The incidence of acute kidney injury(AKI) between simultaneous bilateral total knee arthroplasty(TKA) and staged bilateral TKA ; a propensity score matched analysis

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Introduction

Several studies support the economic and functional outcome advantage of simultaneous bilateral total knee arthroplasty (TKA). But simultaneous bilateral TKA is known to have greater risk of major complications and higher mortality compared with staged bilateral TKA. However, there was no previous study comparing the incidence of acute kidney injury (AKI) between simultaneous, early staged and staged groups. The aim of this study was to assess the incidence of AKI in simultaneous, early staged and staged groups and further evaluate the major complication rate, intensive care unit stay (ICU) and 1 year mortality.

Methods

The study included a retrospective review of medical records of 1453 consecutive patients who underwent bilateral TKA between January 2008 and December 2014. The patients were divided into 3 groups according to the type of surgical technique: simultaneous bilateral TKA performed under single anesthesia; early staged bilateral TKA performed under 2 separate induction of anesthesia within 7 days after the first operation; staged bilateral TKA performed under 2 separate induction of anesthesia after 7 days and within 1 year. The incidence of AKI, major complications of $\geq$ stage 3a according to the Clavien-Dindo classifications, incidence of ICU admission, major cardiovascular and cerebral events (MACE), and 1 year mortality were compared between the 3 groups. We performed a weighted propensity score analysis using the inverse probability of treatment weights and the population standardized bias was used to diagnose the balance after propensity analysis.

Results

Table 1. Baseline characteristics of the study patients.

Characteristics	Total (n = 1453)
Demographic	
Age, years	69.0 $\pm$ 6.4
Sex, female	1393 (95.9)
Body mass index, kg/m2	27.0 $\pm$ 3.0
ASA PS 1/2/3/4	76 (5.2)/1313 (90.4)/49 (3.4)/15 (1.0)
Diabetes mellitus	179 (12.3)
Hypertension	444 (30.6)
Ischemic heart disease	117 (8.1)
Cerebrovascular diseases	82 (5.6)
Pulmonary diseases	66 (4.5)
Laboratory	
Hemoglobin, g/dL	12.6 $\pm$ 1.1
Platelets, x 103/ μ L	245.9 $\pm$ 61.8
Albumin, 3.8 g/dL	3.9 $\pm$ 0.3
Creatinine, mg/dL	0.7 $\pm$ 0.2

Table 2. Comparison of clinical outcome variables between AKI group and no AKI group in bilateral total knee arthroplasty patients.

Outcome	AKI (n=126)	No AKI (n=1327)	OR	95% CI	P
1 year mortality	2	6	3.551	0.709-17.781	0.123
Admission to ICU	11	14	8.971	3.981-20.213	<0.001
Major complication	11	12	10.482	4.525-24.281	<0.001
MACE	15	34	5.139	2.716-9.724	<0.001

Of total 1453 patients, 820 patients underwent simultaneous bilateral TKA, 368 patients underwent early staged bilateral TKA and 265 patients underwent staged bilateral TKA. The overall incidence of AKI was 126/1453 (8.6%). The AKI group patients demonstrated higher incidence of major adverse events. The incidence of ICU admission, major complication and MACE was higher in the AKI group compared with no AKI group (p < 0.001, Table 2).

Table3. Comparison of AKI incidence and clinical outcome variables by the type of bilateral total knee replacement arthroplasty operation strategies.

		IPTW		
Outcome	Event/N	OR	95% CI	P
AKI				<0.001
Early staged	9/368	1		
Staged	16/265	3.443	1.330-8.911	0.011
Simultaneous	92/820	7.719	3.396-17.549	<0.001
Admission to ICU				0.029
Early staged	4/368	1		
Staged	6/265	2.706	0.449-16.298	0.277
Simultaneous	15/820	5.046	1.102-23.104	0.037

Weighted logistic regression using IPTW (Inverse probability of treatment weighting) was used for the data analysis

The incidence of AKI was 92 (11.2%), 9 (2.45%) and 16 (6.04%) in simultaneous, early staged and staged groups based on Kidney Disease Improving Global Outcomes criteria, respectively (overall p < 0.001, Table 3). The incidence of ICU admission was 15 (1.83%), 4 (1.08%) and 6 (2.26%) in simultaneous, early staged and staged groups, respectively (overall p = 0.029, Table 3). One year mortality (p = 0.25), the incidence of major complications (p = 0.924) and MACE (p = 0.472) was not different between the three groups.

Conclusion

In this study, we demonstrated that patients receiving simultaneous bilateral TKA operations were associated with a higher risk of AKI development and ICU admission compared with early staged bilateral TKA. The incidence of major complications, renal replacement and in-hospital mortality was not different between the study groups.