patterns, antimicrobial stewardship policies, and pharmacologic properties of antibiotics. For patients with community-acquired pleural empyema in whom the risk for methicillin-resistant *S aureus* and highly resistant gram-negative infection is low, a second-generation or a nonpseudomonal, third-generation cephalosporin (eg, ceftriaxone) or an aminopenicillin with β-lactamase inhibitor (eg, ampicillin/sulbactam) will provide activity against the most commonly identified organisms.[54-58] Anaerobic organisms should be treated empirically and, whereas ampicillin/sulbactam is active against a range of anaerobes, ceftriaxone requires the addition of an agent such as metronidazole. Clindamycin is a suitable alternative to metronidazole for most upper gastrointestinal and respiratory anaerobic infections.[59] Even when there is a positive, monomicrobial, aerobic culture to direct therapy, it often is reasonable to continue anaerobic coverage because of the frequency with which anaerobes infect empyemas and because of the inconsistent success at culturing these organisms.[60] Empiric antibiotics with activity against atypical organisms generally are not necessary.[60,61] In the setting of hospital-acquired or postsurgical infection, vancomycin, cefepime and flagyl, or vancomycin and piperacillin/tazobactam (dosed adequately for *P aeruginosa*) will cover the added risk of methicillin-resistant *S aureus* and *Pseudomonas*. Vancomycin and meropenem may be indicated if there is a history or suspicion of extended spectrum β-lactamase−producing organisms. Aminoglycosides are inactivated in empyema fluid and are not recommended. There is no evidence that direct administration of antibiotics into the pleural space increases microbial clearance or outcomes in comparison with systemic antibiotics alone. In many cases of slowly progressing or chronic empyemas, empiric therapy can be held until culture results are available for directed therapy. It is recommended that a infectious diseases consultation is undertaken to assist with diagnosis and therapy for chronic empyema.

Duration of therapy for empyema has not been studied in comparative trials. A range of 2 to 6 weeks of antibacterial therapy for acute empyema is reported in the literature, and this Working Group recommends a minimum of 2 weeks from the time of drainage and defervescence. The final duration should be determined by the sensitivities of the infecting organism, the adequacy of drainage, and the response to therapy on follow-up. If the patient has responded to therapy, there has been source control, the isolated organism is susceptible to orally bioavailable agents, and the patient is tolerating oral intake, then a transition to oral therapy can be made. Chronic empyema should be managed in conjunction with an infectious diseases consultation.

ACUTE PLEURAL EMPYEMA: PLEURAL DRAINAGE

Thoracentesis

Recommendation. Class III no benefit: Thoracentesis without pleural drain placement is not recommended for the treatment of parapenumonic effusion or empyema (LOE C).

Thoracentesis is a useful tool in the management of uncomplicated pleural effusion and a recommended step in the diagnosis of complicated effusion. In the setting of known pleural infection, however, ongoing pleural drainage is regarded as a requirement for adequate treatment and thoracentesis alone, without pleural drain placement, is not recommended.

Image-Guided Drain Placement

Recommendations.

1. Class I: Image-guided pleural drain placement is useful in the treatment of early-stage, minimally septated empyema (LOE B).
2. Class IIa: In septated effusions, placement of small bore catheters are recommended in patients that are not surgical candidates (LOE C).
3. Class I: Routine drain flushing is recommended to prevent occlusion (LOE B).
4. Class I: Tube thoracostomy should be combined with close CT follow-up to confirm adequacy of drainage. Persistence of any undrained fluid should prompt additional drains or more aggressive management (LOE C).

Reasoning. Drainage of infected material from the pleural space is a fundamental part of empyema treatment. Traditionally, tube thoracostomy has been performed with large-bore catheters, but no consensus exists regarding ideal drain size. Initial studies using smaller drains placed with imaging guidance reported success rates around 80%, which were favorable relative to success rates in earlier studies of large-bore drains.[62-66] A recent and widely cited study included 405 patients; it demonstrated equivalent success rates with the use of tubes $\leq$14-F and tubes >14 F.[67] Tube size in this study, however, was not randomized; it is likely that patients with more complicated effusions or effusions returning frank pus received larger drains. Based on this evidence, small-bore tubes have become an accepted alterative as first-line therapy in patients amenable to tube thoracostomy alone.[68]

Expert opinion holds that small-bore catheters are ineffective in draining thick pus or extensively septated effusions; however, absent any randomized trials, the role of empyema stage in the success or failure of image-guided drain placement is unclear. Existing data are mixed. In an unblinded trial, the presence of sonographic septations was predictive of more aggressive