Core decompression and conservative treatment for avascular necrosis of the femoral head: a meta-analysis

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Authors' objectives
To evaluate core decompression and conservative treatment for avascular necrosis (AVN) of the femoral head.

Searching
MEDLINE was searched from 1966 to 1998 using the MeSH terms 'femoral head necrosis' and 'osteonecrosis', and the reference from retrieved articles were examined for additional studies. The search was restricted to citations in the English language.

Study selection
Study designs of evaluations included in the review
Studies with at least 10 participants and a minimum average follow-up of 12 months were eligible for inclusion. Studies where patient selection protocols created sample biases were excluded. The average length of follow-up was 43 months (SE=6 months).

Specific interventions included in the review
Surgical core decompression, i.e. the removal of a single core of bone from the avascular segment of the femoral head, was compared with conservative treatment, i.e. a period of protected weight bearing with crutches. Studies in which participants received additional treatments, such as iliac crest bone graft, vascularised fibular grafting, or pulsed electromagnetic stimulation, in addition to core decompression, were excluded from the analysis.

Participants included in the review
Patients with AVN of the femoral head, as determined by radiographic staging according to the Steinberg classification (stages 0 to V) or an equivalent classification system (see Other Publications of Related Interest), were included. The three most common causes of AVN were steroid use (344 hips), alcohol abuse (153 hips) and idiopathic (127 hips). The average age of the participants presenting was 40 years (standard error, SE=2 years). Bilateral disease was present in 31% of the participants undergoing core decompression and in 62% of those undergoing conservative treatment.

Outcomes assessed in the review
Successful treatment, defined as no further surgical intervention implemented or recommended, was assessed. Radiographic progression from stage I to stage II was not considered a failure, since radiographs significantly lag behind the physiological condition in the femoral head. Steinberg stage 0 outcomes were not compared since prophylactic core decompression of an asymptomatic, normal hip was not recommended by most authors. The stage III hips were not compared because their advanced disease predisposes them to failure, regardless of the intervention.

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

Assessment of study quality
No formal assessment of quality was undertaken.

Data extraction
The authors do not state how the data were extracted for the review, or how many of the reviewers performed the data extraction.
Data from the individual studies were not extracted into tables or presented in the text of the review. Summary data on the demographics of the core decompression and conservative treatment sample groups were provided in a table covering the following categories: the number of studies, the number of patients, the average age (years), the percentage of male participants, the percentage of female participants, the number of hips studied, the number and percentage of hips with bilateral involvement, cause of AVN, and the number of patients associated with each Steinberg stage.

Methods of synthesis
How were the studies combined?
A meta-analysis was performed to compare the success rates for core decompression and conservative treatment for Steinberg stages I and II. The description of the meta-analysis process stated that a chi-squared analysis was performed, but this process was not shown and only selected outcomes were summarised in tables.

How were differences between studies investigated?
A sensitivity analysis was used to compare the 22 studies included in the meta-analysis with the 9 studies excluded on account of highly selected patient groups; this compared year of publication, distribution of Steinberg stages, and percentage of bilateral cases. The sensitivity analysis was performed in order to determine whether the variables used to select patients were predictive of core decompression failure.

Results of the review
Twenty-two studies (n=818) using a single surgical core decompression technique, and 8 studies (n=264) using a conservative technique, were included. Eleven studies were non-randomised prospective, 10 were retrospective, and 1 was randomised prospective. An additional 9 studies that were excluded on account of highly selected patient groups were used in a further sensitivity analysis.

The most significant finding was that, with an average follow-up time of 42 months, core decompression was 23% more successful than conservative treatment for hips with Steinberg stage I AVN. This statistically-significant difference of 23% should be interpreted cautiously.

The success rates for surgical core decompression were 84, 63 and 29% for Steinberg stages I, II, and III, respectively. Conservatively-treated patients with stage 0, I, II and III AVN demonstrated success rates of 86, 61, 59 and 25%, respectively.

Chi-squared analysis showed that for stage I hips only, the success rate of core decompression (84%) was statistically significantly higher than that for conservative treatment (61%) (p=0.001).

Several significant differences were found in the sensitivity analyses. Studies with selection biases tended to be performed earlier than non-biased studies (1,986 versus 1,992; p=0.0068). Studies on specific groups also had proportionately fewer patients in Steinberg stage I (21 versus 48%; p=0.02), more patients in Steinberg stage III (42 versus 18%; p=0.03), and more patients with bilateral disease (86 versus 31%; p=0.0001). When 70% or more of the sample patients had bilateral disease, the success rates for Steinberg stages I, II and III were 50, 60 and 44%, respectively.

There were 33 (5%) complications in the 688 cases reported in the 13 studies. Reported complications were intertrochanteric fracture (n=14), technical errors in surgery (n=6), seromas and wound infections (n=8), femoral head fractures (n=3), deep vein thrombosis (n=1) and pulmonary embolus (n=1).

Authors' conclusions
The authors state that the 23% difference between core decompression and conservatively-treated patients with Steinberg stage I AVN was interpreted cautiously. Although many authors agree that core decompression provides excellent and immediate pain relief, core decompression did not alter the progression of AVN in Steinberg stage II hips.
CRD commentary
The authors clearly stated the research question and the inclusion and exclusion criteria. The literature search was limited since it searched only one database and only considered English language publications.

The quality of the included studies was not formally assessed, although sensitivity analyses were performed to determine the effects of selection bias on the results. The authors did not report how the articles were selected, or who performed the selection and data extraction. Few details of the included studies were provided in the review.

The studies were combined in a statistical analysis using a chi-squared test. However, this was not shown in the review and the results were not presented in detail. Heterogeneity was not formally assessed although some sensitivity analyses were performed. The conclusions appear to follow from the results but should be viewed with caution.

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

Research: The authors state that large multicentre prospective double-blinded studies with patients randomised to either core decompression or conservative treatment, then stratified by stage, cause and bilaterality, are needed to determine the best treatment for early-stage AVN.

Bibliographic details

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Other publications of related interest

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Record Status
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.