


CLINICAL ARTICLE

Preoperative Use of Aspirin in Total Knee Arthroplasty: Safe or Not?

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Objective: To compare the blood loss, transfusion rates and complications between the aspirin and non-aspirin group in unilateral and bilateral total knee arthroplasties (TKAs) with a nested case-control design.

Methods: The present study retrospectively selected TKA cases from the Joint Arthroplasty Database at the Peking Union Medical College Hospital from January 2014 to December 2019 following strict inclusion and exclusion criteria, and divided them into the aspirin and non-aspirin group based on the use of aspirin preoperatively. Bleeding was measured by blood loss, transfusion rate, drainage volume, hemoglobin (HGB) and hematocrit (HCT), while complications (cardiovascular events, venous thromboembolism events, cerebrovascular events and wound events) were compared between the groups. Student's unpaired *t*-test and Mann-Whitney U-test were used to compare the differences of continuous variables between the two groups while chi-square test and Fisher's exact test were applied in categorical variables.

Results: A total of 560 patients with unilateral TKA and 285 patients with bilateral TKA were extracted. Among these, 280 patients used aspirin preoperatively. No other differences were found in demographic and surgical characteristics between the two groups except for the proportion of coronary artery diseases ($P < 0.001$). For primary outcomes, there was no significant higher blood loss and transfusion rate in the aspirin group, while the drainage of aspirin group was higher than the control group in bilateral TKAs ($P = 0.043$). The HGB and HCT of the aspirin group was significant lower in both unilateral and bilateral TKAs at POD5 ($P < 0.05$). For complications, there was a lower vascular related complication rate in aspirin group after unilateral TKAs ($P = 0.040$), but the wound event rate in aspirin group was higher than the control group ($P = 0.049$).

Conclusions: Preoperative use of aspirin could prevent vascular related events during the perioperative period of TKA. However, it might also increase the risk of bleeding and wound complications.

Key words: Aspirin; Blood loss; Complication; Total knee arthroplasty; Transfusion

Introduction

With increasing life expectancy, a growing number of elderly patients who suffer from osteoarthritis (OA) choose

to undertake total knee arthroplasty (TKA) to improve the knee function.¹⁻³ However, considerable proportions of these patients have various comorbidities and need to take aspirin routinely.³

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Aspirin is a common anti-platelet agent which has been used to prevent cardiovascular and thromboembolic events in patients with cerebrovascular diseases, coronary artery diseases, atrial fibrillation and peripheral vascular diseases.^{4,5} It was reported that about 30% of the adult population used aspirin for prophylactic use in the United States from 2012 to 2015.^{5,6} In our database, more than 15% of all TKA patients were using aspirin when admitted to hospital from 2014 to 2019. Therefore, it is of great importance to manage the use of aspirin during the perioperative period of TKA.

Preoperative use of aspirin could be considered as a two-edged sword. On the one hand, it played an important role in decreasing the risk of cardiovascular events, stroke and other vascular diseases in the perioperative period.^{7,8} A retrospective observational study of 5690 patients who underwent major joint and spine surgery reported that the incidence of postoperative cardiovascular events decreased with the use of aspirin. And among the patients with coronary artery disease, there was a trend toward fewer episodes of perioperative myocardial injury.⁹

However, according to the guideline of antithrombotic medications management, preoperative use of aspirin may also increase the blood loss perioperatively or influence the wound healing after surgery.⁸ A systematic review and meta-analysis which included six observational studies found preoperative use of aspirin before the surgery could increase the risk of bleeding when compared with planned short-term discontinuation of aspirin.¹⁰ In a cohort of 982 patients who underwent joint arthroplasty, the risk of wound complication was significantly higher with aspirin (12.3%) when compared with direct oral anticoagulants group (4.2%) in venous thromboembolism prophylaxis postoperatively.¹¹ For the perioperative risk, guidelines of the American Academy of Orthopedic Surgeons (AAOS) recommended to stop anti-platelet therapy prior to undergoing elective knee replacement surgery (moderate recommendation grade).¹² Safety of preoperative use of aspirin during the perioperative period of TKA remains controversial.

To the best of our knowledge, published studies regarding perioperative aspirin use in TKA were limited and had some limitations. First, there were significant differences in demographic and surgical characteristics of the patients in some studies, such as age, BMI, and comorbidity, which led to bias in the comparisons.^{13,16} Second, some studies did not analyze the complication events which were important outcomes to evaluate the perioperative safety of aspirin.^{13,14} Third, most of the studies did not include bilateral TKA cases in the analysis. However, preoperative aspirin use in bilateral TKAs might have higher risks of blood loss and complication rate because of the longer surgical time and greater trauma, so that it was necessary to analyze the risk of bilateral TKAs.^{13–16} Therefore, the present study intended to include both unilateral and bilateral TKAs and tried to use a nested case–control design to achieve a more convinced result. The aims of this study were: (i) to compare the blood

loss, transfusion rates, postoperative HGB and HCT between the aspirin and non-aspirin group; and (ii) to evaluate the risk of vascular related complication and wound complication of the aspirin and non-aspirin group.

Materials and Methods

Study Design

The present study retrospectively reviewed the TKA cases from the Joint Arthroplasty Database at the Peking Union Medical College Hospital from January 2014 to December 2019. This study was approved by the Research and Ethics Institutional Committee of Peking Union Medical College Hospital (2020-S-K1358) and performed in accordance with the relevant guidelines and regulations.

The inclusion criteria were: (i) patients undertook primary unilateral TKA or bilateral TKA simultaneously without undergoing other surgeries in one admission and the main orthopedic diagnosis of the patients should be primary osteoarthritis; (ii) patients took aspirin routinely before the TKA procedure; (iii) patients had comorbidity or history which indicated risk of vascular events according to the American College of Cardiology (ACC)/American Heart Association (AHA) guidelines, such as diabetes, stroke, heart failure, valvular diseases, coronary artery diseases (CAD), and certain arrhythmias including ventricular arrhythmias, supraventricular arrhythmias, high-grade atrioventricular block and atrial fibrillation;¹⁷ and (iv) blood loss, transfusion, drainage volume and complication should be recorded while hemoglobin (HGB) and hematocrit (HCT) should be tested before the surgery and at the first, second, third, fifth day after the surgery (POD 1, 2, 3, 5). In all included cases, tranexamic acid was administered intravenously during surgery as routine and tourniquet and drainage were also used after surgery. All included cases followed the standard rehabilitation schedule and thrombosis prevention program, including ankle flexion and extension, compression stockings and anticoagulation plan (low molecular heparin after surgery for 4 days and Rivaroxaban for 10 days, then continue to take aspirin if needed). We excluded patients with connective tissue diseases, cancers, blood diseases or using medications that may influence blood test results other than aspirin.^{18,19} Cases were reviewed by two authors independently. The cases which had disagreement were screened by the third author to determine whether the cases were included or not. The included patients were categorized into aspirin group or non-aspirin group based on the use of aspirin preoperatively.

Data Extraction

The following patient information were extracted from medical records: demographic characteristics including age, sex, and BMI; medical conditions including knee deformity, and comorbidities; tobacco and alcohol use; surgical data including sides, anesthesia, implant type and tourniquet time. The primary outcome was bleeding risk, including blood loss and transfusion during the surgery, drainage, transfusion after

the surgery, HGB and HCT value before the surgery and at POD 1, 2, 3, 5. The secondary outcomes were complications classified as cardiovascular events, venous thromboembolic events, cerebrovascular events and wound events. The follow-up was 1 year after surgery. All data were extracted by two authors independently and supervised by a third author to guarantee the accuracy.

Statistical Analysis

Continuous variables were presented as mean and standard deviation (SD). For normally distributed continuous variables, the Student's unpaired *t*-test was used to compare the differences between the two groups. For nonparametric variables, the Mann-Whitney U-test was used to compare the differences between the two groups. Categorical variables were presented as number and percentage, and compared using chi-square test or Fisher's exact test when appropriate. A *P*-value less than 0.05 was considered as statistically significant difference, and all tests were two-sided. Data were analyzed using SPSS version 23.0 (IBM Corp., Armonk, NY, USA).

Results

Demographic and Surgical Characteristics

From 2748 patients who undertook TKA in our hospital between January 2014 to December 2019, 560 patients with unilateral TKA and 285 patients with bilateral TKA were selected following the inclusion and exclusion criteria. The concordance rates between two observers were 97.51% (824/845). Among these, 180 unilateral TKA patients and 100 bilateral TKA patients used aspirin preoperatively (Fig. Fig. 1). Of the patients using aspirin, 226 (80.71%) took 100 mg daily and 54 (19.29%) took 75 mg daily. The average length of time was 4.99 ± 3.51 years. One hundred fifty-seven patients, 157 (56.07%) used aspirin for primary prevention of thromboembolic events in high

risk people (such as patients with coronary artery disease), and 123 (43.93%) for secondary prevention (preventing recurrence of thromboembolic events, including those who underwent the endovascular stent surgery or cardiac valve replacement).

For demographic characteristics and medical conditions, there were no significant differences between the aspirin and non-aspirin group regarding age, sex, BMI, knee deformity and tobacco/alcohol use in both unilateral and bilateral TKAs ($P > 0.05$). In terms of comorbidities, the aspirin group had higher a proportion of CAD ($P < 0.01$) than the control group. No significant differences were detected in the proportions of hypertension, diabetes, stroke or arrhythmia between the aspirin and non-aspirin groups in both unilateral and bilateral TKAs ($P > 0.05$) (Table 1). For surgical characteristics, there were no significant differences in anesthesia, implant types or tourniquet time, either ($P > 0.05$) (Table 2).

Primary Outcomes

Blood loss in the surgery was similar between the aspirin and non-aspirin group in both unilateral and bilateral TKAs (63.88 mL vs. 63.94 mL for unilateral TKAs, and 115.45 mL vs. 110.79 mL for bilateral TKAs, both $P > 0.05$). There were no significant differences on drainage volume between the two groups in unilateral TKAs (229.17mL vs. 211.28mL, $P > 0.05$), while drainage volume of the aspirin group was significant higher in bilateral TKAs (456.21 mL vs. 402.54 mL, $P < 0.05$). In comparison of transfusion rates, neither of the groups had transfusions during unilateral TKAs and there was no significant difference in transfusion rates during bilateral TKAs (3.00% vs. 2.70%, $P > 0.05$). The transfusion rates after the surgeries did not show any significant differences either (4.44% vs. 4.74% for unilateral TKAs, and 11.00% vs. 10.27% for bilateral TKAs, both P s > 0.05) (Table 3).

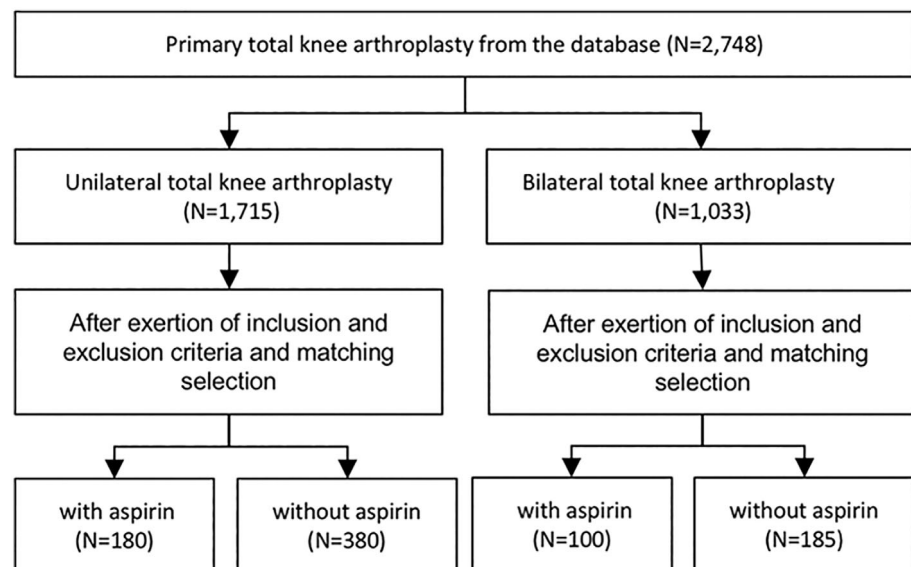


Fig. 1 Flowchart of the study participants.

TABLE 1 Demographic and medical conditions of the included patients

	Unilateral TKA (N = 560)				Bilateral TKA (N = 285)			
	Aspirin	Non-aspirin	TS	P	Aspirin	Non-aspirin	TS	P
Number	180	380	–	–	100	185	–	–
Age (years)	70.39 (5.94)	69.62 (6.54)	1.339	0.181	68.84 (7.93)	68.75 (6.74)	0.096	0.923
Sex								
Female	136 (75.56)	285 (75.00)	0.020	0.887	78 (78.00)	139 (75.14)	0.293	0.588
Male	44 (24.44)	95 (25.00)	–	–	22 (22.00)	46 (24.86)	–	–
BMI (Kg/m ²)	27.78 (3.21)	27.82 (4.03)	–0.127	0.899	27.40 (2.17)	27.31 (3.40)	0.049	0.961
Knee deformity	47 (26.11)	94(24.74)	0.122	0.726	26 (26.00)	47 (25.41)	0.012	0.913
Comorbidity								
Hypertension	143 (79.44)	279 (73.42)	2.386	0.122	66 (66.00)	133 (71.89)	1.069	0.301
Diabetes	58 (32.22)	148 (38.94)	2.376	0.123	30 (30.00)	73 (39.46)	2.517	0.113
CAD	86 (46.24)	126 (33.16)	11.097	0.001	51 (51.00)	50 (27.03)	16.305	<0.001
Stroke*	42 (23.33)	73 (19.21)	1.272	0.259	11 (11.00)	29 (15.68)	1.176	0.278
Arrhythmia	25 (13.89)	36 (9.47)	2.453	0.117	8 (8.00)	7 (3.78)	2.314	0.128
Tobacco use	15 (8.33)	33 (8.69)	0.019	0.890	7 (7.00)	21 (9.72)	1.387	0.239
Alcohol use	9 (5.00)	26 (6.84)	0.707	0.400	5 (5.00)	7 (3.78)	0.032	0.858

Abbreviations: BMI: Body mass index; CAD: Coronary artery disease; TS: test statistic.; Notes: Values are given as the mean, with the standard deviation in parentheses (Age, BMI); Values are given as the number of patients, with the percentage in parentheses (Sex, knee deformity, comorbidity, tobacco use and alcohol use); * Include transient ischemic attack.

TABLE 2 Surgical characteristics of the included patients

	Unilateral TKA (N = 560)				Bilateral TKA (N = 285)			
	Aspirin	Non-aspirin	TS	P	Aspirin	Non-aspirin	TS	P
Anesthesia								
General	170 (94.44)	344 (90.53)	2.487	0.115	99 (99.00)	180 (97.30)	0.274	0.601
Spinal	10 (5.56)	36 (9.47)	–	–	1 (1.00)	5 (2.70)	–	–
Implant style								
PS	135 (75.00)	298 (78.42)	0.815	0.367	94 (94.00)	173 (93.51)	0.026	0.872
CR	45 (25.00)	82 (21.58)	–	–	6 (6.00)	12 (6.49)	–	–
Tourniquet time*	81.02 (12.93)	81.97 (14.50)	–0.780	0.436	82.57 (13.18)	80.70 (17.98)	1.002	0.317

Abbreviations: CR, Cruciate retention; PS, Posterior stabilization; LCCK, Legacy constrained condylar knee; TS: test statistic.; Notes: Values are given as the mean, with the standard deviation in parentheses (Tourniquet time); Values are given as the number of patients, with the percentage in parentheses (Anesthesia, implant type); * Tourniquet time for one side.

TABLE 3 Comparisons of blood loss, drainage and transfusion rate between the aspirin and non-aspirin group

	Unilateral TKA (N = 560)				Bilateral TKA (N = 285)			
	Aspirin	Non-aspirin	TS	P	Aspirin	Non-aspirin	TS	P
Blood loss during the surgery	63.88 (30.85)	63.94 (39.13)	–0.018	0.986	115.45 (60.21)	110.79 (38.48)	0.700	0.485
Transfusion during the surgery	0 (0.00)	0 (0.00)	–	–	3 (3.00)	5 (2.70)	0.000	1.000
Drainage	229.17 (150.24)	211.28 (135.36)	0.358	0.176	456.21 (230.14)	402.54 (201.88)	2.038	0.043
Transfusion after the surgery	8 (4.44)	18 (4.74)	0.024	0.878	11 (11.00)	19 (10.27)	0.037	0.848

Abbreviations: Blood loss, Blood loss during the surgery; TS, test statistic.; Notes: Values are given as the mean, with the standard deviation in parentheses (Tourniquet time); Values are given as the number of patients, with the percentage in parentheses (Anesthesia, implant type)

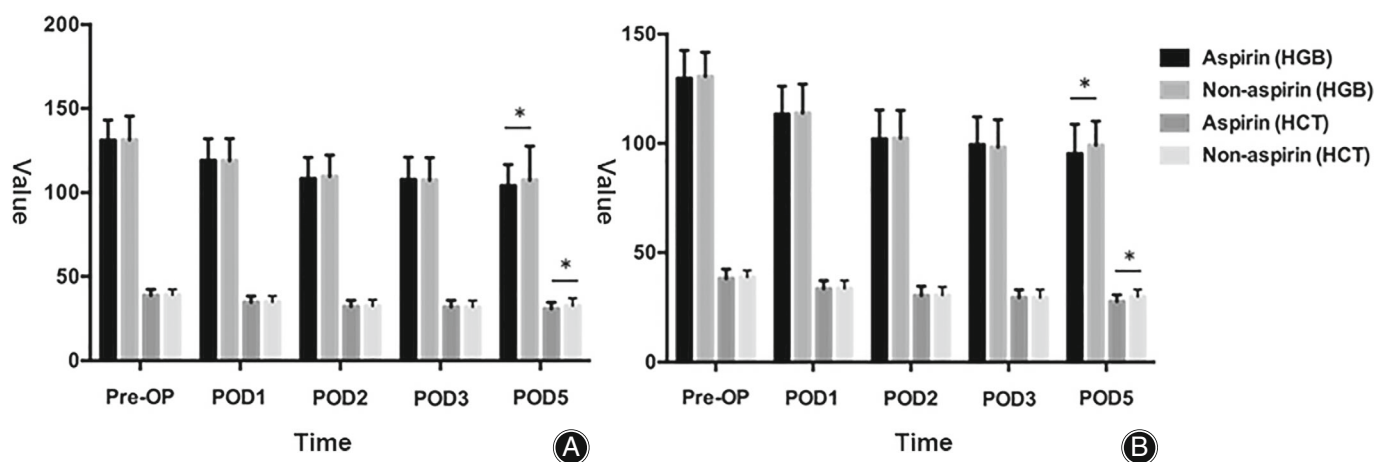


Fig. 2 Perioperative HGB and HCT levels of TKA patients in aspirin group and non-aspirin group. (A) Perioperative HGB and HCT levels of unilateral TKA patients. (B) Perioperative HGB and HCT levels of bilateral TKA patients. HGB, hemoglobin (g/L); HCT, hematocrit (%); POD, postoperative day. (* $P < 0.05$).

TABLE 4 Comparisons of complication rate between the aspirin and non-aspirin group

	Unilateral TKA (N = 560)				Bilateral TKA (N = 285)			
	Aspirin	Non-aspirin	TS	P	Aspirin	Non-aspirin	TS	P
Complications*	11 (6.11)	37 (9.74)	2.049	0.152	8 (8.00)	18 (9.73)	0.234	0.628
Vascular related	6 (3.33)	30 (7.89)	4.225	0.040	6 (6.00)	16 (8.65)	0.639	0.424
Wound related	4 (2.22)	3 (0.79)	1.036	0.309	2 (2.00)	1 (0.54)	0.296	0.586
Total events [†]	11	40	–	–	9	19	–	–
Cardiac events	2 (18.18)	10 (25.00)	0.005	0.944	2 (22.22)	5 (26.32)	0.000	1.000
Cerebrovascular events	1 (9.09)	5 (12.50)	0.000	1.000	1 (11.11)	3 (15.79)	0.000	1.000
VTE events	3 (27.27)	17 (42.50)	0.322	0.570	4 (44.44)	8 (42.11)	0.000	1.000
Wound events	4 (36.36)	3 (7.50)	3.877	0.049	2 (22.22)	1 (5.26)	–	0.234
Others [‡]	1 (9.09)	5 (12.50)	0.000	1.000	0 (0.00)	2 (10.53)	–	–
Length of stay	10.93 (4.93)	10.98 (5.50)	–0.108	0.914	11.55 (4.64)	11.99 (4.66)	–0.762	0.447

TS, test statistic; VTE, venous thromboembolism, including venous thromboembolism and pulmonary thromboembolism.; Notes: Values are given as the mean, with the standard deviation in parentheses (Length of stay).; Values are given as the number of patients, with the percentage in parentheses (Complications).; *Complications were counted by patients.; [†] Different events were counted by cases.; [‡] Include infection and implant related complication.

HGB and HCT before the surgeries were not different in the two groups for both unilateral and bilateral TKAs ($P > 0.05$). For the HGB and HCT levels after surgery, the results showed that there were no significant differences between the aspirin and non-aspirin groups at POD 1, 2, 3 in both unilateral and bilateral TKAs ($P > 0.05$), while the HGB and HCT levels in the aspirin group were significant lower at POD5, not only in unilateral TKAs (104.15g/L vs. 107.49g/L for HGB, and 30.89% vs. 32.70% for HCT, both $P < 0.05$), but also in bilateral TKAs (95.39g/L vs. 99.18g/L for HGB, and 27.79% vs. 29.91% for HCT, both $P < 0.05$) (Fig. Fig. 2).

Subgroup analysis based on different types of prosthesis (PS or CR) were also performed in both aspirin and non-aspirin group. As a result, there were no significant differences between the two kinds of prosthesis in the aspects of

blood loss, transfusion rate, postoperative HGB and HCT (Table S1).

Secondary Outcomes

In the comparison of complication rates, there were no significant differences between the aspirin group and non-aspirin group in both unilateral and bilateral TKAs (6.11% vs. 9.74% for unilateral TKAs, and 8.00% vs. 9.73% for bilateral TKAs, both $P > 0.05$). For vascular related complications (including cardiovascular events, VTE events and cerebrovascular events), the rate was 3.33% for the aspirin group, which was significantly lower than that of the non-aspirin group (7.89%, $P < 0.05$). No significant difference was found in bilateral TKA series (6.00% vs. 8.65%, $P > 0.05$). For the rates of wound complication, there were no significant differences between the two groups (2.22% vs. 0.79% for unilateral

TKA, and 2.00% vs. 0.54% for bilateral TKA, both P s > 0.05).

The proportions of various complications were also compared, including cardiovascular events, cerebrovascular events, VTE events, wound events and others. In unilateral TKAs, the proportion of wound events of the aspirin group was significantly higher than that of the non-aspirin group (36.36% vs. 7.50%, $P < 0.05$), while other rates were similar ($P > 0.05$). For bilateral TKAs, no significant differences were found between the two groups ($P > 0.05$). Although the complication rates were different, the length of stay between the two groups in unilateral and bilateral TKAs had no significant differences (10.93 d vs. 10.98 d for unilateral TKA, and 11.55d vs. 11.99d for bilateral TKA, both P s > 0.05) (Table 4).

Then, the complication rates and proportions of various complications were compared between unilateral and bilateral TKAs in both aspirin and non-aspirin group. As a result, bilateral TKAs did not have higher risk of complications, even in the aspirin group ($p > 0.05$). And the proportions of various complications in bilateral TKAs did not have significant differences when compared with unilateral TKAs (Table S1).

Discussion

Our data from a well-match case-control study of 845 patients undergoing unilateral or bilateral TKA showed that preoperative use of aspirin did not increase the transfusion rates in both unilateral and bilateral TKAs, but might lead to more blood loss, especially in bilateral cases. For the complications, preoperative aspirin use was associated with less vascular related complications but more wound complications in the perioperative period.

Bias Reduction in Study Design

The safety of preoperative use of aspirin during the perioperative period of TKA remains controversial. There have been some studies investigated this topic in recent years, but with various limitations.¹³⁻²⁰ In order to reduce bias, strict inclusion and exclusion criteria were applied. TKA had various indications, including osteoarthritis, rheumatoid arthritis (RA), hemophilic arthritis (HA) and other joint diseases. Among these, osteoarthritis is the leading cause and closely related with aging.^{6,21} For the consistency of age and joint diseases, only osteoarthritis patients in our database were included. Then, patients with risk of vascular events according to the ACC/AHA guidelines were selected from osteoarthritis patients to guarantee the consistency between aspirin group and control group.¹⁷ In order to decrease the bias in blood loss estimation, all included cases used tourniquet and drainage. As a result, the demographic and surgical characteristics between the two groups were largely comparable. There were no differences in age, sex, BMI, knee deformity, tobacco/alcohol use, anesthesia or implant type. However, there was a difference in the proportions of CAD

due to the selection bias by aspirin use which was hard to eliminate.^{11,22}

Bleeding Risk of Aspirin Use

During the procedures of TKA, it needs multiple osteotomies and has a large cancellous bone cutting surface which would cause relatively high blood loss. It was reported that the total blood loss could reach to 1000 mL in unilateral TKA, and it would be more in bilateral TKAs.^{20,23} To evaluate the bleeding risk, various indicators were measured, including blood loss and transfusion rate during the surgery, drainage and transfusion rate after the surgery, HGB and HCT change during the perioperative period. Although the blood loss during the surgery (with tourniquet) and transfusion rates were similar, the drainage volume was higher in the aspirin group than the non-aspirin group, especially in bilateral TKAs (17 mL higher in unilateral TKAs and 54 mL higher in bilateral TKAs). It was also reflected in the HGB and HCT levels after surgery, both of them were significantly lower in the aspirin group at POD5. In the study conducted by Chen *et al.*, calculated blood loss, transfusion amounts, and percentage of transfused patients were found to be significantly higher in unilateral TKA patients on preoperative aspirin use, which showed higher risk than that of the present study. However, this may result from the different perioperative blood management, such as the use of tranexamic acid.¹⁶ The study conducted by Schwab *et al.* achieved similar results with decreased HGB value in aspirin use group.¹³ All in all, the above results concluded that the bleeding risk of preoperative aspirin use could not be ignored.

As TKA with PS prosthesis (had a box for the cam-post) may increase the blood loss, the subgroup analysis based on different types of prosthesis were performed in both aspirin and non-aspirin group.²⁴ However, there were no significant differences between the PS and CR prosthesis.

Complication Risk of Aspirin Use

Aspirin may also influence the complication rate during the perioperative period of TKA. First, aspirin could reduce the risk of cardiovascular and thromboembolic events.^{11,22} In a previous study, decreased risk of cardiac complications was found in the patients who took aspirin perioperatively.¹⁵ In the present study, after matching the vascular risk of the two groups under the ACC/AHA guidelines, we found the rate of vascular related complications (including cardiovascular events, VTE events and cerebrovascular events) in the aspirin group decreased significantly in unilateral TKAs. It indicated that aspirin played a protective role for vascular disease in the perioperative period.

However, aspirin may increase the risk of wound complications of TKA. The soft tissue around the TKA incision is relatively weak so that it is vulnerable to various factors, such as intra-articular hemorrhage and bleeding in incision edges.²⁵ It was found that TKA with continued aspirin more frequently showed marked knee swelling after 1 week than those discontinuing aspirin.¹⁵ And in the HA patients who

had coagulation disorder, the wound complication rate was much higher than the patients without coagulation disorder.^{26,27} Whether the use of aspirin could influence wound healing in TKA should be considered. In the present study, we compared the rate of wound complication between the two groups. Although there were no significant differences in the complication rate, wound events occupied a significant higher proportion in complications of the aspirin group than that of the non-aspirin group (36.36% vs. 7.50%). Among the four wound events of the aspirin group, one was a surgical site infection and others were poor wound healing, which indicated the aspirin use might affect the wound healing. It drew attention regarding adverse effects of aspirin usage on wound healing, especially for patients with high risk of wound events, such as those with RA or post-traumatic arthritis.^{18,28}

Whether bilateral TKA had higher risk of complications under preoperative use of aspirin remains unknown. In the present study, complication rates and proportions of various complications were compared between unilateral and bilateral TKAs in both the aspirin and non-aspirin groups. As a result, bilateral TKA did not have higher risk of complications, even in aspirin group.

Limitations

The present study thoroughly evaluated the bleeding risk and complication rate under preoperative use of aspirin in both unilateral and bilateral TKA. It is also a relatively large study which included 280 patients who used aspirin during the perioperative period.^{13–16} However, it also had some limitations. The main limitation of the present study was the retrospective design and all the data were extracted from medical records which might result in some errors. Furthermore, this study had a limited sample size which might lead to bias in the comparisons of complication rates. There was also a difference in the demographic characteristics between the two groups though the strict inclusion and exclusion criteria were used. The findings in the present study need to be validated by future prospective studies with an adequate sample size and better consistency between the groups. And for preoperative use of aspirin, an assessment tool should be developed to balance the benefit of vascular related complications prevention with risk of blood loss and wound complications, especially for bilateral TKAs. It is

meaningful to provide an accurate guideline for patients taking aspirin before TKA and other orthopedic surgeries.

Conclusion

Based on the results of this well-matched case-control study, preoperative use of aspirin did not increase the blood loss and transfusion rate in unilateral TKAs. However, use of aspirin might lead to more blood loss in bilateral TKA cases without increased transfusion rate. In the aspects of perioperative complications, though preoperative aspirin use could prevent vascular related complications, the risk of wound complications should be considered, especially in patients at high risk.

Authors' Contribution

Xisheng Weng and Zeng Li designed the study. Zeng Li, Shuai Xiang and Bin Feng performed data acquisition. Yan Du and Mo Zhang performed statistical analyses. Zeng Li and Shuai Xiang drafted the manuscript. Xisheng Weng and Bin Feng revised the manuscript critically. All authors reviewed and approved the final manuscript.

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Supporting Information

Additional Supporting Information may be found in the online version of this article on the publisher's web-site:

Table S1 Comparisons of blood loss, drainage, transfusion rate, perioperative HGB and HCT between the PS and CR group

Table S2 Comparisons of complication rate between the unilateral and bilateral TKAs

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