



Article: Use of prophylactic antibiotic in preventing complications for blunt and penetrating chest trauma requiring chest drain insertion: a systematic review and meta-analysis

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Background and Study Objective(s):

Many patients with blunt or penetrating chest wall trauma require the insertion of a chest tube. Prior studies report an infection complication rate of chest tube insertion ranging from 2-25% in patients with isolated chest trauma. Pleural space contamination from chest tube insertion or from direct penetrating chest injury are the main risk factors for this complication. The use of prophylactic antibiotics to reduce the occurrence of infection after chest tube insertion is debated. Prior clinical trials have showed mixed outcomes and the 2012 Eastern Association for the Surgery of Trauma (EAST) guidelines state insufficient evidence to support the use of prophylactic antibiotics. The objective of this study was to analyze the effectiveness of prophylactic antibiotics versus placebo in preventing empyema and pneumonia after chest tube insertion in isolated blunt and penetrating chest trauma. This is the first meta-analysis to be conducted on the topic following the 2012 EAST recommendations.

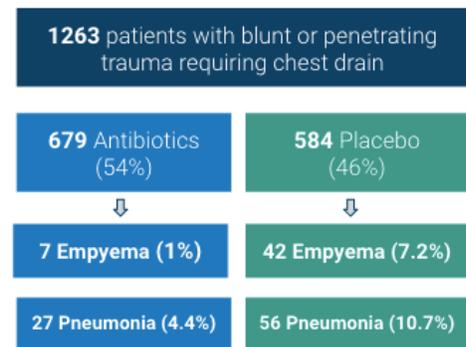
Study Design:

The study conducted was a systemic review and meta-analysis following PRISMA guidelines. The literature search was completed in May 2017 using four electronic databases, including gray literature, and there was no restriction based on language or date of publication. The references of included abstracts were also searched for any literature not included in the initial searches. The inclusion criteria stated that the trials must be a randomized control trial that compared prophylactic antibiotic use to placebo and the patients must have isolated blunt or penetrating trauma requiring chest tube insertion. Two reviewers determined eligibility criteria and extracted data independently. The Cochrane Collaboration Tool was used for assessing risk of bias amongst the included studies. The primary outcome of interest was the number of patients who developed post-traumatic chest infection after chest tube insertion. The rates of infection were compared between those who received prophylactic antibiotics and those that received the placebo treatment. Secondary outcomes examined included length of hospital stay and duration of chest tube insertion. A meta-analysis using a pooled random effect model to assess the relative risk of chest infection after chest tube insertion in these patients was conducted.

Results:

A total of 12 studies met the inclusion criteria and were included in the systematic review and meta-analysis. All patients with blunt and penetrating chest trauma were pooled. The studies included both male and female patients above the age of 12 except for one, which included patients above the age of 8 years old. Two studies only included patients with penetrating chest trauma, and one study only included those with blunt trauma. A total of 679 (54%) patients received prophylactic antibiotics compared to 584 (46%) patients who received a placebo. In those that received antibiotics, the incidence of post-traumatic empyema and pneumonia after chest tube insertion were 1% (7/679) and 4.4% (27/616), respectively. This is compared to placebo group where 7.2% (42/584) and 10.7% (56/521) developed empyema and pneumonia, respectively. Chi-square and I-square testing demonstrated homogeneity across studies; however, the authors report high heterogeneity for secondary outcomes precluding statistical analysis. On meta-analysis, prophylactic antibiotic use led to decrease rates of empyema (relative risk 0.25%, 95% CI, 0.13 to 0.49) and pneumonia (RR 0.41; 95% CI 0.24 to 0.71) when compared to placebo.

The overall effect demonstrated statistical significance favouring antibiotic use for preventing empyema and pneumonia. Six of the seven studies that reported on hospital length of stay (LOS) demonstrated a shorter LOS in the prophylactic antibiotic group compared to placebo. Four of the six studies that reported on chest tube duration showed a shorter duration of chest tube days in the antibiotic group compared to placebo.



Validity of Results:

This study addressed a clearly focused relevant clinical question, and the study's outcomes measures achieve its predetermined objectives. No competing interests or funding was identified and contributors are clearly outlined.

The study followed PRISMA guidelines and only randomized clinical trials with explicit outcomes comparing prophylactic antibiotic use to placebo were included. A search of primary databases as well as gray literature was conducted in which no limitation was placed on language or date of publication. The quality of the included papers was examined using the Cochrane Collaboration Tool. The authors state most eligible studies to be of high quality; however, only one study addressed all parameters included in the tool and not all the included trials were double-blinded. Meta-analysis for the study's primary outcome was appropriate given homogeneity of results. A limitation, however, was the overall combination of both blunt and penetrating trauma populations as they differ in their baseline rates of infection risk.

Another limitation of the included studies was the variability in the types, lengths, and doses of antibiotics prescribed although most studies assessed the use of a cephalosporin versus placebo. Additionally, though the meta-analysis showed decreased rates of chest infection in the prophylactic antibiotic group, there was an overall lack of reported risk factors in each study to explain why a patient possibly got a chest infection (for example, emergency vs. planned chest tube, experience of provider placing the chest tube); therefore, study outcomes between the two groups may be attributable to alternative explanations. Finally, during the review the disagreements between inclusion criteria and quality study were not adjudicated by a third party and its unclear if the authors extracted data using standardized forms.

Generalizability of Results:

A majority of studies were conducted in the United States, which has a similar demographic to British Columbia. However, the quality of hospital care may be quite variable in the United States, which may be contributory to the overall rates of infection. Only one of the studies was conducted in the last 10 years, and 75% of the studies were conducted more than 20 years ago, which limits generalizability as practice patterns change. We do note that there has been a trend to overall smaller chest tube placement within the last five years and may further influence rates of infection. Nevertheless, the most recent RCT done in 2014 shows a trend toward benefit for prophylactic antibiotic use.

The Bottom Line:

This meta-analysis demonstrates a significant reduction in empyemas and pneumonias when prophylactic antibiotics are administered to patients with isolated chest wall trauma requiring a chest drain. In penetrating trauma, this reduction makes sense given one's already elevated risk of infection from a violated chest wall. However, because no subgroup analysis was performed separating penetrating and blunt trauma groups, this effect is less clear in the blunt trauma population. Prophylactic antibiotics should be given to all patients with penetrating chest trauma requiring a chest tube; however, future subgroup analysis is required to provide specific recommendations regarding blunt chest wall trauma patients. Furthermore, studies are needed to examine the optimal duration and antibiotic type for preventing chest infection in those with isolated chest trauma requiring a chest tube.