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## What Are the Contraindications for Performing Bilateral Total Knee Arthroplasty Under the Same Anesthesia?



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**What are the contraindications for performing bilateral total knee arthroplasty under the same anesthesia?**

**Response/Recommendation:** Based on evidence primarily from retrospective cohort studies, the main contraindications for simultaneous bilateral total knee arthroplasty are advanced age and uncontrolled comorbidities such as congestive heart failure, chronic obstructive pulmonary disease, pulmonary hypertension, and renal disease. Appropriate selection criteria have been shown to significantly reduce the complication rates seen with simultaneous bilateral total knee arthroplasty (TKA). Simultaneous bilateral TKA under the same anesthesia provides a cost-effective approach to bilateral TKA with considerable patient satisfaction, but surgeons should carefully consider the contraindications when determining patient suitability.

**Certainty of Evidence:** Low.**Consensus Voting:** agreed: 94.1%, disagree: 3.2%, abstain: 2.7%.**Rationale**

Due to the lack of available randomized controlled trials and prospective evidence, this review included any comparative study of simultaneous and staged total knee arthroplasty that specifically evaluated factors predictive of complications. A total of 12 articles were included. The purpose of this review was to identify and determine studies in which contraindications were evaluated within simultaneous bilateral total knee arthroplasty (TKA) patients in comparison to staged or staggered bilateral TKA. A

qualitative synthesis of predictive modeling and regression results from nonrandomized studies was used to summarize the contraindications found within the included studies, as meta-analysis was not possible for these data. Numerous meta-analyses exist that identify an overall increased risk of complication with simultaneous bilateral TKA over staggered or unilateral TKA [1–3]. Thus, this investigation did not seek to identify overall complication rates between these groups. Specific focus was put on factors predictive of complications—as they are significantly more likely to occur in specific patient subpopulations [4].

**Contraindications**

There were seven studies that provided adequate assessment of contraindications through regression modeling of observational data [4–10]. The presence of pulmonary hypertension and

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congestive heart failure were most consistently determined to be risk factors for increased complications after simultaneous bilateral TKA [6,7,9,10]. Memtsoud et al. provided the largest observational study of contraindications ( $n = 42,003$  bilateral TKA procedures), which determined that congestive heart failure (odds ratio (OR): 5.55, 95% confidence interval (CI): 4.81 to 6.39) and pulmonary hypertension (OR: 4.10, 95% CI: 2.72 to 6.10) were the largest factors associated with an increased odds of complication [7]. Advanced age, typically assessed as  $> 75$  years old, was also commonly reported as a significant predictor of complication [4,5,7–10]. In a categorical assessment of age, Wang et al. reported a 3.77 times increase in odds of complication for patients  $\geq 75$  years of age (OR: 3.77, 95% CI: 1.35 to 10.52), while the increase in odds markedly jumps to 8.79 times greater in patients  $\geq 84$  years (OR: 8.79, 95% CI: 3.21 to 24.09) [4]. An increased risk of complication was also observed for patients who have renal disease (OR: 5.08, 95% CI: 1.29 to 20.00) and chronic obstructive pulmonary disease (OR: 2.50, 95% CI: 1.19 to 5.26)—which is supported by findings of multiple studies [4,6]. The body mass index (BMI) was evaluated in multiple studies, with conflicting results [4,5]. Chan et al. concluded that, while BMI was associated with longer surgical times, there was no difference in complications based on BMI [5]. In contrast, Wang et al. found an increased risk of complications for patients who had a BMI  $\geq 42$  (OR: 2.10, 95% CI: 1.21 to 3.62) [4].

### Appropriate Selection Criteria

Multiple studies utilized contraindication data to determine an appropriate selection criteria to decide if a patient is a candidate for simultaneous bilateral TKA [4,11,12]. A single center implemented a patient selection criteria for simultaneous bilateral TKA that specifically targeted patients who have an age  $< 75$  years, American Society of Anesthesiologists Score I to II, and an absence of any major cardiopulmonary morbidity. They compared complication rates when using these guidelines to before these criteria were implemented. Within this investigation, the implemented selection criteria significantly reduced the rate of operative complications observed at this center [11]. Wang et al. used modeling to develop comprehensive selection criteria for simultaneous bilateral TKA [4]. This study developed a scoring system (the bilateral total knee Safety Score) to determine the suitability of simultaneous bilateral TKA, in which patients were assigned points: +1 for age  $\geq 75$  years, +2 for age  $\geq 82$  years, +1 for BMI  $\geq 34$ , +2 for BMI  $\geq 42$ , +1 for a patient using hypertension medication, +1 for pulmonary disease, and +3 for end-stage renal disease [4]. Patient scoring was highly correlated with the risk of complication, as patients who had a score of 0 had a 0.3% complication rate, 1.6% complication rate with a score of 2, 9.5% complication rate with a score of 4, and a 99% complication rate in patients who had a score of 6 [4]. This scoring system provides a useful tool for determining the suitability of simultaneous bilateral TKA for patients based on their prognostic factors [4].

### Appropriate Timing of Staggered Bilateral TKA

In an analysis of the New Zealand national joint registry, it was observed that patients who received simultaneous bilateral TKA were younger, had lower BMIs, and had lower American Society of Anesthesiologists scores, than those who were provided with staggered bilateral TKA [13]. For those patients who were not provided simultaneous bilateral TKA, it was recommended that staggered patients do not receive the second TKA any sooner than 3

months after the first procedure [13]. An additional investigation of surgical timing identified staggered bilateral TKA with surgeries to have a lower risk of the patient developing acute kidney injury, although this investigation did not consider additional risk factors in their analysis [14].

### Strengths and Potential Limitations

Although there are a large number of publications focusing on simultaneous bilateral TKA, the overall quality of the data is generally poor. Available data consist of retrospective cohort studies, which are at risk of having confounded results due to imbalances in prognostic factors. Due to this, the level of evidence must be considered as low. Despite this limitation, the available evidence from a large volume of real-world data provides generally consistent results and conclusions. This provides further certainty in the understanding of key contraindications for simultaneous bilateral TKA.

### Conclusions

Based on the available evidence, advanced age, congestive heart failure, chronic obstructive pulmonary disease, pulmonary hypertension, and renal disease are key contraindications for simultaneous bilateral TKA, while BMI may also be a factor for consideration. Evidence has demonstrated that the use of strict patient selection can minimize the risk of complications when conducting simultaneous bilateral TKA.

### CRediT authorship contribution statement

**Mark Phillips:** Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Software, Resources, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Nicola Santori:** Writing – review & editing, Validation, Methodology, Data curation. **Ibrahim Gado:** Writing – review & editing, Validation, Data curation. **Salvatore Tecce:** Writing – review & editing, Resources, Data curation. **Gholam Shahcheraghi:** Writing – review & editing, Methodology. **Manuj Wadhwa:** Writing – review & editing, Validation, Data curation. **Seper Ekhtiari:** Writing – review & editing, Methodology, Formal analysis, Conceptualization.

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