Comparison of Acute Kidney Injury between Open and Laparoscopic pylorus-preserving pancreaticoduodenectomy: Propensity Score Analysis

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INTRODUCTION

- Laparoscopic pylorus-preserving pancreaticoduodenectomy (LPPPD) may predispose acute kidney injury (AKI) during the operation not only because of being a major abdominal surgery, but a surgery needing a long duration of pneumoperitoneum.
- Previous studies have shown that creatinine clearance and urine output were decreased during pneumoperitoneum.
- This study aimed to identify the prevalence and predisposing factors of postoperative AKI defined by The Kidney Disease: Improving Global Outcomes (KDIGO) criteria after LPPPD and open pylorus-preserving pancreaticoduodenectomy(OPPPD) .

METHODS

- Retrospective study
- Between February 2012 and November 2015
- 457 patients
  - 335 OPPPD group vs 102 LPPPD group
- Kidney Disease: Improving Global Outcomes(KDIGO) criteria
- Propensity score(PS) matching analysis and Inverse probability of treatment weighting(IPTW)

RESULTS

Demographics and perioperative characteristics before and after propensity score matching

		Total (n = 457)	OPPPD (n=355)	LPPPD (n=102)	p value
Demographics	Age (yr)	58.5 ± 12.5	59.7 ± 11.9	54.0 ± 13.8	<0.001
	Sex, male	254 (55.0)	208 (58.6)	43 (42.2)	0.003
	BMI (kg/m²)	23.6 ± 3.4	23.9 ± 3.5	22.2 ± 2.3	<0.001
	Diabetes	87 (19.0)	80 (22.5)	7 (6.9)	<0.001
	Hypertension	152(33.3)	132 (37.2)	20 (19.6)	0.001
Medications	Cerebrovascular disease	30 (6.6)	26 (7.3)	4 (3.9)	0.221
	ACE inhibitor	68 (14.9)	55 (15.5)	13(12.8)	0.492
	Calcium channel blocker	76 (16.6)	67 (18.9)	9 (8.8)	0.016
	Beta blocker	35 (7.7)	33 (9.3)	2 (2.0)	0.014
	statin	43 (9.4)	36 (10.1)	7 (6.9)	0.318
Preoperative	Hemoglobin (g/dl)	12.8 ± 1.5	12.8 ± 1.57	12.9 ± 1.43	0.584
	Platelets (×10³/μL)	239.3 ± 72.7	239.4 ± 76.0	239.8 ± 62.0	0.528
	Prothrombin time (INR)	0.98 ± 0.07	0.98 ± 0.07	0.98 ± 0.06	0.752
	Creatinine (mg/dL)	0.8 ± 0.2	0.8 ± 0.2	0.7 ± 0.2	0.314
	Albumin (g/dL)	3.7 ± 0.4	3.7 ± 0.5	3.8 ± 0.3	0.001
	Total bilirubin (mg/dL)	1.0 ± 1.3	1.1 ± 1.5	0.6 ± 0.6	<0.001
	AST (IU/L)	28.2 ± 23.3	30.0 ± 25.7	22.4 ± 11.0	<0.001
	ALT (IU/L)	33.0 ± 40.0	36.5 ± 44.1	21.6 ± 16.9	<0.001
	Sodium (mmol/L)	140.3 ± 2.7	140.2 ± 2.8	140.6 ± 2.3	0.324
	Glucose (mg/dL)	129.5 ± 53.7	132.2 ± 54.6	116.6 ± 44.2	0.001
Intraoperative	Crystalloid (ml)	3552.4 ± 1214.2	3540.2 ± 1239.5	3593.8 ± 1128.4	0.691
	Synthetic colloid (ml)	666.0 ± 463.6	723.0 ± 438.8	474.8 ± 495.8	<0.001
	Albumin infusion (ml)	372.7 ± 457.0	384.4 ± 491.7	332.9 ± 310.2	0.198
	RBC transfusion (Units)	0.4 ± 0.9	0.5 ± 1.0	0.2 ± 0.7	0.007
	Urine output (L)	545.4 ± 325.9	542.1 ± 340.3	556.9 ± 272.3	0.645
	Duration of surgery (min)	466.8 ± 84.2	452.9 ± 81.6	514.4 ± 75.1	<0.001

		OPPPD (n=100)	LPPPD (n=100)	p value	SD
Demographics	Age (yr)	54.7 ± 13.3	54.3 ± 13.8	0.821	0.03
	Sex, male	47 (47.0)	43 (43.0)	0.537	0.081
	BMI (kg/m²)	22.6 ± 3.3	22.4 ± 2.2	0.391	0.122
	Diabetes	6 (6.0)	7 (7.0)	0.739	0.04
	Hypertension	13 (13.0)	20 (20.0)	0.162	0.176
Medications	Cerebrovascular disease	4 (4.0)	4 (4.0)	1.000	0.0
	ACE inhibitor	10 (10.0)	13(13.0)	0.513	0.09
	Calcium channel blocker	7 (7.0)	9 (9.0)	0.617	0.071
	Beta blocker	0 (0)	2 (2.0)	0.157	0.144
	statin	7 (7.0)	7 (7.0)	1.000	0
Preoperative	Hemoglobin (g/dl)	13.0 ± 1.56	12.9 ± 1.44	0.594	0.082
	Platelets (×10³/μL)	240.7± 64.9	240.0 ± 62.1	0.936	0.012
	Prothrombin time (INR)	0.97 ± 0.05	0.98 ± 0.06	0.229	0.152
	Creatinine (mg/dL)	0.8 ± 0.2	0.7 ± 0.2	0.479	0.112
	Albumin (g/dL)	3.8 ± 0.4	3.8 ± 0.3	0.567	0.083
	Total bilirubin (mg/dL)	0.6 ± 0.3	0.6 ± 0.6	0.715	0.062
	AST (IU/L)	22.1 ± 9.6	22.3 ± 11.0	0.857	0.024
	ALT (IU/L)	21.7 ± 13.9	21.5 ± 17.0	0.551	0.013
	Sodium (mmol/L)	140.8 ± 2.4	140.6 ± 2.3	0.593	0.078
	Glucose (mg/dL)	115.0 ± 38.3	116.9 ± 44.6	0.828	0.042

Postoperative outcomes

		AKI		Overall mortality	
		OPPPD	LPPPD	OPPPD	LPPPD
Crude	Event/N (%)	17/355(4.8)	1/102(1.0)	16/355(4.5)	0/102(0.0)
	OR	1	0.20	1	
	95% CI		0.03-1.50		
	p value		0.12		
IPTW	Event/N (%)	2/100(2.0)	1/100(1.0)	5/100(5.0)	0/100(0.0)
	OR	1	0.28		
	95% CI		0.13-2.49		
	p value		0.25		
PS - matched	OR		0.50		
	95% CI		0.04-5.64		
	p value		0.57		

		Crude		IPTW		PS-matched	
		median [IQR]	p value	median [IQR]	p value	median [IQR]	p value
Hospital stay	OPPPD	15 (12–21)		14 (12–20)		14 (12–19)	
	LPPPD	12 (11–16)	<0.001	12 (11–16)	0.001	12 (11–16)	0.02

Univariate & Multivariate analysis for AKI

	Univariate			Multivariate		
	OR	95% CI	P value	OR	95% CI	p value
LPPPD	0.197	0.026 – 1.497	0.116	0.355	0.045 – 2.814	0.327
Sex	2.196	0.770 – 6.264	0.141	2.377	0.811 – 6.963	0.114
Age	1.061	1.012 – 1.113	0.015	1.069	1.014 – 1.127	0.014
BMI	1.053	0.922 – 1.202	0.446			
Diabetes	1.225	0.393 – 3.819	0.726			
Hemoglobin	0.998	0.734 – 1.358	0.992			
Platelets	1.003	0.998 – 1.009	0.237			
Glucose	0.997	0.986 – 1.008	0.568			
Albumin	0.540	0.192 – 1.515	0.241			
AST	1.001	0.982 – 1.020	0.933			
ALT	1.004	0.995 – 1.012	0.383			
Total bilirubin	0.954	0.627 – 1.452	0.825			
Crystalloid	1.000	0.999 – 1.000	0.081	1.000	0.999 – 1.000	0.038
Albumin infusion	1.001	1.000 – 1.002	0.005	1.001	1.000 – 1.002	0.010
Synthetic colloid	1.001	1.000 – 1.002	0.050			
Transfusion	2.113	0.771 – 5.793	0.146	1.863	1.204 – 2.881	0.005
Urine output	0.998	0.996 – 1.000	0.097	0.098	0.996 – 1.000	0.079
Lowest MBP	0.992	0.941 – 1.046	0.767			
Vasopressor use	1.827	0.695 – 4.800	0.221			

Proportion of patients with AKI stages according to KDIGO criteria

CONCLUSION

- In this study, no significant difference was found in the incidence of postoperative AKI between two groups.
- LPPPD was not a predictor for the development of postoperative AKI.

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