Journal of Orthopaedic Surgery and Research

SYSTEMATIC REVIEW

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Comparative efficacy and safety of bicompartmental versus total knee arthroplasty: a systematic review and update meta-analysis

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Abstract

Background This study was aimed at comparing the efficacy and safety of bicompartmental knee arthroplasty (BKA) and total knee arthroplasty (TKA) in treating bicompartmental knee osteoarthritis through a systematic evaluation and meta-analysis.

Methods A comprehensive systematic literature search of the Pub Med, Embase, Web of Science, Cochrane Library, and ClinicalTrials.gov databases was performed to identify the relevant scientific literature published until 1st March 2024. The eligible studies were evaluated for quality assessment and data extraction, and meta-analysis was performed using Review Manager 4.1 software.

Results A total of 1378 studies were identified. Based on strict inclusion criteria, 12 studies were finally included in this meta-analysis. The results of the analysis revealed that BKA yielded better postoperative outcomes than TKA, in terms of Knee Society Score (KSS) Knee Score, Function Score, and range of knee flexion ($P=0.02$; $P<0.0001$; $P=0.0005$, respectively). Intraoperative bleeding in the BKA group was significantly lower than that in the TKA group ($P=0.02$), although postoperative complications ($P<0.05$) were higher and operative time ($P=0.04$) was longer in the BKA group. However, the two groups did not show any significant difference in terms of Oxford knee score and WOMAC pain score ($P=0.53$ and $P=0.96$, respectively).

Discussion Our present results indicate that while BKA affords better improvement in knee function and quality of life in bicompartmental knee osteoarthritis than TKA, it also increases complications and operative time. Therefore, further studies are warranted to confirm these results and assess long-term outcomes and cost-effectiveness.

Other Systematic review registration PROSPERO CRD420-24551418.

Keywords Bicompartmental knee arthroplasty, Total knee arthroplasty, Knee osteoarthritis, Update meta-analysis

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Introduction

Total knee arthroplasty (TKA), one of the most successful operative treatment procedures of the late 20th century, is known for its 25-year survival rate of 85–95%, providing significant pain relief and functional improvement for patients with arthritis [1–3]. However, approximately 10–20% of patients who undergo TKA report dissatisfaction with the postoperative outcome [4]. In TKA, all three compartments of the knee joint are replaced, which inevitably affects the knees' natural movement patterns, functionality, gait, and sensory localization. Approximately 23% of patients undergoing initial TKA for osteoarthritis (OA) have disease involvement only in the medial tibiofemoral and patellofemoral joints, while the lateral compartments may be in good condition; thus, if TKA is performed for bicompartmental OA, the lateral compartments and cruciate ligaments may be unnecessarily sacrificed [5, 6]. These inherent problems with TKA led to the emergence of bicompartmental knee arthroplasty (BKA) as an innovative treatment option that can be used to replace the damaged compartment while preserving as much of the bone, meniscus, and anterior cruciate ligament as possible.

Despite the increasing interest in BKA as an alternative to TKA during the last few years, the literature on BKA presents a mixed picture regarding its outcomes. Some studies have shown that compared to TKA, BKA may provide similar or superior functional recovery and more rapid rehabilitation due to its less invasive nature and sparing of knee structures [7, 8]. In contrast, some studies have found that BKA is associated with inconsistent pain relief, suboptimal functional recovery outcomes, and high repair rates, which has led to reservations in recommending BKA as an alternative to TKA [9, 10]. A 2017 meta-analysis of randomized and prospective controlled trials [11] revealed that compared to TKA, BKA provides better knee function and quality of life in bicompartmental knee OA, although its other potential benefits were relatively limited. However, that meta-analysis included only a small number of studies.

Subsequent to 2017, more randomized controlled trials, retrospective studies, and systematic evaluations have been conducted, and currently, there is no consensus on the definitive conclusions regarding the comparative efficacy and safety of BKA and TKA. Considering these differences in opinion, a systematic review and meta-analysis of the latest evidence is warranted for an accurate and comprehensive comparison of the safety and efficacy of BKA and TKA.

In this study, we aimed to conduct a systematic review and updated meta-analysis to comprehensively assess the latest evidence that compares BKA and TKA in terms of efficacy and safety in the treatment of bicompartmental knee OA. With the obtained data, we seek to bridge the currently existing knowledge gaps regarding the improvement in parameters such as the Knee Society Score (KSS) knee score, knee range of motion, postoperative complications, WOMAC pain, and complication offered by BKA and TKA. We believe that the insights thus gained will help provide evidence-based guidance to clinicians and patients dealing with bicompartmental knee OA in making the most appropriate surgical choice by weighing the benefits and potential risks of the available treatment options.

Materials and methods

Literature search strategy

This work was reported in line with the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) 2020 [12] and AMSTAR (Assessing the methodological quality of systematic reviews) 2 guidelines [13]. Accordingly, we systematically searched multiple databases, including PubMed, Embase, Web of Science, Cochrane Library, and ClinicalTrials.gov, to identify relevant studies published up to 1st March 2024, without any strict year or language restrictions. The specific search terms used in this analysis are listed in Supplementary Table 1. Further, to ensure the comprehensive coverage of the literature, we meticulously reviewed the introduction and discussion sections of the retrieved original studies, review articles, and meta-analyses in order to identify any potentially omitted trials. Two authors of this study independently performed the literature search, abstract screening, and selection of the articles for inclusion in the trial.

Inclusion criteria and exclusion criteria

Studies were considered eligible for inclusion if they met the following criteria: (1) patients with knee OA; (2) performance of BKA or TKA; (3) studies including at least one of the following outcome indicators, namely, KSS-Knee Score [14], KSS-Function Score [15], Oxford knee score [16], WOMAC pain [17], postoperative complications, flexibility range of knee, blood loss, and surgical time; (4) study design: RCTs or prospective clinical controlled studies. Studies were excluded from the analysis if they met any of the following criteria: (1) review articles; (2) conference abstracts; (3) studies that included only one surgical technique; (4) studies with no comparative data; (5) full text articles not in English or with insufficient information provided in the English abstract; (6) irrelevant studies; and (7) papers describing smaller studies if they had overlapping data.

Data extraction

To ensure the accuracy and completeness of the study data, the two researchers independently used a standardized data extraction form to extract key information from the selected articles. Specifically, data for the following parameters were extracted: date of publication, study authors, study design, number of participants and their demographic characteristics, inclusion and exclusion criteria, follow-up period, and primary and secondary outcome indicators. Any disagreements between the two researchers that arose during the data extraction process were resolved through mutual discussion to reach consensus. To further ensure the accuracy of data extraction and minimize the possibility of human error, a third researcher reviewed the extracted data against the original literature.

Quality assessment of the included studies

To ensure that the included studies were of high quality, a comprehensive quality assessment of randomized controlled trials (RCTs) was conducted using the Risk-of-Bias Assessment Tool developed by the Cochrane Collaboration [18]. This assessment tool covers six key domains: selective bias (bias in the randomization process), implementation bias (bias in the blinding of participants and researchers), detection bias (bias in the assessment of outcomes), attrition bias (bias in missing data), reporting bias (bias in the reporting of selective outcomes), and other possible sources of bias. Furthermore, we used the Newcastle-Ottawa Scale (NOS) score to assess the quality of the prospective clinical controlled studies included [19]. The NOS score evaluates the quality of the study in three dimensions: fairness of patient selection criteria, comparability of the study and control groups, and exposure assessment for the BKA and TKA groups. A maximum score of 9 can be obtained, with a score of 7 and above indicating a high-quality study. Both investigators independently performed the quality assessment. Any disagreements that arose during the assessment process were resolved by mutual discussion to reach a consensus.

Statistical analysis

We performed statistical analysis using Review Manager (RevMan, version 4.1; The Cochrane Collaboration). The threshold for statistical significance was set at a p-value of less than 0.05. Continuous outcomes were evaluated in terms of the mean difference (MD) along with 95% confidence interval (CI), whereas dichotomous outcomes were assessed by presenting relative risk (RR) with 95% CI. The extent of heterogeneity across the studies was quantified using the I-square and chi-square tests. A fixed-effects model was applied when I2 was $<50\%$ and $P>0.1$; otherwise, a random-effects model was employed. The results of the meta-analysis were depicted using forest plots. Additionally, funnel plots were constructed to assess publication bias within the fixed-effects model framework. To ensure clarity, repair rates were defined as the percentage of successful surgical outcomes without revision within the study period, and patient satisfaction was measured using validated scales, with higher scores indicating greater satisfaction.

Results

Process and results of literature selection

An initial search retrieved 1378 articles, and after removing duplicates, 380 articles were identified. On screening the titles and abstracts, 175 articles were found to satisfy the full-text screening criteria. The full text of these articles was assessed, and 151 articles were excluded because they did not meet the selection criteria. The remaining 24 articles were included in the qualitative review. Of these, 12 clinical studies, including six randomized clinical trials (RCTs) and six prospective controlled trials, were found to be eligible for meta-analysis, encompassing a total of 620 patients, of whom 293 underwent BKA and 327 underwent TKA. A flow chart depicting the study screening protocol is shown in Fig. 1.

Basic features of included studies and results of risk-of-bias

Table 1 shows the basic characteristics of the studies included in this analysis. Table 2 presents the Newcastle-Ottawa Scale (NOS) scores for the included prospective cohort studies, whereas Table 3 provides a summary of the risk-of-bias assessments of the RCTs included in this review.

Data analyses and synthesis

KSS-Knee score

Nine studies [20–28], involving a total of 480 patients (BKA: 233 patients; TKA: 247 patients), reported data on the KSS-Knee Score. MD was used as the effect size, and a Q-test for heterogeneity was performed, which was analyzed using a random-effects model given the heterogeneous results between effect sizes ($I^2=51\%$; $P=0.04$). The results of the meta-analysis showed that the KSS-Knee Score was significantly higher for patients treated with BKA than those treated with TKA (MD = 2.38; 95% CI: 0.40, 4.35; $P=0.02$; Fig. 2A).

KSS-Function score

Eight studies [20–22, 24, 25, 27–29], which involved a total of 386 patients (BKA: 184 patients; TKA: 202 patients) reported data on KSS-Function score. Using MD as effect size and Q-test for heterogeneity, a fixed-effects model was used for the analysis in view of the heterogeneous results between effect sizes (I2 = 38%, $P=0.13$). The results of the meta-analysis showed that patients who underwent BKA had significantly higher KSS-Function scores than those who underwent TKA (MD = 4.57; 95% CI2.65, 6.49; $P<0.0001$; Fig. 2B).

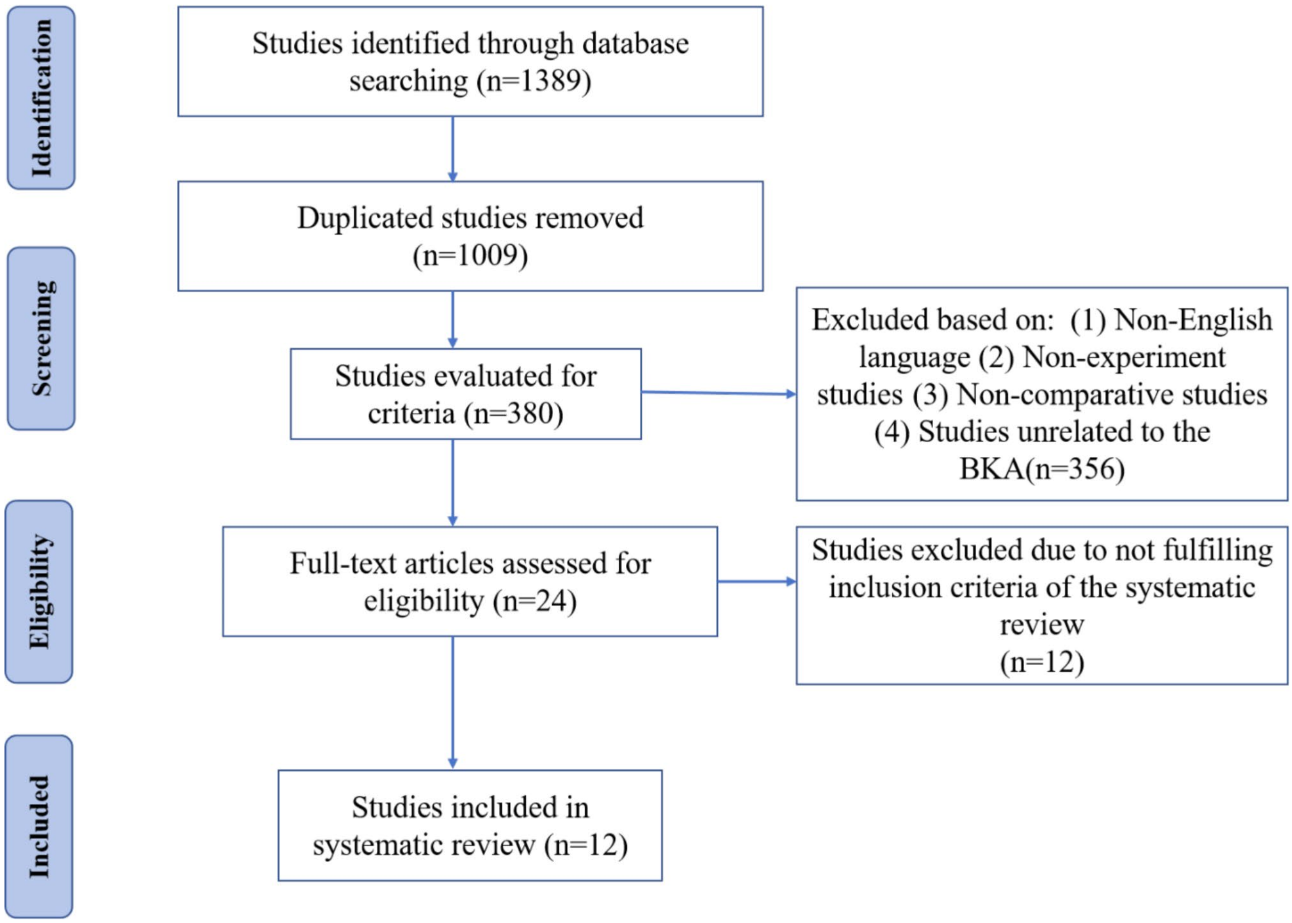

Fig. 1 Systematic search and study selection

Table 1 Basic characteristics of the included studies

Study	Study characteristics				Baseline date of patients						
	Design	Journal	Year of publication	Level of evidence	Participants		Mean Age (years)		Gender		Fol-low-up period (years)
					BKA	TKA	BKA	TKA			
Engh et al.[17]	RCT	The Journal of Arthroplasty	2014	I	25	25	60.3	58.3	NS	NS	2
Yeo et al.[22]	RCT	The Knee	2015	I	26	22	63.8	63.1	11	37	5
Confalonieri et al.[15]	RCS	Arch Orthop Trauma Surg	2009	II	22	22	60.4	60.7	16	28	4
Morrison et al.[25]	RCT	The Journal of Arthroplasty	2011	I	20	31	63.2	67.2	12	39	2
Parratte et al.[19]	RCS	Science Direct	2015	I	34	34	61.0	61.0	26	42	3.8
Tan et al.[21]	RCT	The Journal of Arthroplasty	2013	I	15	12	52.0	60.0	10	17	2
Biazzo et al.[14]	RCS	Musculoskeletal Surgery	2018	II	20	20	67.2	65.0	9	31	3.2
Deng et al.[16]	PCS	Frontier in Surgery	2023	I	25	50	60.0	62.2	42	33	4.8
Garner et al.[24]	PCS	Knee Surgery Sports Traumatology	2023	I	16	20	68.0	65.0	13	23	3.4
Schrednitzki et al.[20]	RCT	The Journal of Arthroplasty	2020	I	40	40	65.25	63.55	21	59	2
Goh et al.[18]	RCT	The Knee	2020	I	26	22	63.8	63.1	11	37	5
Siddharth et al.[23]	RCS	Original Article	2013	II	16	20	52.1	65.1	10	26	2

RCT: randomized controlled trial; RCS: Prospective cohort studies

Table 2 Newcastle-Ottawa Scale scores of included prospective cohort studies

Studies	Selection				Comparability	Outcome			Scores
	A	B	C	D	E	F	G	H	
Confalonieri et al.[15]	1	1	1	1	1	1	1	1	8
Parratte et al.[19]	1	1	1	1	1	1	1	1	8
Biazzo et al.[14]	1	1	1	1	1	1	0	1	7
Deng et al.[16]	1	1	1	1	1	1	1	1	8
Garner et al.[24]	1	1	1	1	1	1	1	1	8
Siddharth et al.[23]	1	1	1	1	1	1	0	1	7

A: representativeness of the exposed cohort; B: selection of the non-exposed cohort; C: ascertainment of exposure; D: demonstration that outcome of interest was not present at start of study; E: comparability of cohorts on the basis of the design or analysis; F: assessment of outcome; G: was follow-up long enough for outcomes to occur; H: adequacy of follow up of cohorts

Table 3 Risk-of-bias assessment of RCTs

Studies	Random sequence generation	Allocation concealment	Binding of allocated intervention	Incomplete outcome data adequately addressed	Free of suggestion selective outcome	Other problems with high risk of bias
Engh et al.[17]	Low risk	Unclear	Unclear	Low risk	Low risk	Low risk
Goh et al.[18]	Low risk	Low risk	Unclear	Low risk	Low risk	Low risk
Morrison et al.[25]	Low risk	Low risk	Low risk	Low risk	High risk	Low risk
Schrednitzki et al.[20]	Low risk	Low risk	Low risk	Low risk	High risk	Low risk
Tan et al.[21]	ITT analysis	Unclear	Unclear	Low risk	Low risk	Low risk
Yeo et al.[22]	Low risk	Low risk	Unclear	ITT analysis	Low risk	Low risk

ITT, intention-to-treat

Oxford knee score

Five studies [23, 24, 26, 28, 30], which involved a total of 262 patients (BKA: 133 patients; TKA: 129 patients) reported data on Oxford knee score with MD as effect size and Q-test for heterogeneity. Analysis using a random-effects model in view of the heterogeneous results between the effect sizes ($I^2 = 90\%$; $P < 0.01$) indicated that patients who underwent BKA had a slightly higher Oxford knee score than those who underwent TKA, although the difference was not significantly significant (MD = 1.06; 95% CI2.29, 4.41; $P = 0.53$; Fig. 2C).

WOMAC pain score

Five studies [21, 22, 27, 29, 31], involving 233 patients (BKA 98 patients; TKA: 135 patients), reported data on WOMAC pain score with MD as effect size and Q-tests for heterogeneity. Meta-analysis using a random-effects model given the heterogeneous results between effect sizes ($I^2 = 80\%$, $P = 0.0005$) showed that WOMAC pain scores were comparable for BKA and TKA, with no significant difference between the two (MD=-0.10; 95% CI-4.03, 3.84; $P = 0.96$; Fig. 2D).

Blood loss

Four studies [20, 26–28], involving a total of 195 patients (101BKA: 101 patients; TKA: 94 patients), reported data on blood loss. Due to differences in units of measurement used in the different studies, SMD was used as the effect size and Q-test for heterogeneity. Given the heterogeneous results between the effect sizes ($I^2 = 81\%$; $P = 0.001$), a random-effects model was used for the analyses. The results of the meta-analysis showed that blood loss was significantly lower with BKA as compared to that with TKA (SMD=-0.83; 95% CI -1.54, -0.12; $P = 0.02$; Fig. 3A).

Flexion range of knee

Three studies [24, 25, 28], including a total of 165 patients (BKA: 86 patients; TKA: 78 patients) reported data on flexion range of knee. Using MD as the effect size and Q-test for heterogeneity, the data were analyzed with a fixed-effects model in view of the heterogeneous results in the effect sizes ($I^2 = 0\%$, $P = 0.90$). The results of the meta-analysis indicated that the postoperative flexion range of the knee in patients who underwent BKA was higher than in those who underwent TKA, with the effect size between the two groups being significantly different (MD = 4.77; 95% CI2.07, 7.47; $P = 0.0005$; Fig. 3B).

Operative time

Five studies [20–22, 26, 27], which involved a total of 266 patients (BKA: 122 patients; TKA: 144 patients), reported data on operative time. MD was used as the effect size, and a Q-test for heterogeneity was performed, and the results were analyzed using a random-effects model in view of the heterogeneous results of the effect sizes ($I^2 = 90\%$; $P < 0.0001$). The results of the meta-analysis indicated that operative time was significantly greater for

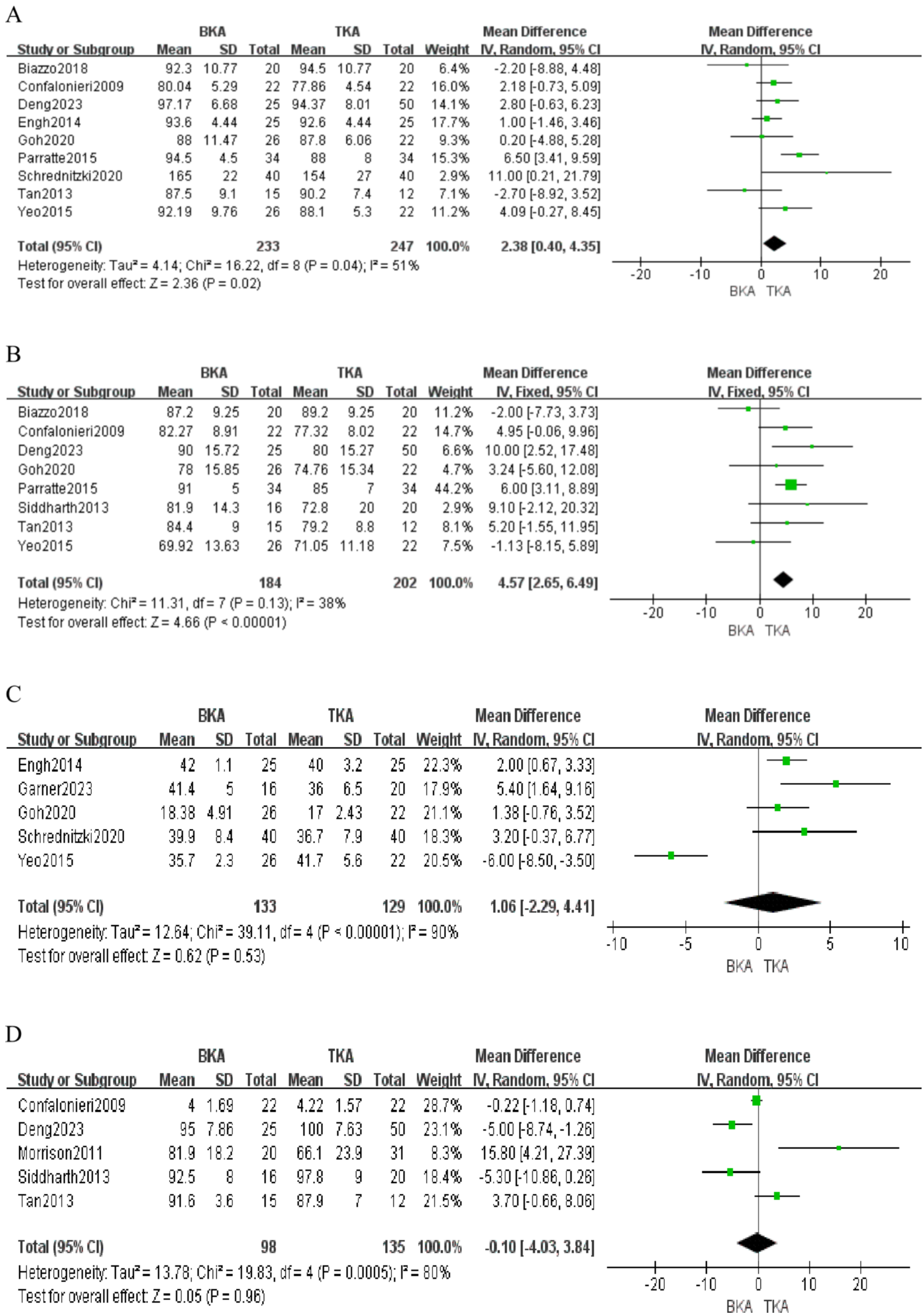

Fig. 2 (**A**) Forest plot diagram showing the KSS-Knee Score in BKA and TKA groups. (**B**) Forest plot diagram showing the KSS-Function Score in BKA and TKA groups. (**C**) Forest plot diagram showing the Oxford Knee Score in BKA and TKA groups. (**D**) Forest plot diagram showing the WOMAC pain score in BKA and TKA groups

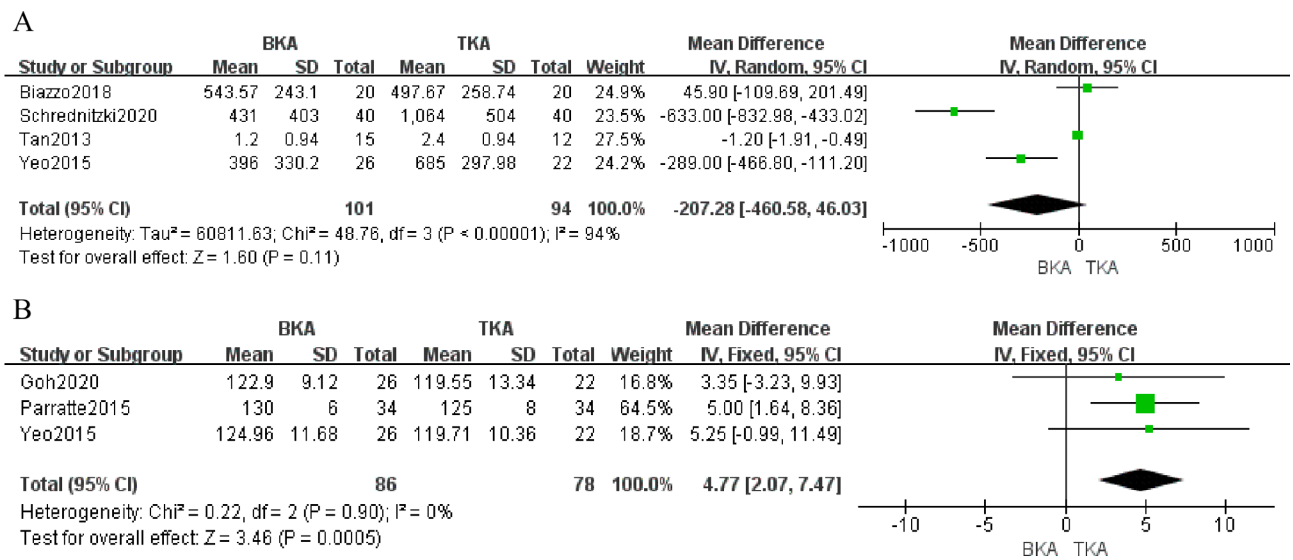

Fig. 3 (**A**) Forest plot diagram showing the blood loss in BKA and TKA groups. (**B**) Forest plot diagram showing the flexion range of knee in BKA and TKA groups

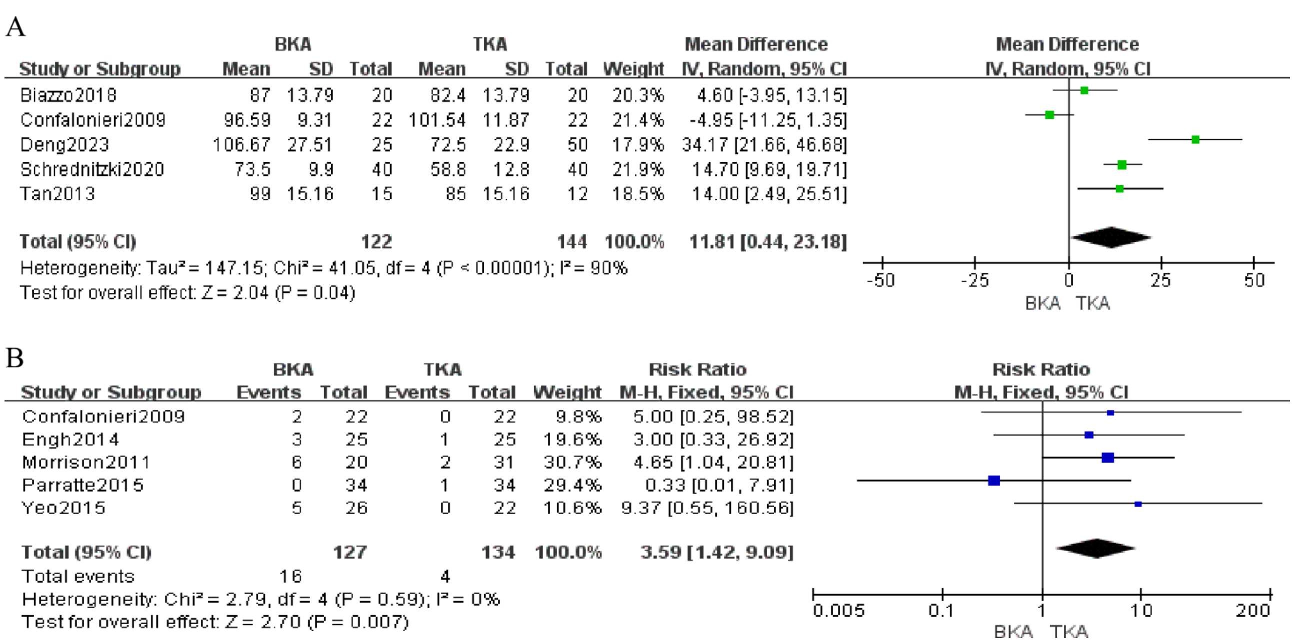

Fig. 4 (**A**) Forest plot diagram showing the operative time in BKA and TKA groups. (**B**) Forest plot diagram showing the postoperative complications in BKA and TKA groups

BKA than TKA (MD = 11.81; 95% CI0.44, 23.18; $P = 0.04$; Fig. 4A).

Postoperative complications

Five studies [21, 23, 25, 28, 31], with a total of 261 patients, reported data regarding postoperative complications. In these studies, 127 cases with 16 complications were noted in the BKA group, whereas 134 cases with 4 complications were recorded in the TKA group. ($I^2 = 0\%$, $P = 0.59$). A fixed effect model was used for assessment, and the results of the meta-analysis showed a significantly higher postoperative complication rate for BKA than for TKA (12.60% vs. 2.99%; RR = 3.59; 95% CI 1.42, 9.09; $P = 0.007$; Fig. 4B).

Publication bias analysis

We constructed the Beggs funnel plot to assess publication bias within the included studies. The funnel plot that focused specifically on KSS-Knee Score (Fig. 5) revealed no significant evidence of publication bias.

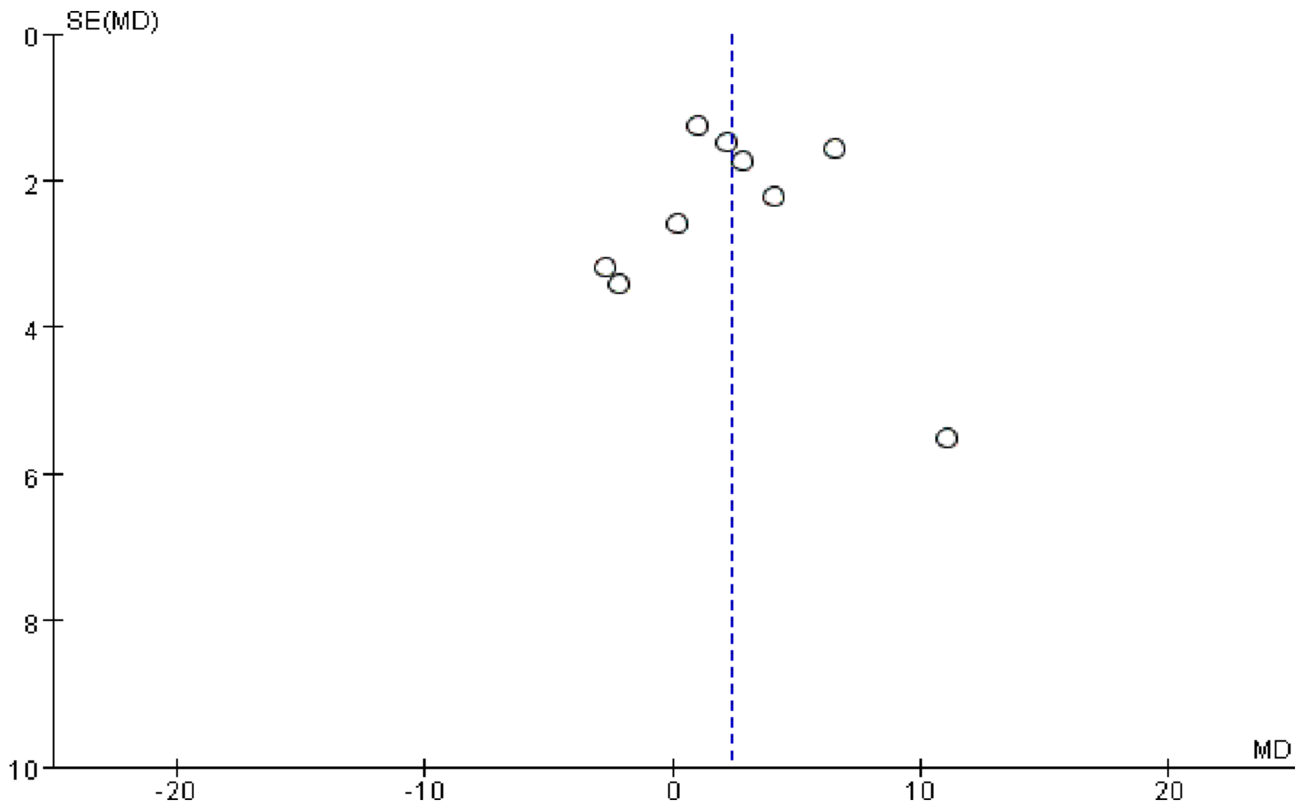

Fig. 5 Begg's funnel plot for assessing publication bias on the KSS-Knee score in BKA and TKA groups

Discussion

This present study is a systematic review and updated meta-analysis that evaluates the feasibility of BKA as a potential therapeutic alternative to TKA in patients with bicompartmental knee OA. BKA and TKA were compared in terms of certain key aspects of knee function recovery and quality of life improvement, and the results of the comprehensive analysis indicate that despite the higher incidence of postoperative complications and longer operative time associated with BKA, it has significant advantages over TKA in KSS-Knee score, KSS-Function score, and knee flexion range. Furthermore, intraoperative bleeding was significantly less with BKA than TKA. BKA and TKA showed no significant differences in the Oxford knee score and WOMAC pain score. The results of these comparisons indicate that BKA significantly promotes the recovery of knee function and improves quality of life—a conclusion that is consistent with the results of our previous meta-analysis [30],. However, it should be noted that BKA additionally carries a higher risk of postoperative complications and has a longer operative time than TKA.

The results of the present meta-analysis reveal that the postoperative quality of life scores achieved with BKA were comparable, or in some aspects superior, to those obtained with TKA. These findings are consistent with the recent findings of Garner et al. [30], who reported that BKA offers a significant advantage in post-surgery improvement of knee function, as reflected in the KSS and WOMAC pain scores. Similarly, a prospective randomized study comparing unicompartmental and TKA revealed similar clinical scores and functional outcomes at postoperative intervals of 1, 4, 12, and 24 months, with no significant intergroup differences [32]. Longitudinal studies, such as the one conducted by Goh et al. [24] indicate that BKA affords high functional scores even at 10 years post-surgery, suggesting that beyond short-term functional improvement, BKA also provides sustained long-term benefits. Additionally, Haffar et al. [33] have shown that progressive arthritic conditions following patellofemoral arthroplasty, which is commonly treated with revision TKA, may be addressed by BKA as a safe and cost-effective alternative, with the latter offering significantly higher postoperative KSS and functional scores (90.4 ± 10 vs. 72.1 ± 20, $P < 0.001$; and 80.3 ± 18 vs. 67.1 ± 19, $P = 0.011$, respectively). Thus, BKA presents a more favorable postoperative recovery profile as compared to TKA, particularly in terms of the long-term maintenance of knee function.

BKA has been shown to be associated with a potential for increased postoperative complications [10, 34–36], which was also confirmed in our own study: a retrospective cohort analysis that compared complications such as the number of repairs, prosthetic joint infections, loosening of fixtures, and surgery under anesthesia, at 1 and 2 years revealed that a higher repair rate at postoperative year 2 in patients who underwent BKA as compared to those who underwent TKA [34]. Developing more detailed clinical protocols for BKA specific complications, especially in high-risk groups such as diabetic patients, with enhanced infection prevention and management is critical. Personalised pre-operative assessment provides a comprehensive understanding of the patient's health, diabetes control and potential risks, and tailored preventive measures are put in place [10]. Intraoperative procedures are optimised to reduce trauma and infection through the use of advanced aseptic techniques and meticulous handling. Detailed post-operative care, including blood glucose monitoring, wound care, nutritional support and personalised rehabilitation, promotes recovery and reduces the risk of complications. Taken together, these measures aim to significantly reduce BKA-specific complications and improve patients' quality of life [37]. Similarly, Francesco Pardo et al. [10] reported that a comprehensive analysis of patients who underwent BKA, as recorded in the Regional Joint Replacement Registry database, indicated a relatively high failure rate secondary to patellofemoral surface replacements. The study also indicated that implant survival and occurrence of complications may be influenced by various factors, such as the type of prosthesis used. The Journey-Deuce prosthesis can achieve good functional results with clear indications and precise anatomical positioning. However, due to the technical complexity and insufficient range of implant sizes, it is prone to malpositioning and instability, which leads to a high revision rate. In order to achieve anatomically correct positioning and provide appropriate treatment, it is urgent to introduce additional position guidance and a wider range of implant size options. Given the observed revision rates, clinicians should provide patients with comprehensive information about the potential risks and benefits of using the Journey-Deuce prosthesis and compare it with other alternatives [36]. As highlighted in recent research, effective informed consent requires a transparent and patient-centered presentation of risks, benefits, and available alternatives. This process ensures that patients make informed decisions based on their preferences and expectations, thereby optimizing treatment outcomes [38].

In recent years, robotic-assisted surgical techniques have attracted much attention as a means of improving the precision of complex operations and reducing complications. In BKA surgery, these techniques have shown great potential for reducing postoperative complications by improving surgical precision, enabling precise osteotomy, enhancing visualization, and optimizing soft tissue management. Michael A. Gaudiani reviewed a single-center cohort study involving 50 patients who underwent robotic-arm-assisted BKA. Interim follow-up results showed excellent implant survival, functional recovery, and patient satisfaction [39]. Jai Thilak et al. [40] conducted a matched study comparing the outcomes of robot-assisted BKA and robot-assisted TKA in patients with similar demographic characteristics. Their findings suggest that image-based robotic-assisted BKA is a bony-sparing and physiologically aligned procedure with outcomes comparable to TKA and fewer complications, and therefore holds promise as an alternative for patients with bilateral knee osteoarthritis. However, there are challenges to adopting robot-assisted surgery. The high initial cost of robotic systems and the financial burden of maintenance, especially in resource-limited settings, are a concern. In addition, steep learning curves and the need for extensive training for surgeons and operating room staff may delay implementation and lead to inconsistent early results [41, 42]. Accessibility of these systems remains an issue. These considerations highlight the importance of further research to assess the cost-effectiveness and equity of robot-assisted approaches, particularly for patients undergoing BKA.

Before conducting this meta-analysis, we assessed the quality of the included studies by implementing a rigorous literature screening protocol based on the guidelines of the Cochrane Handbook as well as PRISMA, in order to ensure the reliability and accuracy of the results of our analysis. In all, 12 studies were included in this analysis, most of which were fairly recent studies published between 2009 and 2024, thereby reflecting the latest study results and technological advances in the field.

Despite its merits, this meta-analysis has several limitations. First, the study population in the included studies varied in terms of type of knee prosthesis, age, gender, and ethnicity, which led to significant heterogeneity in the results of these studies. This heterogeneity may have been influenced by several factors, such as trial quality, design, sample size, and outcome definition, and the exact extent of their specific contributions to heterogeneity remains unclear. Second, an important aspect to consider is the effect of the surgeon's experience on the surgical outcomes. Several of the studies included in this analysis point to the fact that inexperienced surgeons may be faced with the problem of a learning curve, and it is generally recognized that surgical outcome is closely related to surgeon's level of experience and that the outcomes improve with increasing experience. Therefore, the surgeon's level of experience is an important consideration when undertaking a comprehensive assessment of surgical treatment outcomes. Furthermore, data on certain important metrics used to assess outcomes, such as SF-12 scores, repair rates, and visual analog scale (VAS) scores, have only been reported in very few studies, despite the wide recognition of the importance of these metrics in assessing the efficacy and safety of BKA. Therefore, the results of our analysis should be interpreted with caution.

In summary, although this meta-analysis provides important insights into the safety and efficacy of BKA compared with TKA, further validation and elucidation of these findings is necessary via conducting prospective, multicenter RCTs with longer follow-up periods, in order to obtain data to accurately guide clinical practice.

Conclusion

The present meta-analysis builds on our previous work, incorporating more high-quality randomized controlled trials and prospective cohort studies as well as multiple outcome metrics for an in-depth analysis. Overall, our results indicate that for patients with bicompartmental knee OA, BKA offers a significant advantage over TKA in knee functional recovery and quality of life improvement. These findings are in line with the results of our previous meta-analysis. However, special attention should be paid to the possibility of a higher risk of postoperative complications and a longer operative time associated with BKA may be associated with a higher risk of. Considering these results, we believe that additional studies are warranted to validate these preliminary findings, in order to comprehensively assess the long-term outcomes and cost effectiveness of BKA. In addition, further investigations should also focus on postoperative management strategies for BKA, including methods to prevent and control complications. Given the specificity of the BKA surgical technique, it is recommended that further investigation be conducted on surgical techniques, patient screening criteria, and postoperative rehabilitation protocols, in order to further enhance surgical safety and efficacy and facilitate the development of personalized treatment strategies for patients.

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s13018-024-05384-6.

Supplementary Material 1

Acknowledgements

The authors thank the experts who kindly responded to specific questions during the conduct of this research.

Author contributions

Rongwei Zhang: Data curation, software, writing (original draft, review, and editing).Xianyue Shen: Methodology, writing (review and editing).Kangyong Yan: Conceptualization, formal analysis, software.Xianzuo Zhang, Chen Zhu: Software, supervision, validation, visualisation, writing (review and editing).

Funding

This work was supported by Research Funds of Centre for Leading Medicine and Advanced Technologies of IHM (No. 2023IHM02009) and USTC Research Funds of the Double First-Class Initiative (No. YD9110002053).

Data availability

No datasets were generated or analysed during the current study.

Declarations

Ethical approval

Institutional review board approval was not needed as this is a meta-analysis of published data, however, PROSPERO registration was done.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

Received: 21 October 2024 / Accepted: 18 December 2024
Published online: 05 March 2025

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