Original Article

History of previous knee surgery does not affect the clinical outcomes of primary total knee arthroplasty in an Asian population

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Background: Patients with a history of previous knee surgeries, such as anterior cruciate ligament reconstruction (ACLR) and high tibial osteotomy (HTO), often have a higher likelihood of requiring a subsequent total knee arthroplasty (TKA). However, there is relatively limited data, especially in the Asian population, on how previous knee surgery could affect the clinical outcomes of TKA. Therefore, this study aims to evaluate the impact of previous knee surgeries on the clinical outcomes of future TKA.

Methods: We reviewed the prospectively-collected data of 303 patients who underwent TKA by a single surgeon from a total joint registry of a tertiary hospital over a period of 5 years. Those with a history of previous knee surgery were identified. The SF-36 Health Survey, Oxford Knee Score (OKS) and Knee Society Score (KSS) were used to evaluate clinical outcomes pre-operatively, at 6 months and 2 years.

Results: Previous knee surgery did not have a significant impact on the patients' pre-operative baseline clinical scores and body mass index (BMI). Patients with a history of knee surgery undergo TKA at a significantly younger age (mean of 6.6 years younger). On follow-up, patients with a history of knee surgery have similar post-operative outcome scores as those without previous knee surgery. Also, a high proportion of these patients are satisfied with their post-operative results and feel that their expectations have been met.

Conclusions: Patients with previous knee surgery had TKA at a significantly younger age than those without. But these patients have similar clinical and quality of life outcomes after TKA. In addition, a high proportion of these patients are satisfied with the results of surgery and feel that their expectations of TKA are met. This is important for clinicians when counselling patients pre-operatively.

Keywords: Primary total knee arthroplasty (TKA); previous knee surgery; clinical outcomes; satisfaction

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Introduction

With the increasing number of knee surgeries performed for patients, it is likely that patients presenting for total knee arthroplasty (TKA) have had previous knee surgeries and certain knee surgeries, such as anterior cruciate ligament reconstruction (ACLR) and high tibial osteotomy (HTO), which will result in a higher likelihood of requiring future TKA (1-4). However, there is relatively limited data in current literature on how previous knee surgery could affect the age at which TKA is performed, as well as the outcomes of TKA (5) in an Asian population. These are clinically significant questions, as patients often enquire about the risks of TKA following a history of previous knee surgery.

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Therefore, this study aims to evaluate the impact of previous knee surgeries on the timing and clinical outcomes of future TKA. Parameters assessed include patients' age, post-operative clinical outcomes, quality of life and patient-reported satisfaction in those who have a history of knee surgery, as compared to those without a history of knee surgery. We hypothesize that patients with a history of knee surgery will undergo TKA at a significantly younger age as compared to those without a history of knee surgery, but they should have similar post-operative clinical outcomes.

Methods

Study design

This study was performed at Singapore General Hospital, Singapore, Republic of Singapore. Centralized Institutional Review Board approval was obtained for this study (CIRB 2015/2626). We retrospectively analyzed prospectively-collected data from a total joint registry of a tertiary hospital of patients who underwent primary TKA by a single senior surgeon over a 5-year period between January 2007 and December 2012, with a minimum of 2 years follow-up. Patients with a diagnosis of contralateral TKA, revision TKA and inflammatory arthroplasty were excluded from the study to limit the number of intra- and post-operative variables. All patients included in the study underwent TKA for symptomatic knee pain caused by osteoarthritis of the knee, which has failed conservative management. All patients were placed on a standardized post-operative clinical pathway for arthroplasty surgery and underwent supervised physical therapy post-operatively by trained physiotherapists.

Patient metrics

The patient's age, gender, body mass index (BMI) and any history of previous knee surgeries were evaluated at the time of TKA. Information regarding the nature of the previous knee surgery was obtained from the patients' medical records and intra-operative notes. The time interval between the previous knee surgery and current TKA was also recorded for all patients. Clinical parameters were assessed pre-operatively and post-operatively at 6 months and 2 years. Patient-reported outcome measures were assessed using a self-administered patient questionnaire containing the SF-36 Health Survey, Oxford Knee Score (OKS), and Knee Society Score (KSS), so as to evaluate the impact of TKA pre-operatively and at 6 months and 2 years follow-up. The KSS was further stratified into a functional component (KSS-functional score), which includes ability to walk distances and climb up and down stairs, and a objective component (KSS-objective score), which includes pain, range of motion, stability and alignment.

We also evaluated patients' opinions as to whether the surgery met their expectations and whether they were satisfied with the results of their surgery, using two questions adopted from the validated North American Spine Society (NASS) questionnaire. The two questions were (I) "*Has the surgery met your expectations so far?*" and (II) "*How would you rate the overall results of surgery?*". For question 1, patients had the choice of selecting from the following answers: (I) yes, totally; (II) yes, almost totally; (III) yes, quite a bit; (IV) more or less; (V) no, not quite; (VI) no, far from it; or (VII) no, not at all. For question 2, patients had the choice of selecting from the following answers: (I) excellent; (II) very good; (III) good; (IV) fair; (V) poor; or (VI) terrible. Patients were defined as either having their expectations met by their surgeries (responses to question 1 =1–4) or not having their expectations met by their surgeries (responses to question 1 =5–7). Patients were defined as either satisfied (responses to question 2 =1–3) or dissatisfied (responses to question 2 =4–6).

Statistical analysis

A paired *t*-test was used to compare the patients' age at the time of TKA, BMI and clinical outcomes between patients with previous knee surgery and patients without a history of knee surgery. For all analyses, statistical significance was defined as a P value of 0.05 or less. All statistical analysis was performed using SPSS version 21 (SPSS, Inc., Chicago, Illinois, USA) with consultation from biostatisticians.

Results

A total of 303 patients (220 males, 83 females) met the criteria and were included in this study. Of these 303 patients, 29 (9.6%) had a previous history of knee surgery. Pre-operative radiological investigations showed that these 29 patients had Kellgren-Lawrence grade III/IV before their TKA. The most common type of knee surgery performed prior to TKA was arthroscopic partial meniscectomy and chondroplasty (21 patients; 72.4%),

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Table 1 Patient demographics for each group of arthroplasty patients pre-operatively

Patient demographics	TKA with no previous knee surgery	TKA with previous history of surgery	P value
Number of patients	279	29	–
Age	66.10±7.80	61.00±7.51	<0.001*
Gender (male:female)	202 (72.4%):77 (27.6%)	18 (62%):11 (38%)	–
BMI	27.2±4.1	27.0±3.7	0.777
Flexion range of movement (degree)	119±16	121±20	0.605
KSS-functional score	53.7±18.4	61.0±13.8	0.039*
KSS-objective score	37.5±19.4	40.4±16.7	0.431
Oxford Knee Score	34.6±8.0	34.5±7.8	0.998
SF-36 (physical function)	39.4±23.3	45.7±22.1	0.166
SF-36 (role physical)	22.1±36.4	26.7±40.6	0.519
SF-36 (bodily pain)	35.8±18.1	34.1±20.0	0.636
SF-36 (general health)	68.3±19.1	70.3±22.4	0.605
SF-36 (vitality)	67.7±19.6	60.9±28.0	0.210
SF-36 (social functioning)	53.3±33.8	51.7±39.5	0.839
SF-36 (role emotional)	80.0±38.7	69.0±47.1	0.230
SF-36 (mental health)	76.5±15.7	73.7±18.7	0.368

*, P<0.05. TKA, total knee arthroplasty; BMI, body mass index; KSS, Knee Society Score.

followed by HTO (6 patients; 20.7%) and ACLR (2 patients; 6.9%). All patients with a history of knee surgery underwent a standard midline incision and medial parapatellar approach. Patients who had previous HTO had their HTO staples removed during TKA. In addition, those with a history of previous knee surgery, including HTO, did not undergo revision surgeries at follow-up. The patients who had a previous history of ACLR and HTO had a mean interval of 13.5 and 9.2 years respectively before subsequent TKA. Patients who underwent arthroscopic debridement with pre-existing knee osteoarthritis underwent TKA about 4 years post-arthroscopy. There is one patient with a history of meniscectomy at a young age of 33 underwent TKA 30 years post-knee surgery.

The patients' age, gender, pre-operative BMI and clinical parameters are shown in *Table 1*. There was no significant difference in BMI between the two groups of patients (27.0 *vs.* 27.2; P=0.77). The mean time interval from index knee surgery to subsequent TKA is 6.6 and 5.2 years in patients with previous knee arthroscopy with meniscectomy and chondroplasty. At the time of primary TKA, the mean age of patients with a history of knee surgery was significantly younger (61.0±6.2, P=0.0002) than the mean age of those without a history of knee surgery (66.1±7.7).

Pre-operatively, only the KSS-function score was significantly different between the two groups of patients with and without previous history of knee surgery (61.0 *vs.* 53.7; P=0.039). The rest of the clinical scores (flexion range of movement, KSS-knee score, OKS and SF-36) were similar between the two groups (P>0.05).

The same trend is seen at 6 months follow-up, when there was no significant difference between both groups in terms of flexion range of movement, KSS-knee score, SF-36 and OKS (P>0.05), while the KSS-function score remained significantly higher in patients with previous knee surgery (76.8 *vs.* 69.5; P=0.045). This is shown in *Table 2*.

At 2 years follow-up, only SF-36 (physical role functioning) was significantly different between the two groups of patients with and without previous history of knee surgery (58.6 *vs.* 77.6; P=0.038). Those patients without a previous knee surgery had a better SF-36 (physical role functioning) outcome. The remaining clinical outcome

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Table 2 Clinical outcomes for each group of arthroplasty patients at 6 months

Clinical outcomes	TKA with no previous knee surgery	TKA with previous history of surgery	P value
Flexion range of movement (degree)	115±15	118±13	0.290
KSS-functional score	69.5±18.5	76.8±16.1	0.045*
KSS-objective score	82.7±12.1	83.2±11.2	0.841
Oxford Knee Score	20.1±6.2	19.5±5.0	0.584
SF-36 (physical function)	64.9±21.2	70.0±19.7	0.220
SF-36 (role physical)	69.6±39.5	73.2±40.8	0.650
SF-36 (bodily pain)	68.2±23.6	63.5±25.4	0.329
SF-36 (general health)	72.6±19.0	72.1±19.6	0.892
SF-36 (vitality)	72.6±20.0	72.1±19.5	0.909
SF-36 (social functioning)	85.8±27.5	84.3±30.5	0.795
SF-36 (role emotional)	91.6±26.7	94.0±22.3	0.641
SF-36 (mental health)	83.5±15.3	83.0±14.8	0.860

*, P<0.05. TKA, total knee arthroplasty; KSS, Knee Society Score.

Table 3 Clinical outcomes for each group of arthroplasty patients at 2 years

Clinical outcomes	TKA with no previous knee surgery	TKA with previous history of surgery	P value
Flexion range of movement (degree)	118±15	119±17	0.684
KSS-functional score	73.0±19.3	74.7±16.8	0.656
KSS-objective score	84.8±12.6	83.6±14.8	0.637
Oxford Knee Score	18.8±6.1	18.4±5.8	0.732
SF-36 (physical function)	66.9±22.3	66.4±22.4	0.905
SF-36 (role physical)	77.6±36.7	58.6±45.5	0.038*
SF-36 (bodily pain)	72.2±24.9	62.1±25.4	0.060
SF-36 (general health)	71.5±19.7	74.6±21.1	0.425
SF-36 (vitality)	74.3±18.2	72.8±19.5	0.670
SF-36 (social functioning)	90.2±24.4	87.9±24.7	0.636
SF-36 (role emotional)	95.5±19.4	86.2±31.5	0.130
SF-36 (mental health)	84.1±13.7	83.0±13.4	0.682

*, P<0.05. TKA, total knee arthroplasty; KSS, Knee Society Score.

scores for both groups did not show any significant difference (P>0.05). The post-operative clinical outcomes at 2 years are shown in *Table 3*.

In terms of patient-reported satisfaction and expectation scores at 2 years follow-up, 85.7% of patients who had a history of knee surgery reported that they were satisfied with the results of surgery and 92.6% felt that the surgery met their expectations. In patients without a history of knee surgery, 89.2% were satisfied with the results of surgery and 87.4% felt that the surgery met their expectations.

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Discussion

In our study, approximately 10% of patients who underwent TKA had a history of previous knee surgery, of which knee arthroscopy, followed by HTO and ACLR were commonest. This finding corresponds with current literature, in which many studies have shown that the incidence of TKA is increased by previous knee surgery (1,5-10). For ACLR, it is reported that the cumulative incidence of TKA is low at 1.4% (4). However, this incidence is still seven times greater than the general population (4,7-15). Similarly, in a 10-year follow-up study by Wasserstein *et al*. [2014] (11), 7.3% of patients who underwent fracture fixation of the tibial plateau subsequently had a TKA. This corresponds to a 5.3 times increase in likelihood of requiring a TKA as compared to a matched group from the general population. In addition, Brophy *et al*. [2014] (1) reported that 30% of their patients who underwent TKA for osteoarthritis or post-traumatic arthritis had a history of previous knee surgery.

A history of previous knee surgery did not appear to have a significant relationship with pre-operative baseline clinical scores and BMI, as these parameters were relatively similar between the two groups of patients. However, a larger proportion of patients with a history of previous knee surgery in our study were male (62%), which corresponds with the current literature (1). Patients with a history of knee surgery were also shown to undergo TKA at a significantly younger age of 61 years old as compared to those without with a mean interval time of 6.6 years from index knee surgery to subsequent TKA. Patients with a history of knee surgery have a better pre-operative KSS functional score, which could be due to this younger group of patients having greater function pre-operatively. The other pre-operative clinical scores for patients with a history of knee surgery were similar to those without previous knee surgery. This may signify that the former group of patients have developed symptomatic osteoarthritis necessitating TKA at a younger age, as they have relatively similar pre-operative baseline scores as their more elderly counterparts. Having a TKA at a younger age carries its implications, such as the potential need for revision TKA in the future and an overall increase in the demand for TKA in the general population (16-18). Nonetheless, this should not deter patients from undergoing knee surgery when necessary, as the development of osteoarthritis is multifactorial and cannot be solely attributed to a previous surgery. For example, in ACL injuries, concomitant meniscal or chondral injuries, post-operative excessive musculoskeletal loading, high BMI and inadequate strength training can all result in early osteoarthritis (19-21). In our study, patients who underwent previous knee surgery had no reported complications necessitating re-operation or revision surgeries on their follow-up visits (longest follow-up being up to 8 years after TKA).

In our 2-year follow-up study, patients with and without a history of previous knee surgery have similar clinical outcome scores, quality of life outcomes, patient-reported satisfaction scores and most were of the opinion that TKA has met their expectations. Also, in our follow-up, patients with a history of previous knee surgery did not require re-operations or revision surgeries. Therefore, this shows that previous knee surgery does not adversely affect the outcome of TKA and does not increase the risk of re-operation or revision surgeries in the early follow-up period. This information is important to clinicians when counselling patients for knee surgery.

One limitation of our study is that there may be a selection bias, as only patients with previous knee surgeries who eventually underwent TKA were analyzed in this study. As such, the actual incidence of future TKA following previous knee surgery is not known. We also do not have a longer follow-up (i.e., more than 10 years) of the younger patients with a history of knee surgery who underwent primary TKA to evaluate if they eventually required revision TKA. Although most studies of primary TKA have a larger proportion of female patients, in our study, we have excluded all patients with a history of contralateral knee arthroplasty, thus there were more male than female patients.

Our study's strength lies in its contribution to current literature by addressing a clinically important question of whether a history of previous knee surgery would affect the outcomes of TKA. To our knowledge, there has been no reported study in the Asian population with regards to the impact of previous knee surgery on the clinical outcome and time interval to subsequent TKA. This is particularly important for clinicians in Asian populations, where there is a higher prevalence of knee osteoarthritis and hence, a greater need and demand for TKA.

Conclusions

In our study, a history of knee surgery had TKA at a significantly younger age than those without. However,

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this does not adversely affect the clinical and quality of life outcomes of their TKA. These patients have similar clinical outcomes as those without previous knee surgery; in addition, a high proportion of these patients are satisfied with the results of surgery and feel that their expectations of TKA are met. All of this serves as pertinent information for clinicians, in order to provide accurate and effective pre-operative counselling.

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None.

Footnote

Conflicts of Interest: The authors have no conflicts of interest to declare.

Ethical Statement: Centralized Institutional Review Board approval was obtained for this study (CIRB 2015/2626).

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