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Empyema management: A cohort study evaluating antimicrobial therapy☆

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Summary *Objectives:* Empyemas require aggressive antimicrobial and surgical management. However, the specifics of antimicrobial therapy have not been studied in clinical trials. The present study examines management and outcomes among a cohort of patients with empyema cared for in a tertiary-care referral hospital over a decade.
Methods: We retrospectively identified patients hospitalized with empyema from January 2000 through December 2010 at one institution. Patient demographics, laboratory findings, treatments, and patient outcomes were abstracted using a standard form. Data were summarized with standard descriptive statistics.
Results: A total of 91 patients were identified. The predominant organisms were viridans group streptococci, which were isolated in 64% of cases with cultures. The median length of hospitalization was 9 days. Length of antimicrobial therapy from time of source control was variable, with a median (interquartile range) duration of 27 (15–31) days. Of note, longer courses of parenteral, but not oral, therapy were associated with fewer cases of clinical failure.
Conclusions: This descriptive analysis demonstrated a higher rate of viridans group streptococci

Abbreviations: BTS, British Thoracic Society; IQR, interquartile range; IV, intravenous; VGS, viridans group streptococci.

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than expected. Three weeks of therapy was generally adequate and prevented clinical failure, but further study is needed with a much larger cohort to better define the optimal drug regimen, route, and duration of antimicrobial therapy for empyema.

Background

Effusions frequently complicate pneumonia, as migration of neutrophils and monocytes results in intrapleural inflammation and fluid accumulation. Most of these effusions are sterile and resolve with the pneumonia (*simple effusions*), but if bacteria translocate into the pleural space, septations and fibrin deposits form, resulting in complex effusions and, if frank pus develops, empyema. Although simple effusions can be managed conservatively, empyema and complicated parapneumonic effusions necessitate invasive drainage to achieve resolution.[1,2] Surgical management of empyemas and effusions is not highly controversial,[1,3] but medical management with antimicrobials after drainage is subject to debate. Current evidence is insufficient for high-quality guidelines on treatment duration, route of administration, and choice of regimen.

To date, the only evidence-based guidelines on the management of parapneumonic effusions and empyemas come from the British Thoracic Society (BTS),[4,5] with the most recent version released in 2010.[5] The guidelines do not identify an empiric preferred regimen. Rather, they emphasize pathogen-directed courses of therapy. Unfortunately, about 40% of cases are culture negative, leaving clinicians with scant data to inform drug selection.[2] The guidelines state that, although initial therapy should be intravenous (IV), de-escalation to an oral regimen can be considered if the patient is improving. The BTS guideline recommends a minimum of 3 weeks of therapy but explicitly states that this recommendation has not been tested in clinical trials.

The present study represents a cohort examination of antimicrobial management at our tertiary referral center with an active thoracic surgery program and numerous cases of empyemas and parapneumonic effusions managed jointly by specialists in infectious diseases and thoracic surgery. We retrospectively analyzed our experience to provide data on length and routes of therapy associated with positive patient outcomes.

Methods

The Mayo Clinic Institutional Review Board approved this study and granted a waiver of consent for this minimal-risk human subjects research project (IRB#10-008570). A retrospective cohort study of all cases of empyema among patients who were hospitalized at Mayo Clinic, Rochester, Minnesota, between January 2000 and December 2010 was performed. Cases were identified by using the Mayo Clinic Enterprise Data Trust, an integrated informatics tool that allows for text searching of note, laboratory, billing, and demographic data.[6] The database was queried for billing codes related to empyema, pneumonia, and procedures related to treatment of these conditions, as well as internal research identifier codes used for case finding[7] (Appendix). Patients were excluded if they were younger than 18 years, did not have research consent on file, or had postpneumonectomy- or postesophagectomy-related empyemas.

Charts were reviewed manually for demographic and epidemiologic information, pre-existing comorbid conditions, diagnostic procedures, microbiology data, surgical procedures, antibiotic therapy, complications, adverse events secondary to surgical and medical therapy, and long-term follow-up. *Treatment failure* was defined as unplanned inpatient or outpatient contact to modify therapy within 30 days, or patient death of any cause within 30 days.

JMP 10 software (SAS Institute, Inc) was used for data analysis. Descriptive data were analyzed using standard statistical methods including ANOVA for continuous variables and the χ^2 test or Fisher exact test for categorical variables. Two-tailed P values $\leq .05$ were considered statistically significant in all analyses.

Results

During the study period, 91 patients met the inclusion criteria. There were more men than women (66%), and the median age was 59 (interquartile range [IQR], 48—72) years. One-third of the patients were transferred from other hospitals, with the rest admitted directly from our emergency department or clinics. Median length of hospitalization was 9 days (IQR, 7—11 days). Demographic characteristics and pertinent preadmission comorbid conditions are summarized in Table 1. Of note, more than 25% of patients had a prior history of alcoholism, and malignancy was present in 19%.

Vital signs and laboratory results obtained from all patients at the time of admission are summarized in Table 2. Fever was relatively uncommon at admission. More than half of patients were tachycardic or tachypneic. Leukocytosis was common; the median white blood cell count was 17.5×10^9/L. Although not obtained routinely, inflammatory markers (erythrocyte sedimentation rate and C-reactive protein) were increased among those evaluated.

A pleural fluid specimen was obtained from most patients. Median cell count was 3328 (IQR, 1500—14,150) nucleated cells/mm^3, typically neutrophil predominant. Blood cultures were obtained in the majority of patients (80%), although they were positive in only 3 patients. Pleural cultures were obtained from 96% of patients, 63% of which showed microbial growth. Of the cultures that demonstrated growth, the organisms isolated were viridans group streptococci (VGS) in 64%.

Management of empyema was predominantly surgical, with 82 patients undergoing a thoracic surgery intervention. Infectious diseases specialists were consulted for comanagement of 70% of cases. No patient died during their index

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