Corticosteroids in the emergency department therapy of acute adult asthma: an evidence-based evaluation  
Rodrigo G, Rodrigo C

Authors' objectives
To determine the effectiveness of corticosteroids (CCSs) (oral, IM, IV or inhaled) in the treatment of adult patients with acute asthma.

Searching
The authors performed a search of the electronic MEDLINE database (1966 to October 1998) using the MeSh terms: 'Asthma or Wheez*', and 'glucocorticoids or steroids', and 'Acute* or Emerg'. The authors also searched Current Contents, a previous meta-analysis, review articles, and the reference sections of located studies. The authors also handsearched 15 journals in respiratory care and emergency medicine. The search was limited to English language publications.

Study selection
Study designs of evaluations included in the review
Randomised controlled trials (RCTs) conducted in an emergency care setting.

Specific interventions included in the review
Corticosteroids (CCSs) (hydrocortisone (HYD), methylprednisolone, or flunisolide with HYD equivalents ranging from 8.3 to 300.0 mg/kg/24 hours) administered either orally, intramuscularly, intravenously, or by inhalation) with a co-intervention of aminophylline for the intervention groups, and placebo for the control groups.

Participants included in the review
Adult patients over 18 years of age with asthma, presenting in acute-care settings, whose acute exacerbations were the primary reason for assessment. The mean age of participants was 32.3 years.

Outcomes assessed in the review
Pulmonary function tests and hospital admission rates.

How were decisions on the relevance of primary studies made?
Two authors independently reviewed the articles for inclusion using specific criteria. Disagreements were resolved by consensus. Agreement was measured using k-statistics.

Assessment of study quality
All trials were assessed using the following criteria: randomisation method; demographic characteristics of the sample; inclusion/exclusion criteria; asthma definition; sample size calculations; and withdrawals. The mean score of the two evaluations was divided by the possible score of 12 and was expressed as a value between 0.08 and 1.0. Trials with a score of > 0.7 were considered to be good quality. Validity criteria were applied by two of the authors. Inter-rater reliability was measured by using the k-statistic.

Data extraction
The authors do not state who, or how many of the authors, performed the data extraction.

Data were extracted for the categories of: study identification, treatments, hydrocortisone equivalent (mg/kg/25 hours); number of participants, co-interventions; quality scores; and effect sizes at 1, 3, 6, 12, and 24 hours.

Data were pooled for: any CCS versus placebo; parenteral versus oral administration; and high or moderate dose versus
low dose. Doses were converted to the HYD equivalent using the tables provided by Spiegel (See Other Publications of Related Interest no.1). The effect of treatment in each trial was computed using the standardised mean difference, reported in SD units. The effect size (ES) calculated was the ratio of the mean difference and the pooled SD, and the absolute difference between the two group means was divided by the pooled SD.

**Methods of synthesis**

How were the studies combined?

Pooled effect sizes (ES) were calculated for the effects of treatment with 95% confidence intervals (CIs). Studies were weighted by the reciprocal of the variance. In case of heterogeneity, a random-effects model was used.

Relative risks for dichotomous outcomes (admission rates) with 95% CIs were calculated using the fixed-effect Mantel-Haenszel method. If heterogeneity was present, then the calculations were performed using the DerSimonian and Laird random-effects model. The number-needed-to-treat statistic (NNT) with 95% CIs was also calculated.

How were differences between studies investigated?

Homogeneity was tested with the chi-squared statistic, using $p = 0.1$ as the cut-off point for significance.

When heterogeneity was found, subgroup analyses were performed. Sensitivity analyses were performed to assess the effects on results of methodological quality. To detect other bias, funnel plots were calculated.

**Results of the review**

Sixteen RCTs were included in the review. Groups in included studies ranged from 18 to 150 patients with a mean study group size of 61 patients.

Methodological quality scores ranged from 0.30 to 0.92 (mean 0.55). The inter-rater K-agreements for study selection and validity assessment were 0.81 and 0.89 respectively.

The funnel plot statistical assessment indicated the absence of bias associated with sample size.

At the 3-hour assessment, only high doses of inhaled corticosteroids (CCSs) significantly improved pulmonary function compared with placebo (ES = 0.56, 95% CI: 0.15, 0.97). After receiving IV CCSs, patients required at least 6 to 24 hours to show moderate but nonsignificant improvements of pulmonary function: 6-hour ES = 0.44, 95% CI: -0.01, 0.89; 12-hour ES = 0.54, 95% CI: -0.08, 1.17; and 24-hour ES = 0.53, 95% CI: -0.39, 1.45).

The data from 6 studies used for admission rate outcome showed a 32% reduction in favour of the use of IV CCSs (RR = 0.68, 95% CI: 0.47, 0.99; NNT = 12.5, 95% CI: 7.1, 50). However, the pooled effect of the 3 high-quality studies showed no difference between groups (RR = 1.21, 95% CI: 0.67, 2.18).

Oral CCSs provided a similarly beneficial effect on pulmonary function when compared with parenteral administration (ES = -0.14, 95% CI: -0.82, 0.31).

The results showed a nonsignificant favourable trend toward improved outcome with medium or high doses of CCSs.

**Authors' conclusions**

This review suggests that the administration of parenteral corticosteroids (CCSs) to the patient on arrival at the emergency department (ED) neither improves airflow obstruction nor reduces the need for hospitalization. Parenteral CCSs probably require > 6 to 24 hours to begin to act. Comprehensible conclusions about admission rates in the ED setting are difficult to make. At the 3-hour assessment, only high-doses of inhaled CCSs (in 1 study) significantly improved pulmonary function compared with placebo. IV and oral CCSs appear to have equivalent effects, and there is a tendency toward improvement in pulmonary function with medium or high doses.

**CRD commentary**
The authors have clearly stated their research question and inclusion and exclusion criteria. The literature search appears thorough, however the authors do not mention the inclusion of unpublished data in the review and they have limited the search to English language publications. It is therefore possible that additional relevant studies may have been missed. The quality of the included studies was assessed and the authors have reported on how the articles were selected and how many of the reviewers were involved in the data selection but not the data extraction.

The data extraction is reported in tables and text. The statistical pooling was appropriate and there were tests for heterogeneity, the results of which were used to guide further subgroup and sensitivity analyses. The authors discuss some of the methodological and data limitations in the review including the possibility of publication bias or study selection bias and the small number of studies being pooled.

The authors’ conclusions appear to follow from the results.

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

Practice: The authors stated that early response of the patient to beta-agonist therapy would determine whether waiting for the onset of action of CCSs would be of value. When the PEFR is < 40% of predicted and PEFR variation over baseline is < 60 L/minute, both measured at 30 minutes of therapy, then it is possible to wait for the onset of action of inhaled CCSs for 2 or 3 additional hours. If the PEFR remains < 40% after that time, these patients will require hospitalisation and parenteral CCS therapy, since improvement from discharge from the hospital takes 4 days.

Research: The authors did not state any implications for further research.

**Bibliographic details**


**PubMedID**

10453853

**DOI**

10.1378/chest.116.2.285

**Original Paper URL**


**Other publications of related interest**


**Indexing Status**

Subject indexing assigned by NLM

**MeSH**

Adult; Asthma /drug therapy /physiopathology; Emergency Service, Hospital; Evidence-Based Medicine; Glucocorticoids /therapeutic use; Hospitalization; Humans; Respiratory Function Tests; Treatment Outcome

**AccessionNumber**

11999001636

**Date bibliographic record published**

31/10/2000

**Date abstract record published**


31/10/2000

**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.