Authors' objectives
To conduct a risk-benefit analysis using a meta-analysis, for the comparison of complication rates and clinical advantages associated with the use of high-dose methylprednisolone in surgical patients.

Searching
PubMed and the Cochrane Library (Issue 2, 2000) were searched using the term 'methylprednisolone' and the publication type 'randomised controlled trial'. Both searches were repeated in August 2000. The references of all articles and two related Cochrane reviews were checked for further studies. The manufacturer of a commonly-used MPSS was also contacted for further information.

Study selection
Study designs of evaluations included in the review
Only randomised controlled trials were included in the review. Pseudo- or non-randomised trials on less invasive interventions were excluded. All trials of head injuries were excluded as they used either medium doses or extended therapy for more than three days.

Specific interventions included in the review
High-dose methylprednisolone sodium succinate (MPSS). A high dose was defined as an intravenous dose of at least 15 mg/kg or 1 g MPSS given as a single or divided dose over a 3-day period then discontinued.

Participants included in the review
Patients undergoing surgery were included in the review. Studies were excluded if they involved patients who routinely required intensive care at study entry, or were studies of minor operations that were usually performed on an out-patient basis, e.g. oral and facial surgery.

Outcomes assessed in the review
The potential adverse effects assessed were: significant gastrointestinal bleeding, infection, bleeding, leakage or seroma of a wound, pulmonary complications, psychiatric complications, symptomatic avascular bone necrosis proven by X-ray, and death from any cause.

Effectiveness was assessed in terms of pain at rest, fatigue, mobilisation, and hospital stay.

Data on these outcomes were only extracted from trials on pre-operative MPSS administration in elective noncardiac surgery.

How were decisions on the relevance of primary studies made?
The studies were selected by a single reviewer. When there was doubt whether a paper should be included or not, the decision was made by a second investigator who was unaware of the results of the study.

Assessment of study quality
The authors did not report a formal method for assessing the validity or quality of the primary studies. They did, however, report whether the trials were placebo-controlled, and whether publications provided sufficient details of the randomisation procedure and allocation concealment.

Data extraction
A single reviewer extracted the data from the studies. The following categories of data were extracted: reference details, type of operation, type of trauma, the number of patients, the MPSS dose and route of administration, the outcomes reported, and results.

**Methods of synthesis**

How were the studies combined?
Statistical analyses were carried out using Cochrane Collaboration software (RevMan 4.0.4). For adverse effects, the results were combined by a meta-analysis using a fixed-effect model. The 95% confidence intervals (CIs) and the number-needed-to-harm (NNH) were calculated. Risk differences with 95% CIs were displayed in forest plots for placebo-controlled trials only. A brief narrative synthesis of the efficacy data was presented.

How were differences between studies investigated?
Statistical heterogeneity was evaluated using a chi-squared test (p<0.1 level of significance).

**Results of the review**

A total of 51 studies met the inclusion criteria; the number of patients was not stated.

The pooled data did not show any statistically-significant increase in complication rates. In patients treated with corticosteroids, more gastrointestinal bleeding and wound complications were observed; when compared with placebo or no treatment, these differences were not statistically significant. For gastrointestinal bleeding, the risk difference was +0.3% (95% CI: -1.0, +1.7) and the NNH was 333 (lower 95% CI: 59). For wound complications, the risk difference was +1.0 (95% CI: -7.0, +2.6) and the NNH was 100 (lower 95% CI: 38). Compared with control, pulmonary complications were reduced in patients treated with MPSS (risk difference -3.5%, 95% CI: -6.1, -1.0; chi-squared 42.99, d.f.=34). This was most pronounced in trauma patients.

Data on efficacy were obtained from only 13 studies where MPSS was administered to patients undergoing elective surgery. Four studies reported pain relief outcomes; all found reduced pain with MPSS. Fatigue and convalescence were assessed in only 2 studies, both of which showed better results in the MPSS-treated group than in the control. Hospital stay was documented in 4 studies: 2 studies reported a reduction in stay for MPSS treatment, one reported a small increase, and one no difference.

**Authors' conclusions**

For patients undergoing surgical procedures, a peri-operative single-shot administration of high-dose MPSS was not associated with a significant increase in the incidence of adverse effects. In patients with multiple fractures, the limited evidence suggested that the use of glucocorticoids may have a beneficial effect on pulmonary complications.

**CRD commentary**

This review addressed a relevant question using well-defined inclusion criteria. Only randomised controlled trials were included in the review, ensuring that the basic quality of the evidence was reasonable. The literature search was limited to PubMed and the Cochrane Library and, therefore, may have missed some relevant publications. Study selection, validity and data extraction were performed by a single reviewer, with no independent checking, except for individual papers at the request of the single reviewer. This could have resulted in the introduction of some reviewer bias. The details of the primary studies were adequately summarised and presented in the review. The meta-analysis performed was appropriate, and used adequate methods. The results of the heterogeneity test were only presented for pulmonary complications. The authors' conclusions were supported by the findings of the review.

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

Practice: The authors state that for patients undergoing surgical procedures, a peri-operative single-shot administration of high-dose MPSS is not associated with a significant increase in the incidence of adverse effects.
Research: The authors state that further studies are needed to confirm the beneficial effects of MPSS on pulmonary complications.

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