Middle-Aged Total Knee Replacement

Subjects: Others

Contributor: Jason Trieu , Daniel J. Gould , Chris Schilling , Tim Spelman , Michelle M. Dowsey , Peter F. Choong

An increasing number of total knee replacements (TKRs) are being performed in response to the growing burden of osteoarthritis. Patients <65 years of age represent the fastest growing group of TKR recipients, and are expected to account for an increasing number of primary and revision procedures. Concerns have been raised about the outcomes that can be expected by this age demographic who are more active, physically demanding, and have longer life expectancies compared to older TKR recipients. This systematic review and meta-analysis evaluated the effectiveness of TKR for osteoarthritis in patients < 65 years of age, compared to older individuals.
The increasing use of TKR in patients < 65 years of age may be supported by a large degree of clinically meaningful improvements in patient-reported pain, function, and quality of life outcomes, and the majority of these patients are satisfied with their surgery. However, results into the second postoperative decade remain uncertain, with data suggesting a high prevalence of pain and increasing functional decline. Limited evidence suggests younger patients achieved generally equivalent and potentially greater improvements in patient-reported outcomes compared to older individuals following TKR for osteoarthritis.

patient-reported outcomes | total knee replacement | total knee arthroplasty | osteoarthritis | middle aged

1. Introduction

Total knee replacement (TKR) remains a successful and effective procedure in the treatment of knee osteoarthritis [1]. As the osteoarthritis burden grows, an increasing number of TKRs are being performed; high-volume countries like the United States are projecting nearly 3.5 million procedures for the year 2030 [2]. Comparable rates of growth are similarly projected for countries with high rates of TKR utilisation per capita [3]. Australia is anticipated to perform up to 161,000 TKRs in 2030, and the United Kingdom up to 1.2 million TKRs in 2035 [4][5] Growing patient demand, expectations for improved quality of life, and increasing implant survivorship have contributed to the expansion of TKR towards a greater number of younger patients [6]. In particular, patients <65 years of age represent the fastest growing population of TKR recipients and are expected to account for more than 50% of knee replacement procedures by the year 2030 [3][7].

The rapidly expanding use of TKR by younger patients presents a number of different challenges. Due to more active lifestyles, greater physical demands, and longer lifespans compared to traditionally older recipients of TKR, concerns have been raised about the higher rates of revision surgery faced by this group [8]. Bayliss et al. have reported an increased lifetime risk of revision of up to 35% in male patients who undergo TKR in their early 50s [9].

Furthermore, the excellent pain, function, and quality of life outcomes reported in the literature have mostly related to older and less active patient populations, and therefore may not translate to younger patients [8]. Given these complex considerations, the decision to perform TKR in younger patients should be fully informed by an understanding of the risk-benefit profile of the procedure, ensuring that this procedure is able to meet patient expectations (performance and longevity) in terms of what can be realistically achieved through surgery.

2. Discussion

The findings of this review suggest that younger patients attain clinically meaningful improvements exceeding MCIDs across patient-reported pain, function, and quality of life following TKR for osteoarthritis. Satisfaction in this cohort was equivalent to the results achieved in the broader TKR literature. The degree of improvement was considered large (pooled effect size >0.8 SMDs) across pain, function, and quality of life. However, the limited data available for analysis resulted in a high degree of uncertainty around estimates, particularly for the PCS. Some studies suggest a high prevalence of pain and patterns of functional decline in the second post-operative decade, and residual dissatisfaction in a percentage of patients remains an issue [10][11][12]. Limited evidence suggests that improvements observed in younger individuals is generally equivalent and potentially greater than those attained by older individuals [10][11][13][14].

The greatest improvement was reported in the pain subscale (effect size >0.8 SMDs) over a median follow-up period of up to 12 years. Large improvements were also attained in the function subscale. Studies which did not contribute to the meta-analysis reported comparable post-operative scores or improvements over follow-up periods ranging from 6.5 to 16.8 years for patients <55 years of age [15][16]. Scores were available for two instruments which are not strictly patient-reported outcome measures, although they each have a patient-reported component —the KSS, and the Hospital for Special Surgery (HSS) knee score. Improvements in the KSS exceeded the MCID; for the HSS, the MCID has not been established [10][15][16][17][18]. These results support the effectiveness of TKR in relieving pain and improving function for patients <65 years of age with osteoarthritis.

The greatest improvement to quality of life was in physical health, with potentially large improvements over a median follow-up period of up to 12 years. However, there was a high degree of uncertainty around estimates (95% CI of −0.16 to 11.13). Large improvements were reported in mental health over the same period of follow-up. Improvements in quality of life were equivalent to those achieved by older patients. In one study (227 TKRs), 98% considered undergoing the procedure again and 96% would have recommended the procedure to others [19]. Satisfaction of 84% at 2 years post-operatively was equivalent to that in older patients, and consistent with the broader literature [20]. Despite satisfaction rates that are consistent with the TKR literature, satisfaction remains a complex area influenced by a range of factors [21]. The discordance between satisfaction with TKR versus the higher percentage that would undergo or recommend the procedure suggests that some expectations remain unmet [22]. This in particular reinforces the need for treating clinicians to establish clear expectations around the present uncertainties of longer-term results.

The performance of TKR into the second decade following surgery is less predictable. The decision to proceed with TKR, compared to alternative joint-preserving strategies, should be carefully weighed against the elevated risk of revision surgery in this cohort. With younger patients having longer life expectancies and facing higher lifetime rates of revision surgery, the longer-term results will be an important consideration in the decision to undergo TKR. In addition to one of the studies included in the meta-analysis, four other studies had mean or median follow-up periods exceeding ten years, two of which did not report outcomes using patient-reported instruments [10][12][16][17]. For patient-reported outcomes, improvement in the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) at a mean of 16.8 years was comparable to improvements reported by studies that were included in the meta-analysis, and another study reported only the post-operative score for the Oxford Knee Score (OKS) and so the degree of improvement could not be determined [12][16]. An interesting finding was the high prevalence of pain at a mean follow-up of 15.5 years, with 41% of the unrevised TKRs in this cohort reporting moderate or severe pain according to the OKS pain subscale [12]. A trend identified across both younger and older patients was the increasing functional impairment with advancing age, which the authors suggest may be related to an increasing comorbidity burden and declining activity levels [10][11]. Uncertainty of longer-term outcomes, a high prevalence of pain, and patterns of functional decline are concerning and should be examined.

2.1. Implications for Practice and Research

The success of TKR has seen a rapid growth in its utilisation across a number of countries, and also its expansion into younger age groups [3][23]. In response, health services have shown increasing interest in the use of quality metrics including patient-reported outcome measures to evaluate the impact and value of surgery [24][25][26]. These instruments reflect patient-relevant outcomes including pain, function, and quality of life which are some of the primary indications for TKR that are not captured by traditional metrics such as prosthesis survival [12]. With increasing prosthesis longevity reported by national registries, younger individuals will be expected to live with a prosthesis for a longer period of time, and longer-term patient outcomes therefore become an important consideration in the decision to undergo TKR [27]. Although the limited data available support the appropriate use of TKR in this younger cohort, there remain a number of concerns which require further investigation.

Whilst TKR provides clinically meaningful improvements to pain, function, and quality of life in the first decade, a large degree of uncertainty surrounds outcomes and expectations beyond this period. There is a greater likelihood that outcomes may deteriorate whilst the risk of revision surgery increases. Our most comprehensive understanding of prosthesis survivorship currently stems from established national joint registries, with cumulative 15-year revision rates ranging from 4.3% to 15.5% reported by the Australian Orthopaedic Association's National Joint Replacement Registry [27]. However, younger patients are expected to use their prosthesis beyond the period for which data are currently available. Bayliss et al. recently investigated the lifetime risk of revision surgery, and of concern is the marked increase in lifetime revision rate for TKRs from approximately 15% for those undergoing surgery between ages 60–70, rising a few percentage points for females undergoing surgery at age 50–60, but alarmingly more than doubling to 35.0% for males undergoing surgery at age 50–54 [9]. These data lend support to concerns raised by other authors about the rising use of TKR in younger patients, where data and certainty of outcomes are relatively lacking in comparison to older patients and hence appreciation of longer-term

consequences may not be adequately informed [8]. We suggest that due consideration should be provided to alternative strategies that can address symptoms and potentially delay the need for arthroplasty until later stages where outcomes are more predictable and the lifetime risk of revision is lowered. A role for the selective use of joint-sparing techniques such as high-tibial osteotomy in earlier stages of disease progression can be demonstrated if they are able to deliver improved patient outcomes or reduce the rate of revision surgery [28]. Despite potentially higher costs with staged procedures to delay the need for TKR, this option may remain cost-effective if the revision risk can be mitigated.

The investigation of these longer-term outcomes will be required to help inform patients about the realistic results that can be expected. Importantly, patients for whom the expected outcomes of TKR do not align with their expectations may be redirected to alternative and more appropriate treatment strategies. The focus of investigation should now shift towards strategies aimed at maintaining the benefit of TKR throughout the longer-term and minimising dissatisfaction following surgery. Research suggests that there is a strong role for the identification of long-term pain, function, and quality of life trajectories following TKR, where strategies targeting the modifiable predictors of poor response to surgery may have the potential to improve longer-term patient-reported outcomes [29][30]. Furthermore, clinical joint replacement registries have been highly effective in monitoring the long-term survivorship of prostheses to inform practice, and are similarly well placed to facilitate the systematic collection and monitoring of quality metrics including patient-reported outcomes over longer periods of sustained follow-up [24][25][31][32].

Greater emphasis should be placed on the consistent use and reporting of validated instruments. Reporting of pre-operative baseline scores will enable comparison of outcomes, and consistent reporting of data to include means with standard deviations should be adopted. Where feasible, inclusion of patient characteristics including age, gender, body mass index, diagnosis, grade of arthritis, pre-operative scores, American Society of Anaesthesiologists physical status classification, existing mental health co-morbidity such as depression and anxiety, and socioeconomic status, and procedural characteristics including prosthesis design and use of patellar resurfacing, will minimise confounding, facilitate identification of heterogeneity between studies, enable appropriate comparison of results, and aid in the translation of research findings to clinical practice settings [33][34].

2.2. Strengths and Limitations

This is the first review to evaluate patient-reported outcomes following primary TKR for osteoarthritis in patients <65 years of age. This cohort represents the most rapidly growing group of TKR recipients, and findings from this review may assist patients and clinicians by clarifying the outcomes that can be expected from surgery. However, the large degree of heterogeneity amongst study designs presents a source of potential bias. A wide range of instruments were reported, and inconsistencies in the reporting of raw data were frequently encountered which included missing pre-operative scores or variation in the reporting of potential confounders relating to patient or procedural characteristics. As such, only a limited meta-analysis of two prospective studies was performed, with substantial residual heterogeneity. Although large improvements following TKR are reported, it remains unclear how much of the variation in improvement following TKR is attributed to differences in patient or procedural

characteristics between studies. The overall findings reflect a wide range of settings that are not directly comparable, with longer-term outcomes reflecting surgeries performed in previous decades. Findings should be cautiously interpreted with these limitations in mind.

3. Conclusions

The increasing use of TKR in patients < 65 years of age may be supported by a large degree of clinically meaningful improvements in patient-reported pain, function, and quality of life outcomes, and the majority of these patients are satisfied with their surgery. However, results into the second postoperative decade remain uncertain, with data suggesting a high prevalence of pain and increasing functional decline. Limited evidence suggests younger patients achieved generally equivalent and potentially greater improvements in patient-reported outcomes compared to older individuals following TKR for osteoarthritis.

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