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Original article

Impact of atrial fibrillation on postoperative outcomes after total knee arthroplasty–A retrospective study

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ABSTRACT

Background: Total knee arthroplasty (TKA) is primarily preformed among the elderly population who is commonly affected by cardiovascular and cerebrovascular diseases. Atrial fibrillation (AF) is a very common heart disease and its prevalence increases significantly with age. Therefore, we decided to evaluate the outcomes of patients with AF following TKA and analyze the risk factors of AF patients who underwent postoperative complication.

Methods: We designed a retrospective cohort study using data from three institutions in China. We evaluated a total of 453 AF patients who received primary TKA and 453 matched control patients. Comparisons of specific parameters between AF and non-AF cohorts were performed.

Results: Our results demonstrated that AF patients had significantly higher odds of more intraoperative bleeding, periprosthetic joint infection (PJI), post-operative cerebral stroke (POCS), post-operative cardiovascular events (POCE) and worse SF-36 physical component score and mental score at mean 24-month after surgery, but had no increased incidence of post-operative gastrointestinal events, DVT and PE in comparison to patients without AF than those without AF disease. Additionally, multivariate logistic regression analysis was used to identify risk factors of patients who underwent severe complication. Smoking, diabetes mellitus and persistent AF were common risk factors of PJI, POCS, and POCE. Heart rate > 70/min and absence of Beta blocker use were common risk factors of POCS and POCE. Absence of LMWH bridging was risk factor of POCS. BMI >25 kg/m2 and hypertension were risk factors of POCE.

Conclusions: These findings should be taken into consideration when discussing the expected outcomes of AF patients after TKA. AF disease impaired SF-36 physical component score (PCS) and mental component score (MCS) of patient after TKA.

1. Introduction

Total knee arthroplasty (TKA) is the most common type of arthroplastic surgery, with more than 700,000 procedures conducted worldwide in 2008 and 3.5 million procedures projected to be performed worldwide in 2030 [1]. As it is considered a safe orthopedic surgery, a particular population simultaneously affected with other diseases may instead achieve an unsatisfactory outcome, which is associated with immediate or short-term complications after surgery [2,3]. This surgery is primarily performed among the elderly population who is commonly affected by cardiovascular and cerebrovascular diseases [2,3]. The impact of cardiovascular diseases, such as heart failure (HF) and coronary heart disease (CHD), on the outcomes after TKA has been previously assessed [2–4]. These diseases have an impact against satisfactory recovery. Accordingly, it is important to investigate specific outcomes of a different subset of patients affected with different common diseases in order to be able to discuss expected outcomes following TKA.

Atrial fibrillation (AF) is a very common arrhythmia and its prevalence increases significantly with age [5–7]. By the year 2050, the number of patients with AF in United States is expected to increase to almost 8 million [6,7]. We all know that AF patients need

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to receive chronic anticoagulation therapy to decrease the risk of a thrombotic event, which is lifelong for most individuals with this disease [8,9]. This can lead to a rise in blood loss and thrombotic events such as cerebrovascular accident during perioperative period when they undergo surgery [7,8,10]. Additionally, it is desirable to investigate the risk factors of unsatisfactory outcomes for patients with AF, because it could help provide individualized advice on their recovery.

To the best of our knowledge, there are few studies that have assessed the impact of AF on the outcomes after TKA [10]. Additionally, risk factors of AF patients with periprosthetic joint infection (PJI), post-operative cerebral stroke (POCS) and post-operative cardiovascular events (POCE, including death; acute myocardial infarction; unstable angina; ventricular tachycardia; or HF) are not clear yet. We are of interest to investigate whether clinical characteristics related to AF, like AF type, anticoagulation protocol and bridging therapy, etc can affect postoperative outcomes. Accordingly, the main purpose of present study was to assess the association of AF with postoperative outcomes and the risk factors of unsatisfactory outcomes for patients with AF. We hypothesized that AF will be independently associated with higher odds of post-operative complication and less quality of life after primary TKA. In addition, AF type, anticoagulation protocol and bridging therapy were risk factors of AF patients with unsatisfactory results.

2. Materials and methods

2.1. Study design and patients

This was a retrospective study based on data provided by three institutions and designed by a professor specialized in orthopedics and a professor specialized in cardiology [*]. The study was approved by the ethics committee of the 252 hospital of the Chinese PLA, Shanghai Hospital of Traditional Chinese Medicine, and Affiliated Hospital of Hebei University (No. Orth-C-2011-11) and was performed in accordance with the Declaration of Helsinki. Patients provided their written informed consent to this study. Between May 2008 and May 2013, a total of 1098 TKAs were performed during this period. 192 patients were excluded. 453 consecutive patients with AF who accepted primary TKA were admitted in the 3 hospitals and 453 matched patients without AF were included as controls. All patients were followed up for a mean duration of 2 years after TKA (range: 18.5–24.5 months). The patients with AF disease were required to have medical evidence of AF prior to TKA. Patients were diagnosed by three cardiologists to determine whether the patients had either paroxysmal (lasting $\leq$ 7 days at any time) or persistent AF (>7 days at a time); no other AF types were considered as choices in this study. The following patients were excluded from the study in order to analyze a well homogeneous population: patients with a history of other heart diseases, cerebral stroke, cardiovascular events (including acute myocardial infarction, unstable angina, ventricular tachycardia, or HF) prior to TKA and died after surgery; patients who were rehospitalized with reasons except PJI, POCE and POCS; patients using 2 and above anticoagulants before and after surgery; patients with ASA (American Society of Anesthesiologists) grades III/IV/V; patients who failed to be kept follow-up by phone.

2.2. Database

The Data was obtained from those recorded in the Joint Replacement Registry System by three institutions and included the following: data on demographics (age, gender), body mass index (BMI), diagnosis, AF type, intra- and post-operative blood loss, transfusion, incision problem, periprosthetic joint infection (PJI), anticoagulation method, post-operative cerebral stroke (POCS), post-operative cardiovascular events (POCE, including death; acute myocardial infarction; unstable angina; ventricular tachycardia; or HF), pre- and postoperative Short Form 36 (SF-36) score, and the length of stay in the hospital and readmission rate within 2 years after surgery. Demographic data and baseline information are detailed in Table 1. Before admission, the patients with AF included in this study were given a definite diagnosis and received standard treatment by three experienced cardiologists according to the diagnostic criteria as described by the Diagnostic and Statistical Manual IV diagnostic criteria [10]. Considering that patients with AF usually need to take beta blocker use in order to control heart rate (HR), we recorded it to indirectly reflect AF status at a certain level. Beta blocker use in our study refers to the use of 3 months and above before TKA. We collected data on quality of life by the Short Form (SF)-36. The questionnaire was administered to patients at the mean 2-year time-point after surgery by phone. Total blood loss was calculated based on the sum of intraoperative blood loss, post-operative drainage amount and hidden blood loss. Specifically, the hidden blood loss was calculated according to the Sehat-designed mathematical method [11]. The transfusion criteria was hemoglobin less than 80 g/L or patients with symptomatic anemia [10,12]. The primary outcome in this study was the SF-36 score recorded at the mean 2-year time-point after surgery.

2.3. Surgery

Epidural anesthesia was used for TKA. The TKA surgeries in this study were performed by three experienced teams in the respective hospital. Cemented cruciate-retaining prosthesis (Gemini MK-II, Link, Germany) with patellar resurfacing was used for all patients in this study. The recollected blood was filtered and washed in the recovery room and then retransfused into the patient within 12 h. We usually stopped the bleeding in the articular cavity and then closed skin incisions after deflating the tourniquet. The patients received a pain-control regimen, including fentanyl delivered via

Table 1
Pre-, intra-, and post-operative clinical characteristics according to atrial firillation following cardiac surgery.

Clinical characteristics	AF patients (n = 453)	Non-AF patients (n = 453)	P value
Preoperative characteristics			
Age(>65)	343	320	0.0990
Gender (female)	67	72	0.7123
Smoking	48	60	0.2594
BMI > 25 kg/m2	212	220	0.6415
Hypertension	189	200	0.5021
Diabetes mellitus	198	210	0.4626
COPD	23	31	0.3260
Heart rated > 70/min	250	325	<0.0001[a]
patients with Anesthesiologists grades I/II	398	412	0.1605
AF type (paroxysmal/persistent)	96/357	–	–
Anticoagulants type			
Warfarin	352	–	–
Rivaroxaban	85	–	–
Dabigatran	16	–	–
LMWH bridging (yes/no)	212/241	–	–
Intraoperative characteristics			
Surgery time (min)	58.2 ± 9.5	57.5 ± 9.8	0.2753
Tourniquet time (min)	35.8 ± 8.5	34.8 ± 8.0	0.0686
Postoperative characteristics			
Absence of Regular Beta blocker use	75	388	0.0008[a]

COPD chronic obstructive pulmonary disease; PJI periprosthetic joint infection; POCS post-operative cerebral stroke; LMWH low-molecular-weight heparin; POCE post-operative cardiovascular events.

[a] Significant difference between group.

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