Complications after minimally invasive total knee arthroplasty as compared with traditional incision techniques: a meta-analysis

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CRD summary
This review concluded that minimally invasive surgery for total knee arthroplasty resulted in significantly more complications compared with standard incision surgery, but there were no significant differences in alignment outliers and Knee Society Scores. These findings should be interpreted with caution given the limitations of the evidence; the authors appear justified in recommending further research.

Authors' objectives
To compare the complication rates of minimally invasive surgery versus standard incision surgery for total knee arthroplasty. A secondary objective was to compare Knee Society Scores, Knee Society Function scores, and alignment outliers.

Searching
PubMed, EMBASE, Cochrane Database of Systematic Reviews, Cochrane Central Register of Controlled Trials (CENTRAL), and ClinicalTrials.gov were searched up to 2009 for studies written in English. Search terms were reported. Abstracts from the archives of orthopedic meetings were searched including American Academy of Orthopedic Surgeons (2001 to 2009), Knee Society (2001 to 2009), Canadian Orthopedic Association (2003 to 2009), and British Orthopedic Association (2002 to 2009). Reference lists of retrieved studies were screened. Published and unpublished studies were eligible for inclusion in the review.

Study selection
Randomised controlled trials (RCTs) that compared minimally invasive versus traditional incision surgery for patients undergoing primary total knee arthroplasty were eligible for inclusion in the review. Trials that assessed computer navigation–assisted minimally invasive total knee arthroplasty were excluded.

Eligible outcomes were postoperative complications (further defined in the review), Knee Society Scores, Knee Society Function scores, and alignment outliers.

The implants used in the included trial were LPS MB, LPS-Flex, PS, PFC-FB, Genesis II, FB, and CR. In the included trials, different types of total knee arthroplasty procedures were used including quadriceps sparing, minimally invasive, mini-midvastus, mini-medial parapatellar and mini-subvastus. The mean age of participants ranged from 64 years to 76.1 years. The percentage of men ranged from 6.7 to 32% (where reported). The mean body mass index of participants ranged from 28 to 32 (where reported).

The authors did not state how many reviewers assessed the studies for inclusion.

Assessment of study quality
Each RCT was independently assessed for methodological quality by two reviewers using a 21-point scale. Both reviewers were blinded to each article's title, authors and institution. Discrepancies were resolved through consensus.

Data extraction
Two reviewers extracted the mean differences and standard errors of function and knee scores at three months of follow-up. Where the standard error for a mean difference was not reported, it was calculated from other data where possible. Radiographic outliers from the acceptable alignment range were taken as a ratio from each trial. Trials consistently applied the criteria of deviation of 2° to 3° of varus or valgus from a neutral mechanical axis as an outlier. Odds ratios (ORs) with 95% confidence intervals (CIs) were reported for dichotomous outcomes.

Methods of synthesis
Trials were grouped by outcome and pooled weighted mean differences (WMDs) with 95% confidence intervals.
calculated for continuous outcomes, with pooled odds ratios and 95% confidence intervals for dichotomous outcomes using a random-effects model. Heterogeneity was assessed using the Q statistic and $I^2$. $I^2$ values below 25% were considered evidence of low heterogeneity, 50% moderate heterogeneity, and 75% of high heterogeneity.

Publication bias was assessed using a funnel plot

**Results of the review**

Nine RCTs (n=858 patients) were included in the review. Sample sizes varied from 49 to 240 patients. The method of randomisation was reported in seven trials. Two trials used concealment allocation. Five trials carried out blinded outcome assessment. The average follow-up time ranged from three to 28 months.

For the total population (OR 1.58, 95% CI 1.01 to 2.47; nine RCTs) and alignment outliers (OR 0.79, 95% CI 0.34 to 1.82; six RCTs), there was a statistically significant lower rate of complications in the standard surgery group than in the minimally invasive surgery. There was no statistically significant difference between the two treatments in mean Knee Society Scores for the total patient group (five RCTs) or the acceptable range of alignment group (six RCTs).

The authors found no evidence of significant heterogeneity between the trials for the primary outcome, so they did not perform the planned sensitivity analyses. There was some evidence of heterogeneity for the outliers analysis and the Knee Society Scores analyses.

There was no evidence of publication bias.

**Authors' conclusions**

Minimally invasive surgery for total knee arthroplasty resulted in a significantly higher complication rate compared with standard incision surgery. However, there were no statistically significant differences between the two groups for alignment outliers and Knee Society Scores at three months post-surgery. Minimally invasive knee surgery should be approached with caution.

**CRD commentary**

This review answered a clearly defined research question. A number of different sources were searched for published and unpublished studies, which reduced the risk of publication bias. There was some risk of language bias as only English language studies were eligible for inclusion. The risk of reviewer error and bias appeared low, although it was unclear whether precautions were taken to reduce the risk of bias when selecting studies for inclusion.

The methodological quality of the trials was assessed using appropriate criteria; the quality of the included trials appeared mixed and a number of methodological flaws were apparent. The trials showed some variations, particularly in patient populations; in some cases, the pooling of trials may not have been appropriate. The authors did not carry out planned sensitivity analyses, as they reported no significant statistical heterogeneity for the primary outcome.

These findings should be interpreted with caution given the limitations of the evidence; the authors appear justified in recommending further research.

**Implications of the review for practice and research**

**Practice:** The authors stated that minimally invasive total knee arthroplasty did not demonstrate improved outcomes, so its place in practice was unclear. The authors advocated adequate surgical exposure to ensure accurate component alignment and soft tissue balancing.

**Research:** The authors stated that further studies were required to investigate the role of computer navigation in complimenting minimally invasive techniques for total knee arthroplasty.

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