

Simple Aspiration Compared to Chest Tube Insertion in the Management of Primary Spontaneous Pneumothorax

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SYSTEMATIC REVIEW SOURCE

This is a systematic review abstract, a regular feature of the *Annals'* Evidence-Based Medicine (EBEM) series. Each features an abstract of a systematic review from the Cochrane Database of Systematic Reviews and a commentary by an emergency physician knowledgeable in the subject area.

The source for the systematic review abstract is Wakai A, O'Sullivan RG, McCabe G. Simple aspiration versus intercostal tube drainage for primary spontaneous pneumothorax in adults. *Cochrane Database Syst Rev.* 2007;(1):CD004479. doi:10.1002/14651858.CD004479.pub2. The *Annals'* EBEM editors helped prepare the abstract of this Cochrane systematic review, as well as the Evidence-Based Medicine Teaching Points.

OBJECTIVE

To address the clinical efficacy and safety of simple percutaneous aspiration compared with standard intercostal chest tube drainage for the management of primary spontaneous pneumothorax in adults.

DATA SOURCES

The Cochrane Central Registry of Controlled Trials (CENTRAL) was searched up to August 2006. MEDLINE was searched from 1966 to August 2006. EMBASE was searched from 1980 to August 2006. In addition, reference lists of review articles, relevant trials, textbooks, and abstracts of scientific meetings were searched to further identify potential randomized controlled trials. Unpublished trials were also sought by personal communication with lead authors on the guidelines for the management of spontaneous pneumothorax. The search is considered updated to August 2006.

STUDY SELECTION

Studies were included if they were randomized controlled trials designs, involving adult patients with an initial episode of primary spontaneous pneumothorax who received either percutaneous catheter aspiration or intercostal chest tube drainage for initial primary spontaneous pneumothorax. The

aspiration technique was required to involve immediate catheter removal after successful aspiration (studies using kits containing aspiration catheters and a 1-way valve without immediate removal were excluded).

DATA EXTRACTION AND ANALYSIS

Two authors independently selected trials, extracted data, and assessed the quality of the trials. The authors evaluated the respective procedures' immediate success and early failure rate, 1-year success rate, overall cost and complications, mortality rates, hospitalization rates and duration, pain, patient satisfaction, and frequency of subsequent lung pleurodesis procedure within 1 year of the initial primary spontaneous pneumothorax resolution. Relative risks (RR) and 95% confidence intervals (CI) are reported for dichotomous data and mean group difference for continuous data.

MAIN RESULTS

Of the initial 1,735 articles identified by the above listed search criteria, 6 were identified as potentially relevant trials. Only 1 trial containing 60 patients was identified with the authors' search strategy and inclusion/exclusion criteria. The authors found that no statistically significant difference in immediate success rate was observed for simple percutaneous aspiration compared with intercostal chest tube drainage (RR=0.93; 95% CI 0.62 to 1.40). Furthermore, when comparing secondary endpoints, the authors found no statistically significant difference between early failure rate at 1 week (RR=1.12; 95% CI 0.59 to 2.13), 1-year success (RR=1.02; 95% CI 0.75 to 1.38), length of hospital stay (mean group difference=1.09 days; 95% CI 2.18 to 0), or the requirement for pleurodesis by thoracoscopic talc poudrage within a year (RR=0.95; 95% CI 0.41 to 2.22). The authors did observe a statistically significant difference in the need for hospitalization between simple percutaneous aspiration and intercostal chest tube (RR=0.52; 95% CI 0.36 to 0.75). The included study did not report mortality data, a comparison of procedural complications, cost, reported pain during procedures, an average daily pain score, or an average daily dyspnea score.

CONCLUSIONS

In the management of initial primary spontaneous pneumothorax in adults, there is no statistically significant difference between simple percutaneous aspiration and standard intercostal chest tube drainage in the immediate success rate of the procedure, between early failure rate at 1 week, length of hospital stay, or the requirement for pleurodesis at 1 year. A reduction in the rate of initial hospitalization was observed for patients undergoing simple percutaneous aspiration. These effect measures are imprecise because of limited available RCTs, and so no definitive conclusions can be drawn.

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COMMENTARY: CLINICAL IMPLICATION

Pneumothorax is defined as air in the pleural space, with spontaneous pneumothorax occurring without an identifiable cause (eg, blunt or penetrating trauma). Primary spontaneous pneumothorax occurs when no known underlying lung disease is present, whereas secondary pneumothorax occurs in individuals with known lung disease (eg, chronic obstructive pulmonary disease). In the United States, primary spontaneous pneumothorax affects more than 20,000 patients per year¹ and accounts for more than \$130 million in health care expenditures annually.² Although this condition has a relatively low mortality rate of 1.26 per million men per year and 0.62 per million women per year,³ it represents a commonly encountered medical problem with controversial management options. Recurrence rates of primary spontaneous pneumothorax vary but average approximately 30%.⁴

The principle of primary spontaneous pneumothorax management is to eliminate the intrapleural air collection and to prevent recurrence. Initial management options are influenced by the clinical presentation of the patient and include observation, simple percutaneous aspiration, and intercostal chest tube insertion. Although there seems to be consensus that clinically stable patients with small PSPs can safely be observed,^{5,6} there are opposing recommendations on the primary management of patients requiring intervention.^{5,6} Few treatment options are based on research evidence; however, the American College of Chest Physicians advocates intercostal chest tube for all patients requiring intervention and suggests simple percutaneous aspiration is rarely warranted,⁵ whereas the British Thoracic Society advocates the use of simple percutaneous aspiration in the primary management of all PSPs requiring intervention.⁶ The lack of a systematic review of individual management options may explain this recommendation discordance.

Although the authors of this review performed an extensive literature search to identify RCTs about primary spontaneous

pneumothorax management, only 1 study met the inclusion criteria. Most previous studies have examined a highly heterogeneous patient population, with many trials grouping primary and secondary pneumothoraces or recurrent PSPs. The identified study is the first multicenter randomized controlled trials to specifically address the management of initial PSP.⁷ This study failed to identify a difference between simple percutaneous aspiration and intercostal chest tube for all endpoints evaluated except hospitalization. This observation was made on the basis of a small sample, with correspondingly wide CIs, so *equivalence* cannot be claimed (as reported by the authors). Although a comparison of procedural complications, incurred costs, and reported procedural pain was not performed, simple percutaneous aspiration appeared to be as efficacious as standard IT. The application of simple percutaneous aspiration to patients with primary spontaneous pneumothorax in the emergency department (ED) would be an attractive option that could result in faster overall recoveries for these patients; however, according to this evidence such a step cannot yet be advocated.

TAKE-HOME MESSAGE

PSP is an ED condition whose management remains unclear. Although experts agree that small PSPs in stable patients can often be managed without intervention,^{5,6} the treatment of patients who do require interventional care is debated. This review identified only 1 study involving 60 patients that reported similar efficacy of intercostal chest tube compared with simple percutaneous aspiration. Simple percutaneous aspiration has been shown in this small study to reduce the number of hospitalizations for primary spontaneous pneumothorax and could potentially reduce health care expenditures. A sufficiently large, multicenter randomized controlled trials is required to resolve this treatment impasse.

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EBEM TEACHING POINT

"Equivalence" compared to "no difference." Many systemic review summary statistics include the values of no effect (1.0 in dichotomous outcomes such as RR or odds ratio; 0.0 in continuous measures such as weighted or standardized mean difference). As a result, it is seductive to conclude that the treatment options are equivalent; however, this is rarely the case. For example, in this systematic review, the authors identified that there were no differences in failure between the 2 primary spontaneous pneumothorax treatment options (RR=1.12; 95% CI 0.59 to 2.13). In this case, it would be *invalid* to conclude treatment equivalence because the 95% CIs suggests that the effect size could be protective (as much

as a 41% reduction in failure) or detrimental (as much as a 113% increase in failure). The width of the 95% CI is inversely related to the sample size in dichotomous outcomes and to sample size and precision (SD measure) in continuous outcomes. All that can be concluded here is that the study failed to identify a difference between the 2 treatments. An effect measure with narrow 95% CIs (eg, RR=1.01; 95% CI 0.99 to 1.03) may be sufficiently precise to conclude equivalence; however, this requires many studies or large total sample size. Both requirements are rare in acute emergency medicine systematic review topics. Moreover, authors should decide what precision they require to conclude equivalence a priori, and this depends on the importance of the outcome. For example, a less than 1% difference between treatments in acute myocardial infarction may be the threshold for equivalence when the outcome is mortality; however, the threshold for equivalence between treatments for acute migraine headache may be 5% when the outcome is relapse.⁷

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