Systematic review and meta-analysis of antibiotic prophylaxis to prevent infections from chest drains in blunt and penetrating thoracic injuries

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CRD summary
This review concluded that infectious complications were less likely to develop when antibiotic prophylaxis was given to patients with penetrating thoracic injuries that required chest drains. The review was generally well conducted and the authors’ conclusions appear to be reasonable, based on the evidence presented.

Authors’ objectives
To examine the effect of antibiotic prophylaxis on surgical-site and pulmonary infections from chest drains, in blunt or penetrating thoracic injuries.

Searching
EMBASE, MEDLINE, Web of Knowledge, and The Cochrane Library were searched to October 2010 without language restrictions. The search terms were reported. The reference lists of retrieved articles were searched.

Study selection
Randomised controlled trials (RCTs) comparing antibiotic prophylaxis with placebo or no treatment in adult patients who underwent tube thoracostomy for an isolated thoracic injury were eligible for inclusion. The primary outcomes were the effects of antibiotic prophylaxis on surgical-site and pulmonary infections. Antibiotic prophylaxis was defined as antibiotics for patients with no clinical or microbiological infection at the time of administration. Any type of antibiotic was permitted.

The included trials studied cefalotin (cephalothin), cefonicid, cefazolin, cefoxitin, doxycycline, cephapirin, cefamandole, or clindamycin. Trials were published between 1977 and 2009. Treatment lasted longer than 24 hours in most trials and most of the patients were men. The most common type of chest injury was penetrating. Spontaneous pneumothorax was not included in the analysis.

Two reviewers independently selected the trials.

Assessment of study quality
Two reviewers independently assessed trial quality, using the Jadad scale and the Chalmers system, which is used to appraise the quality of items, such as randomisation, loss to follow-up, and blinding.

Data extraction
Two reviewers extracted the risks of any form of infection, of empyema, of a wound infection, and of developing pneumonia. These were used to calculate odds ratios and 95% confidence intervals. Authors were contacted for missing data, where necessary.

Methods of synthesis
Mantel-Haenszel meta-analysis was used to calculate the pooled odds ratios and 95% confidence intervals. All the effects were weighted by the inverse variance. Zero values were removed by adding 0.25 to each group. Statistical heterogeneity was assessed using $I^2$. Subgroup analysis was conducted for the type of antibiotic and the type of wound.

Results of the review
Eleven RCTs were included in the review, with 1,234 patients (range 58 to 229). Randomisation was adequate in four trials; six trials were double-blind; and most trials had comparable groups at baseline and reported loss to follow-up.

Compared with control, antibiotic prophylaxis resulted in a statistically significantly reduction in overall infection rate (OR 0.24, 95% CI 0.12 to 0.49; $I^2=30%$; 10 RCTs), and empyema (OR 0.32, 0.17 to 0.61; $I^2=0$; 11 RCTs). There were non-significant results for wound infection (two RCTs; $I^2=0$) and pneumonia (eight RCTs; $I^2=10%$).
Subgroup analysis showed that antibiotic prophylaxis reduced the risk of infection after tube thoracostomy in patients with penetrating chest injuries (OR 0.28, 0.14 to 0.57; I²=0; six RCTs), but not for patients with blunt trauma (three RCTs; I²=0).

Authors’ conclusions
Infectious complications were less likely to develop with antibiotic prophylaxis for patients with penetrating thoracic injuries that required chest drains.

CRD commentary
The inclusion criteria were clearly defined and several relevant data sources were searched, without language restrictions. Publication bias does not appear to have been assessed and cannot be ruled out. Attempts were made to reduce error and bias throughout the review. The quality of the evidence was generally good, but some trials did not report the randomisation method and double-blinding. Trials were pooled using standard statistical techniques and statistical heterogeneity was considered. The authors noted that most of the trials did not use standard definitions of pneumonia, empyema or wound infections, but they did not believe it had affected the within-trial results, and thus the comparative pooled results.

The review was generally well conducted and the authors’ conclusions appear to be reasonable, based on the evidence presented.

Implications of the review for practice and research
Practice: The authors stated that the recommended duration of antibiotic treatment could not be determined from the available evidence.

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

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