Cryotherapy after ACL reconstruction: a meta-analysis
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CRD summary
This review concluded that cryotherapy after arthroscopic anterior cruciate ligament reconstruction produces significant benefits in post-operative pain control, but no improvement in post-operative range of motion or drainage. Given the degree of variation between the studies and the absence of robust statistically significant differences between study groups, the authors’ findings are unlikely to be reliable.

Authors’ objectives
To evaluate the effectiveness of cryotherapy after arthroscopic anterior cruciate ligament (ACL) reconstruction.

Searching
EBM Reviews (including ACP J Club, the Cochrane Controlled Trials Register, the Cochrane Database of Systematic Reviews and DARE), CINAHL, MEDLINE, SPORTDiscus and Current Contents were searched up to November 2002; the search terms were reported. In addition, the bibliographies of included studies and two relevant journals were checked for additional references. The authors of published RCTs were contacted to try and identify other relevant trials.

Study selection
Study designs of evaluations included in the review
Only randomised controlled trials (RCTs) were eligible for inclusion in the review.

Specific interventions included in the review
Studies comparing cold therapy after arthroscopic ACL reconstruction with placebo were eligible for inclusion. Eligible placebo groups were no cold therapy or the use of a cold therapy device using water at room temperature. Studies of Cryo/Cuffs, cooling pads, ice packs or continuous icing/cooling systems were evaluated in the review. All but one of the included studies compared interventions with no treatment; the remaining study compared the intervention with a cold therapy device used at room temperature only.

Participants included in the review
Studies of individuals undergoing arthroscopic ACL reconstruction were eligible for inclusion. All but one of the included studies evaluated patients undergoing an arthroscopic patellar tendon autograft; the remaining study included patients undergoing an arthroscopic gracilis/semitendinosus autograft. The mean age of the participants varied between 22.1 years and 34.0 years.

Outcomes assessed in the review
Studies reporting the amount of post-operative pain (measured using a visual analogue scale), post-operative drainage or range of knee motion were eligible for inclusion in the review.

How were decisions on the relevance of primary studies made?
The authors did not state how the papers were selected for the review, or how many reviewers performed the selection.

Assessment of study quality
The authors did not state that they assessed validity.

Data extraction
Two reviewers independently extracted the data from the included studies; any discrepancies were resolved through
consensus. Authors were contacted for raw data where data were only reported graphically; if necessary, data were extrapolated from graphical displays. Mean differences between the treatment groups were obtained.

Methods of synthesis
How were the studies combined?
Due to the identification of substantial heterogeneity between the studies, effect sizes were combined using a random-effects model and 95% confidence intervals were calculated.

How were differences between studies investigated?
Unidentified statistical tests for heterogeneity were performed. Some clinical differences between the studies were evident from the text and tables of the review. Sensitivity analyses were used to explore the effects of potential inaccuracies in data extracted from graphical displays.

Results of the review
Seven RCTs (n=551) were included in the review.

Pain (6 RCTs).
Two studies reported a significant reduction in pain favouring the cryotherapy group, whilst the remaining studies showed no or only marginally significant improvements. When pooled using a random-effects model, a significant reduction in pain was reported compared with placebo (p=0.02). Sensitivity analyses excluding graphical data from 2 studies showed that the effect was no longer significant (p=0.075).

Drainage (4 RCTs).
Only 1 study reported a significant improvement in drainage in favour of the cryotherapy group. The meta-analysis found no statistically significant effect of cold therapy on drainage.

Range of motion (4 RCTs).
None of the studies reported a significant improvement in range of motion in favour of the cryotherapy group. The results of the meta-analysis were also statistically non significant.

Authors' conclusions
Cryotherapy produces a statistically significant benefit in post-operative pain control, but no improvement in post-operative range of motion or drainage. Cryotherapy is therefore justified in the post-operative management of knee surgery, given that it is inexpensive, easy to use, has a high level of patient satisfaction and is rarely associated with adverse events.

CRD commentary
This review was based on clear inclusion criteria and it aimed to investigate a clearly defined research question. Several relevant sources were searched, but it is unclear whether sufficient attempts were made to locate unpublished material; the findings may therefore be subject to publication bias. Similarly, the review methods may be open to bias and error as it is unclear whether the study selection process was verified by a second independent reviewer. The reviewers do not appear to have formally assessed the methodological quality of the studies, although they did discuss the lack of blinding and the problems of studies not having a room temperature placebo group.

Differences between the studies appear to have been investigated and statistical tests for heterogeneity carried out. However, these data are poorly reported and the studies appear to have been pooled statistically, regardless of clinical differences. Where effect sizes have been combined, the authors failed to report the pooled effect sizes. Given the degree of heterogeneity between the studies and the absence of robust, statistically significant differences in effect sizes between study groups, the authors' findings are unlikely to be reliable. In addition, the authors' conclusion that
cryotherapy is justified based on its cost, safety, ease of use and patient satisfaction goes beyond the data presented in this review.

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

Practice: The authors stated that, given that cryotherapy is inexpensive, easy to use, has a high level of patient satisfaction and is rarely associated with adverse events, the use of cryotherapy in the post-operative management of knee surgery is therefore justified; however, this goes beyond the evidence presented.

Research: The authors stated that large, multicentre RCTs are required to investigate the clinical effectiveness and cost-effectiveness of cryotherapy in arthroscopically-assisted ACL reconstruction. These should use uniform, standardised protocols with clearly defined outcomes. Two placebo groups should be included (no treatment and treatment at room temperature) in order to control for the 'placebo effect'. Future studies should compare cryotherapy with other methods of post-operative pain control such as continuous anaesthesia and new analgesics.

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This is a critical abstract of a systematic review that meets the criteria for inclusion on DARE. Each critical abstract contains a brief summary of the review methods, results and conclusions followed by a detailed critical assessment on the reliability of the review and the conclusions drawn.