA: abdominal aortic aneurysm; EVAR: endovascular aortic repair; OAR: open aortic repair; CKD: chronic kidney disease; AKI: acute kidney injury; HRP: hypothermic renal perfusion

Other variables examined

Other variables examined were age, sex, presence of Marfan syndrome, history of smoking, comorbidities, echocardiographically determined left ventricular ejection fraction, CT imaging findings, preoperative laboratory values, and operative details. Blood loss volume was defined as the total amount of blood collected in a wall suction device plus the amount of blood absorbed by the surgical gauze. Blood collected in a cell-saver device was not included in the calculation of intraoperative blood loss volume.

Operative procedures

Operative procedures were as reported previously.[17] All procedures were performed under general anesthesia,

and no hybrid procedure combining OAR and an endovascular technique was performed in any of the study patients. OAR was typically performed by transperitoneal approach, and infrarenal aortic cross-clamping was performed in patients with non-juxtarenal AAA. Suprarenal aortic cross-clamping was performed in patients with a juxtarenal or suprarenal aortic aneurysm. The following renal protection technique was used in some patients where suprarenal clamping was performed. Application of renal protection was determined on a case-by-case basis, depending on the anatomical location of the aneurysm and the patient's preoperative renal function. Generally, renal protection was applied to patients for whom the renal ischemia time was anticipated as being prolonged or for those requiring renal artery reconstructions. Renal protection was performed by bolus injection of a 4°C hypothermic solution consisting of 500 mL lactated Ringer's solution, 30 mL of 20% mannitol, and 62.5 mg methylprednisolone for one kidney; extracorporeal bypass circuit was not used. Systemic renal protection agents, namely, mannitol and sodium bicarbonate, were not routinely administered in patients in whom suprarenal clamping was performed. Heparin was administered intravenously before aortic cross-clamping. After the aneurysmal sac was opened, a bifurcated or tube graft made of polyethylene was implanted anatomically. In patients with an aneurysm that extended proximally, the left renal vein was divided to improve exposure of the abdominal aorta. The divided left renal vein was reconstructed in select patients. A cell-saver device was routinely used for intraoperative blood salvage, except in patients with a mycotic aneurysm or malignancy.

Statistical analysis

Continuous variables are shown as mean ± standard deviation (SD) or median (interquartile range), and categorical variables are shown as the number (percentage) of patients. Between-group differences in clinical variables were analyzed as appropriate by χ^2, or Fisher's exact test, or by unpaired t-test, or Mann–Whitney U-test. Forward stepwise multivariate logistic regression analysis was performed to identify predictors of AKI (AKI stage ≥1) in patients who underwent OAR with suprarenal clamping (see **Supplementary Material**). All statistical analyses were performed with IBM SPSS Statistics version 21.0 for Windows (IBM Corp., Armonk, NY, USA), and $P<0.05$ was considered significant.

Results

Clinical characteristics, operative variables, and in-hospital outcomes of patients who underwent OAR with suprarenal clamping and patients who underwent OAR with infrarenal clamping

Characteristics of patients who underwent OAR with suprarenal clamping and those patients who underwent OAR with infrarenal clamping are shown in **Table 1**. Female sex and hypertension were more prevalent among patients in whom suprarenal clamping was performed. Mean age was similar between groups, and there were no significant between-group differences in comorbidities or

Table 1 Clinical characteristics of patients who underwent open aortic repair with suprarenal clamping and those who underwent open aortic repair with infrarenal clamping

	Suprarenal clamping n=73	Infrarenal clamping n=760	P value
Age (years)	72.1±7.0	71.1±7.8	0.30
Male sex	52 (71%)	648 (85%)	0.002
Marfan syndrome	1 (1%)	5 (0.7%)	1.00
History of smoking	57 (78%)	596 (79%)	0.93
Chronic obstructive pulmonary disease	6 (8%)	63 (8%)	1.00
Diabetes	10 (14%)	149 (20%)	0.22
Hypertension	68 (93%)	628 (83%)	0.02
Dyslipidemia	37 (51%)	373 (49%)	0.80
History of cerebrovascular disease	13 (18%)	97 (13%)	0.22
History of coronary artery disease	26 (36%)	278 (37%)	0.87
Peripheral artery disease	6 (8%)	51 (7%)	0.63
History of aortic surgery	6 (8%)	48 (6%)	0.53
Left ventricular ejection fraction<40%	0 (0%)	23 (3%)	0.24
CT measures			
Diameter of the aneurysm (mm)	53.2±9.3	51.3±12.1	0.19
Common iliac artery aneurysm >20 mm	17 (23%)	302 (40%)	0.006
Hypogastric artery aneurysm >20 mm	4 (6%)	114 (15%)	0.040
Laboratory test results			
White blood cell count (×10³/μL)	6.2±1.3	6.3±1.8	0.54
Hemoglobin (g/dL)	12.6±1.5	12.9±1.7	0.13
Platelet count (×10³/μL)	20.6±5.8	20.8±9.5	0.87
Albumin (g/mL)	4.0±0.3	4.1±0.4	0.19
eGFR (mL/min/1.73 m²)	61.9±20.5	61.6±19.2	0.90
eGFR >60 (mL/min/1.73 m²)	42 (58%)	412 (54%)	0.59
eGFR ≥30≤60 (mL/min/1.73 m²)	26 (36%)	306 (40%)	0.43
eGFR <30 (mL/min/1.73 m²)	5 (7%)	42 (6%)	0.64

Mean±standard deviation values or number (%) of patients are shown.
CT: computed tomography; eGFR: estimated glomerular filtration rate

laboratory values, including measures of renal function. CT-determined maximum aortic diameter was similar between groups, but the prevalence of concomitant iliac disease was significantly lower in the suprarenal clamping group.

Table 2 Operative variables and in-hospital outcomes of patients who underwent open aortic repair with suprarenal clamping and those who underwent open aortic repair with infrarenal clamping

	Suprarenal clamping n=73	Infrarenal clamping n=760	P-value
Use of cell-saver device	72 (99%)	748 (98%)	1.0
Operation time (min)	294±88	278±85	0.12
Bleeding volume (mL)	310 (200–605)	295 (170–473)	0.063
Transfusion volume (mL)	0 (0–560)	0 (0–280)	0.090
No transfusion	42 (58%)	514 (68%)	0.080
Bifurcated graft replacement	49 (67%)	669 (88%)	<0.001
Tube graft replacement	24 (33%)	91 (12%)	<0.001
Reconstruction of the IMA	23 (32%)	226 (30%)	0.76
Reconstruction of the hypogastric artery	8 (11%)	219 (29%)	0.001
Reconstruction of the renal artery	15 (21%)	0 (0%)	<0.001
Division of the LRV	16 (12%)	0 (0%)	<0.001
LRV reconstruction	7 (10%)	0 (0%)	<0.001
Supraceliac clamping	0 (0%)	NA	NA
Bilateral suprarenal clamping	17 (23%)	NA	NA
Inter-renal clamping	56 (77%)	NA	NA
Renal ischemia time (min)	35 (29–47)	NA	NA
Hypothermic renal perfusion	15 (21%)	NA	NA
In-hospital mortality	0 (0%)	4 (0.5%)	1.0
Length of hospital stay (days)	18 (15–23)	16 (14–20)	0.016
Complications			
Acute kidney injury	27 (37%)	111 (15%)	<0.001
KDIGO stage 1	17 (23%)	91 (12%)	0.006
KDIGO stage 2	8 (11%)	10 (1%)	<0.001
KDIGO stage 3	2 (3%)	10 (1%)	0.65
AKI restoration at discharge†	74% (20/27)	83% (92/111)	0.29
Need for temporary RRT	0 (0%)	3 (0.4%)	1.0
Need for permanent RRT	0 (0%)	0 (0%)	1.0
Spinal cord ischemia	1 (1%)	2 (0.3%)	0.63
Cerebral infarction	0 (0%)	2 (0.3%)	1.0
Ventilation>48 h	1 (1%)	1 (0.1%)	0.42
Re-exploration for bleeding	2 (3%)	9 (1%)	0.57
Mesenteric ischemia	0 (0%)	5 (0.7%)	1.0
Ileus	2 (3%)	37 (5%)	0.59

Mean±standard deviation or median (interquartile range) values or number (%) of patients are shown.

IMA: inferior mesenteric artery; LRV: left renal vein; NA: not applicable; KDIGO: Kidney Disease Improving Global Outcomes; RRT: renal replacement therapy

†AKI restoration was defined as a serum creatinine concentration within 0.3 mg/dL of the preoperative serum creatinine concentration for patients who suffered acute kidney injury postoperatively.

Operative variables are shown in **Table 2**. Both suprarenal arteries were clamped in 17 (23%) patients, and an inter-renal artery was clamped in 56 (77%) patients. Supravisceral clamping (aortic cross-clamping proximal to the origin of the superior mesenteric artery or celiac trunk) was not performed. Reconstruction of one or both renal arteries was performed in 15 (21%) of the patients who underwent suprarenal clamping. In-hospital outcomes are also shown in **Table 2**. The overall incidence of AKI among the patients who underwent OAR with suprarenal clamping was 37% (27/73): stage 1, 2, and 3 AKI in 23% (17/73); 11% (8/73); and 3% (2/73), respectively. The overall AKI incidence, and the incidences of stage 1 and stage 2 AKI were higher in the suprarenal clamping group ($P<0.01$, all). No patient in the suprarenal clamping group was treated with either temporary or permanent renal replacement therapy, and the AKI resolved in 74% (20/27) of patients in this group. There was no in-hospital death in this group. The median hospital stay was longer in the suprarenal clamping group than in the infrarenal clamping group (18 days vs. 16 days, respectively; $P=0.016$). There was no significant between-group difference in other complications. Sixteen (22%) of the patients in the suprarenal clamping group underwent division of the left renal vein. Seven of these 16 patients underwent subsequent reconstruction of this vein. Incidences of AKI in patients in whom the left renal vein was, and those in whom it was not, reconstructed after division were 14% (1/7) and 33% (3/9), respectively ($P=0.77$).

Effects of AKI following OAR with suprarenal clamping

To clarify the effects of postoperative AKI, we compared in-hospital outcomes in the patients with and without AKI between the patients who underwent OAR with infrarenal clamping and those patients who underwent suprarenal clamping (**Table 3**). In patients in whom infrarenal clamping was performed, AKI was associated with increased in-hospital mortality, reoperation for bleeding, mesenteric ischemia, and a prolonged hospital stay. In patients in whom suprarenal clamping was performed, those suffering postoperative AKI had significantly prolonged hospital stays; however, the incidences of other complications did not differ between the groups.

Predictors of AKI following OAR with suprarenal clamping

Forward stepwise multivariate logistic regression analysis indicated that prolonged renal ischemia time and blood loss volume >1000 mL were associated with postoperative AKI (**Table 4**).

Table 3 In-hospital outcomes, per the presence or absence of acute kidney injury in patients who underwent open aortic repair with infra- or suprarenal clamping

	With acute kidney injury	Without acute kidney injury	P value
Infrarenal clamping	n=111	n=649	
In-hospital mortality	3 (3%)	1 (0.2%)	0.007
Length of hospital stay (days)	20 (15–29)	16 (14–19)	<0.001
Complications			
Paraplegia	0 (0%)	2 (0.3%)	1.0
Cerebral infarction	1 (0.9%)	1 (0.2%)	0.68
Ventilation>48 h	1 (0.9%)	0 (0%)	0.32
Reoperation for bleeding	6 (5%)	3 (0.5%)	<0.001
Mesenteric ischemia	3 (3%)	2 (0.3%)	0.025
Ileus	8 (7%)	29 (5%)	0.22
Suprarenal clamping	n=27	n=46	
In-hospital mortality	0 (0%)	0 (0%)	1.0
Length of hospital stay (days)	21 (17–24)	16 (15–21)	0.005
Complications			
Paraplegia	1 (4%)	0 (0%)	0.79
Cerebral infarction	0 (0%)	0 (0%)	1.0
Prolonged ventilation>48 h	0 (0%)	1 (2%)	1.0
Reoperation for bleeding	2 (7%)	0 (0%)	0.26
Mesenteric ischemia	0 (0%)	0 (0%)	1.0
Ileus	1 (4%)	1 (2%)	1.0

Median (interquartile range) values or number (%) of patients are shown.

Table 4 Results of logistic regression analysis for development of AKI after open aortic repair with suprarenal clamping

Factors associated with AKI	Odds ratio (95%CI)	P value
Renal ischemia time	1.024 (1.006–1.043)	0.008
Blood loss volume >1000 mL	3.46 (1.11–10.74)	0.032
Operation time >300 min	2.25 (0.92–5.55)	0.077

AKI: acute kidney injury; CI: confidence interval

Efficacy of HRP in OAR with suprarenal clamping

We divided the 73 patients who underwent OAR with suprarenal clamping into two groups, according to whether HRP was (n=15) or was not (n=58) performed, and we then compared patients' clinical characteristics, operative variables, and in-hospital outcomes between the two groups (**Supplementary Table 1**). There was no significant difference in age, sex, hypertension, other comorbidities (data not shown), or preoperative renal function between the groups. Renal artery reconstruction and bilateral suprarenal clamping were performed more frequently among patients in whom HRP was performed, and renal ischemia time was greater in this group (P<0.001, all). The incidence of AKI was not lower among patients treated with HRP than among those treated without HRP.

Discussion

AKI is a known complication of OAR performed with suprarenal clamping. Previous studies of such AKI have been based on AKI defined under various classification systems.[2–5] A recent VQI registered, multicenter study showed that postoperative AKI, defined as a serum creatinine concentration increase of >0.5 mg/dL or newly started renal replacement therapy, occurred in 24% (621/2,635) of patients with a nonruptured AAA treated under suprarenal clamping.[3] Dariane et al. in their study performed a meta-analysis of AKI (defined by the RIFLE criteria), following suprarenal clamping, and reported an incidence of 36.8% (n=204).[5] Shahverdyan et al. reported the incidence of KDIGO-defined AKI following suprarenal clamping to be 26.5% (n=34).[23] To the best of our knowledge, our study is the second to analyze KDIGO-defined AKI that occurs after suprarenal clamping. We also investigated the efficacy of our HRP technique, i.e., bolus administration of a hypothermic renal protection solution. We found the incidence of AKI to be 37% (27/73), similar to the previously reported incidences, and use of our HRP technique did not reduce the occurrence of AKI.

Our study also clarified the clinical and morphological characteristics of juxtarenal or suprarenal aneurysm. Female sex and hypertension were more prevalent among patients in whom suprarenal clamping was performed than among those in whom infrarenal clamping was performed. Additionally, patients with juxtarenal or suprarenal aneurysm were less likely than the other patients to have a concomitant iliac artery aneurysm; therefore, tube grafting was performed more frequently among patients who underwent suprarenal clamping. Other studies of patients with a juxtarenal or suprarenal aneurysm revealed similar outcomes.[7,24] Chong et al. in their study reported diabetes and chronic renal failure to be more prevalent among patients in whom suprarenal clamping (vs. infrarenal clamping) was performed, and aortic diameters were greater in this group.[24] We did not observe these trends in the present study.

Prolonged renal ischemia is a known predictor of postoperative AKI,[3,7] and this was evidenced in our study. For patients undergoing kidney transplantation, prolonged warm renal ischemia increases the risk of graft failure.[25] Renal perfusion is a therapeutic option for OAR performed with suprarenal clamping, and it has been reported to decrease the risk of AKI associated with suprarenal clamping.[3,18,19] Several techniques to date have been reported as increasing renal perfusion, including bolus infusion of cold saline[18] and continuous venous blood perfusion via an extracorporeal circuit.[19] For patients in whom prolonged renal ischemia was anticipated, we infused into

each kidney a bolus of 530 mL hypothermic saline. Our study failed to show a decreased incidence of AKI among patients in whom such HRP was applied, but the relatively small patient numbers might explain this result. The VQI study group showed cold renal perfusion to be associated with a lower risk of postoperative renal dysfunction in patients who underwent prolonged clamping (>25 min).[3] We consider cold renal perfusion a preferable renal protection technique in patients for whom prolonged renal ischemia is anticipated.

Our study showed blood loss volume >1000 mL to be associated with post-suprarenal clamping AKI. Perioperative bleeding may result in renal hypoperfusion, leading to development of AKI. We previously showed blood loss volume >1000 mL, preoperative hemoglobin <10 g/dL, and a long operating time (>300 min), to be predictors of postoperative AKI in patients who have undergone elective OAR with infrarenal clamping.[17] In comparison to OAR with infrarenal clamping, OAR with suprarenal clamping carries a high operative risk because wide mobilization of the viscera is often required, and the operative field is located deep in the retroperitoneal space. The 2012 Japanese Society for Vascular Surgery annual report documented a 2.3% in-hospital mortality among patients who underwent elective OAR with suprarenal clamping, a higher rate in comparison to the overall rate of 1.7% among patients who underwent elective OAR for AAA.[1] We consider that expeditious and meticulous surgical techniques are particularly important for performance of OAR with suprarenal clamping.

Although our study did not show an association between the aortic clamping site and postoperative AKI, the VQI group reported association between inter-renal clamping (vs. bilateral suprarenal clamping or supraceliac clamping) and a lower risk of AKI.[3] Selecting the best aortic clamping site is of paramount importance in the performance of OAR for a juxtarenal or suprarenal aortic aneurysm. In particular, in patients with severe atheromatous lesions, the risk for renal and distal embolization should be considered. During the period covered by our study, we performed OAR with temporary axillorenal artery bypass for renal protection in six patients with a suprarenal aneurysm. Heinola et al. in their study reported favorable outcomes when temporary axillorenal bypass was used during complex open abdominal aortic repair.[26]

This study has several limitations. Firstly, it was retrospective, and the patient numbers were relatively small. A large scale study is needed to confirm our findings. Secondly, information regarding perioperative medications was not factored into our analysis; however, preoperative medications such as calcium channel blockers, beta-blockers, and angiotensin-converting enzyme inhibitors were reported to be unrelated to AKI after elective open and endovascular repair of AAA.[10] Thirdly, we did not assess long-term outcomes according to the presence or absence of AKI in patients who underwent OAR with suprarenal clamping. In future, a study of the effects of postoperative AKI on long-term outcomes is warranted.

Conclusion

In this study we assessed the incidence of KDIGO-defined AKI following suprarenal clamping and found that AKI developed in 37% of our study patients. Postoperative AKI prolonged the hospital stay of these patients. KDIGO stage 3 AKI was rare, and no patient required temporary renal replacement therapy. Our study showed the association between renal ischemia time and substantial intraoperative blood loss with AKI following OAR performed with suprarenal clamping. Knowing the predictors might help surgeons to optimize perioperative care.

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Disclosure Statement

Dr. Yamaguchi serves as a consultant to Japan Lifeline Co., Ltd. The other authors have no conflicts of interest to disclose.

Author Contributions

Study conception: NK
Data collection: NY, TN, NK, TF, KM
Analysis: NY, NK, WM
Investigation: NY, NK
Writing: NY, TN, NK
Funding acquisition: none
Critical review and revision: all authors
Final approval of the article: all authors
Accountability for all aspects of the work: all authors

Supplementary Materials

Supplementary materials are available at the online article sites on J-STAGE and PMC.

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