

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

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Response/Recommendation: Based on evidence primarily from retrospective cohort studies, the main contraindications for simultaneous bilateral total knee arthroplasty are advanced age, congestive heart failure, COPD, pulmonary hypertension, and renal disease.

Level of Evidence: Low

Rationale

Due to the lack of available RCT 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 TKA patients in comparison to staged or staggered bilateral TKA. Qualitative synthesis of predictive modeling and regression results from non-randomized studies was used to summarize the contraindications found within the included studies, as meta-analysis was not possible for this 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 complication – as they are significantly more likely to occur in specific patient sub-populations.⁴

Contraindications

Seven studies provided adequate assessment of contraindications through regression modeling of observational data.⁴⁻¹⁰ The presence of pulmonary hypertension and congestive heart failure were most consistently determined to be risk factors for increased complication 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 (OR: 5.55, 95% 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 ≥ 75 : (OR: 3.77, 95% CI: 1.35 to 10.52), while the increase in odds markedly jumps to 8.79 times greater in patients ≥ 84 (OR: 8.79, 95% CI: 3.21 to 24.09).⁴ An increased risk of complication was also observed for patients with renal disease (OR: 5.08, 95% CI: 1.29 to 20.00) and COPD (OR: 2.50, 95% CI: 1.19 to 5.26) – which is supported by findings of multiple studies.^{4,6} 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 complication for patients with a BMI ≥ 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 with age < 75 years, ASA I-II, and an absence of any major cardio-pulmonary 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 BTK Safety Score) to determine the suitability of simultaneous bilateral TKA, in which patients were assigned points: +1 for age \geq 75, +2 for age \geq 82, +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 with 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 99% complication rate in patients with 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, with lower BMI, and with lower ASA 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 Limitations

Although there is a large number of publications focusing on simultaneous bilateral TKA, the overall quality of data is generally poor. Available data consists 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.

Conclusion

Based on the available evidence, advanced age, congestive heart failure, COPD, 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 complication when conducting simultaneous bilateral TKA.

References

1. Makaram NS, Roberts SB, Macpherson GJ. Simultaneous Bilateral Total Knee Arthroplasty Is Associated With Shorter Length of Stay but Increased Mortality Compared

With Staged Bilateral Total Knee Arthroplasty: A Systematic Review and Meta-Analysis. *The Journal of arthroplasty*. Jun 2021;36(6):2227-2238. doi:10.1016/j.arth.2021.01.045

2. Hussain N, Chien T, Hussain F, et al. Simultaneous versus staged bilateral total knee arthroplasty: a meta-analysis evaluating mortality, peri-operative complications and infection rates (Provisional abstract). *Vol. 9*. 2013:50-59-50-59.

<http://onlinelibrary.wiley.com/o/cochrane/cldare/articles/DARE-12014006002/frame.html>

3. Restrepo C, Parvizi J, Dietrich T, Einhorn TA. Safety of simultaneous bilateral total knee arthroplasty. A meta-analysis. *The Journal of bone and joint surgery American volume*. 2007;89(6):1220-6. doi:<https://dx.doi.org/10.2106/JBJS.F.01353>

4. Wang KY, Puvanesarajah V, Raad M, Barry K, Srikumaran U, Thakkar SC. The BTK Safety Score: A Novel Scoring System for Risk Stratifying Patients Undergoing Simultaneous Bilateral Total Knee Arthroplasty. *Journal of Knee Surgery*. 2020;36(7):702-709. doi:<https://dx.doi.org/10.1055/s-0041-1741000>

5. Chan SK, Opanova MI, Thorne TJ, Matsumoto MY, Andrews SN, Nakasone CK. Can obese patients undergo simultaneous bilateral total knee arthroplasty without an increased risk of perioperative complications? *Journal of Orthopaedics*. 2021;27((Chan, Thorne, Matsumoto) University of Hawai'i, John A Burns School of Medicine, 651 Ilalo Street, Honolulu, HI 96813, United States(Opanova, Andrews, Nakasone) University of Hawai'i, John A. Burns School of Medicine, Department of Surgery, 1356 Lusitana):137-140. doi:<https://dx.doi.org/10.1016/j.jor.2021.09.007>

6. Gu A, Wu S, Mancino F, et al. Impact of Chronic Obstructive Pulmonary Disease on Postoperative Complications Following Simultaneous Bilateral Total Knee Arthroplasty. *The journal of knee surgery*. 2021;34(3):322-327. doi:<https://dx.doi.org/10.1055/s-0039-1695766>

7. Memtsoudis SG, Ma Y, Chiu Y-L, Poultsides L, Gonzalez Della Valle A, Mazumdar M. Bilateral total knee arthroplasty: risk factors for major morbidity and mortality. *Anesthesia and analgesia*. 2011;113(4):784-90.

doi:<https://dx.doi.org/10.1213/ANE.0b013e3182282953>

8. Abdalla M, Elsagheir M, Ashry A, et al. Is Simultaneous Bilateral Knee Replacement a Safe Approach for Patients with Bilateral Knee Osteoarthritis? A Prospective Case-control Study. *Ortopedia, traumatologia, rehabilitacja*. 2023;25(6):333-339.

doi:<https://dx.doi.org/10.5604/01.3001.0054.3271>

9. Arslan A, Utkan A, Ozkurt B. Are unilateral or staged bilateral total knee arthroplasty really safer than simultaneously bilateral TKA, or is it a myth? *Acta orthopaedica Belgica*. 2018;84(2):192-202.

10. Poultsides L, Memtsoudis S, Gonzalez Della Valle A, et al. Perioperative morbidity and mortality of same-day bilateral TKAs: incidence and risk factors. *Clinical orthopaedics and related research*. 2014;472(1):111-20. doi:<https://dx.doi.org/10.1007/s11999-013-3156-7>

11. Gerner P, Memtsoudis SG, Cozowicz C, et al. Improving Safety of Bilateral Knee Arthroplasty: Impact of Selection Criteria on Perioperative Outcome. *HSS J*. May 2022;18(2):248-255. doi:10.1177/15563316211014891

12. Memtsoudis SG, Poultsides LA, Stundner O, Do H, Figgie M, Sculco TP. The impact of selection criteria for bilateral knee arthroplasties on perioperative outcomes. *Regional Anesthesia and Pain Medicine*. 2013;38(4)

13. Wyatt MC, Hozack J, Frampton C, Hooper GJ. Safety of single-anaesthetic versus staged bilateral primary total knee replacement: experience from the New Zealand National Joint Registry. *ANZ journal of surgery*. 2019;89(5):567-572.

doi:<https://dx.doi.org/10.1111/ans.15160>

14. Koh WU, Kim H-J, Park H-S, Jang M-J, Ro Y-J, Song J-G. Staggered Rather Than Staged or Simultaneous Surgical Strategy May Reduce the Risk of Acute Kidney Injury in

Patients Undergoing Bilateral TKA. The Journal of bone and joint surgery American volume. 2018;100(18):1597-1604. doi:<https://dx.doi.org/10.2106/JBJS.18.00032>