Does minimally invasive surgery improve short-term recovery in total knee arthroplasty?

CRD summary
The review concluded that minimally invasive surgery led to faster recovery than conventional surgery in total knee arthroplasty, with similar rates of malalignment, but was associated with more frequent delayed healing and infections. Given the variable quality of the included trials and the high degree of statistical variation in some analyses, caution is warranted when interpreting the authors’ conclusions.

Authors' objectives
To assess whether minimally invasive total knee arthroplasty is associated with increased operative time, reduced blood loss, shortened hospital stay, faster recovery of range of motion, higher knee scores, inferior component positioning, and increased complications compared with standard surgery.

Searching
MEDLINE, EMBASE, CBMdisc, Web of Science, and the Cochrane Library were searched to April 2009 for published articles in any language. Search terms were reported. Reference lists of retrieved articles were also searched.

Study selection
Published randomised controlled trials (RCTs) or quasi-RCTs that compared minimally invasive surgery with standard surgical approaches in patients undergoing total knee arthroplasty for symptomatic knee disease were eligible for inclusion. Outcomes of interest included perioperative outcomes, composite knee scores, postoperative radiographs and complications. Trial that did report the outcomes for both techniques or did not provided the necessary data were excluded.

The included trials evaluated minimally invasive surgery (incision length ranging from 9cm to 13.2cm, where reported) with standard incision surgery (incision length ranging from 10.7cm to 18.5cm, where reported) in patients predominantly requiring total knee arthroplasty for primary arthritis. The use of cement and resurfacing of the patella varied across studies. The outcomes reported included total operative time, total blood loss, length of hospital stay, radiographic results, postoperative complications, and various knee scores.

Two reviewers independently selected studies.

Assessment of study quality
Twelve quality criteria were assessed including blinding, exclusion criteria, loss to follow-up and allocation concealment. All trials were given a quality score out of 15.

Two reviewers independently assessed study quality according to the Cochrane Collaboration methodology, and disagreements were resolved through discussion.

Data extraction
Two reviewers independently extracted data on perioperative outcomes, composite knee scores, postoperative radiographs and complications. Data were to calculate mean differences and 95% confidence intervals (CIs); for dichotomous data odds ratios (OR) and 95% confidence intervals were calculated. Authors of the included trials were contacted for missing data.

Methods of synthesis
The pooled weighted mean difference (WMDs), together with 95% confidence intervals, was calculated using a random-effects meta-analysis. Statistical heterogeneity was assessed using the Q statistic and I² statistic.

Subgroup analysis was conducted grouping trials according to surgical approach and follow-up. Sensitivity analysis was
conducted according to trial quality.

Publication bias was assessed by funnel plot assessment.

Results of the review
Thirteen trials (n=979 patients) were included in the review. The study sample size ranged from 30 to 240 patients (as reported in the tables; figures reported in the text differed). The quality of the included trials was variable (scores ranging from 5 to 11 out of 15), with few trials adequately describing quality items.

Perioperative outcomes: Compared with standard surgery, minimally invasive surgery had a statistically significantly greater operative time (WMD 10.49 minutes, 95% CI 4.18 to 16.79; I²=88%; seven trials) and tourniquet time (WMD 12.08 minutes, 95% CI 5.08 to 19.07; I²=86%; six trials). There was no significant difference between standard surgery and minimally invasive surgery in terms of total blood loss (four trials), intraoperative blood loss (two trials), postoperative blood loss (three trials) or length of stay in hospital (five trials).

Composite knee scores: Compared with standard surgery, minimally invasive surgery had a statistically significantly greater range of motion at six days (WMD 10.80, 95% CI 8.00 to 13.59; I²=32%; three trials), knee scoring at six weeks (WMD 9.71, 95% CI 2.11 to 17.32; I²=92%; four trials) and knee scoring at 12 weeks (WMD 2.84, 95% CI 1.58 to 4.10; I²=7%; seven trials). There was no significant difference between standard surgery and minimally invasive surgery in terms knee scores at six months (two trials) or 12 months (four trials). There was also no significant difference between standard surgery and minimally invasive surgery in terms of knee functioning scores (between two and eight trials).

Postoperative radiographs and postoperative complications: There was no significant difference between standard surgery and minimally invasive surgery in terms of radiographic outcomes (four trials) or postoperative complications (eight trials).

There was some evidence of publication bias in the complications outcome.

Results of subgroup and sensitivity analyses were presented.

Authors' conclusions
Minimally invasive surgery led to faster recovery than conventional surgery with similar rates of malalignment, but it was associated with more frequent delayed healing and infections.

CRD commentary
Inclusion criteria for the review were clearly defined and several relevant data sources were searched, without language restrictions. The reviewers undertook each stage of the review in duplicate, which reduced the potential for reviewer error and bias. Publication bias was assessed; there was the potential for bias for one of the outcomes.

The included trials were of variable quality, which the authors acknowledged and explored. The trials were combined using meta-analysis, with subgroup and sensitivity analyses, which appeared appropriate.

The review was generally well conducted, but given the variable quality of the included trials and the high degree of statistical heterogeneity in some analyses, caution is warranted when interpreting the authors' conclusions.

Implications of the review for practice and research
Practice: The authors did not state any implications for practice.

Research: The authors stated that further large, well-conducted and well-reported RCTs with long-term follow-ups are needed to evaluate the clinical and cost benefits of minimally invasive surgery total knee arthroplasty.
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