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<p>Despite ongoing major advances in antisepsis and in the development of potent antimicrobial agents since the early twentieth century, human beings remain subject to bacterial and fungal infection through mechanisms of virulence that continue to evade the latest advances in the microbiologic field today. Infection persists in surgical patients and only via the procurement of an in-depth knowledge of microorganism evolution and progression and an intricate understanding of human immune defense mechanisms are surgeons able to tackle infection in a fashion synonymous to that which allowed historic legends to transform the mere concept of surgery into reality. This article broadly describes current microbial pathogens and related issues in surgical disease.</p>	
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<p>The cognate signals from sterile or pathogen-induced sources converge on the same recognition or response pathways. In the surgical patient, a systemic response to infection most often occurs in the context of ongoing inflammatory stress. Such an inflammatory response is modulated initially by the magnitude of injury and by patient-specific (endogenous) factors, such as confounding illness, age, and genetic variation. Over an extended period of stress, treatment-related (exogenous) factors add unpredictability to host responses to subsequent challenges, such as acquired infection. The host response is discussed in the context of how existing sterile stressors may modify the response to acquired infection in surgical patients.</p>	
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<p>Antimicrobial drugs are useful for the empiric and definitive treatment of infections in surgical patients. They are also important agents for perioperative antimicrobial prophylaxis. The proper selection and use of these drugs is a critical skill for surgeons. Although these agents have many beneficial effects, they also possess occasional adverse effects and should not be used indiscriminately.</p>	

Adjunctive Measures for Treating Surgical Infections and Sepsis

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Matthew C. Byrnes and Greg J. Beilman

The history of adjunctive treatments for severe sepsis has been fraught with more failures than successes. To date, there have been few interventions that have been demonstrated to be efficacious by multiple large, well-designed, multicenter randomized clinical trials. However, recent research into treatment strategies using drotrecogin alfa (activated), effective blood glucose management, early goal-directed therapy, protocolization of care, and intensivist management has demonstrated positive results. Further research is being conducted to verify the success of these initial trials. This article summarizes some of the available adjunctive treatments for severe sepsis.

Prevention of Surgical Site Infection

365

John P. Kirby and John E. Mazuski

Surgical site infections are a frequent cause of morbidity following surgical procedures. Gram-positive cocci, particularly staphylococci, cause many of these infections, although gram-negative organisms are also frequently involved. The risk of developing a surgical site infection is associated with a number of factors, including aspects of the operative procedure itself, such as wound classification, and patient-related variables, such as preexisting medical conditions. Both nonpharmacologic measures and antimicrobial prophylaxis for selected procedures are used to prevent development of these infections. Compliance with these generally accepted preventive principles may lead to overall decreases in the incidence of these infections.

Prosthetic Infection: Lessons from Treatment of the Infected Vascular Graft

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Gabriel Herscu and Samuel Eric Wilson

Surgical prosthetics provide unquestioned benefit to patients in maintenance of life and limb. However, complications associated with prosthetic devices continue to represent a significant source of morbidity and mortality. Even as the surgeon becomes more adept at management of infections, the bacterial characteristics change in favor of increased virulence and greater resistance to antimicrobials. Excision or retention of the prosthesis depends on the time of presentation, the microbial isolates recovered, and the extent of surrounding tissue destruction. Recent work shows improving results with in situ replacement.

Skin and Soft Tissue Infections

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Addison K. May

Skin and soft tissue infections are a common cause of hospitalization and use of antibiotic therapy, and may result in significant disability. Infections managed by surgeons may vary from simple, noncomplicated cellulitis to severe necrotizing soft tissue infections. The differentiation of necrotizing infections from nonnecrotizing infections is critical to achieving adequate surgical therapy. An understanding of the changing epidemiology of all complicated skin and soft tissue infections is required for selection of appropriate empiric antibiotic therapy.

- Intra-Abdominal Infections** 421
- John E. Mazuski and Joseph S. Solomkin
- Most intra-abdominal infections develop from a source in the gastrointestinal tract. They are usually caused by aerobic and anaerobic enteric bacteria. Management generally involves an invasive procedure to control the source of the infection and antimicrobial therapy directed against the causative microorganisms. In a few highly select patients, these infections may be treated without a definitive source control procedure. Antimicrobial therapy is tailored to the individual patient, with narrower spectrum agents used to treat community-acquired intraabdominal infections, and broader spectrum agents used for hospital-acquired infections. Overall, these infections remain associated with significant morbidity and mortality, particularly in higher-risk patients who have impaired host defenses.
- Hospital-Acquired Pneumonia: Pathophysiology, Diagnosis, and Treatment** 439
- Alicia N. Kieninger and Pamela A. Lipsett
- Hospital-acquired pneumonia (HAP) is one of the most common causes of nosocomial infection, morbidity, and mortality in hospitalized patients. Many patient- and disease-specific factors contribute to the pathophysiology of HAP, particularly in the surgical population. Risk-factor modification and inpatient prevention strategies can have a significant impact on the incidence of HAP. While the best diagnostic strategy remains a subject of some debate, prompt and appropriate antimicrobial therapy in patients suspected of having HAP has been shown to significantly decrease mortality. Because the pathogens responsible for HAP are frequently more virulent and have greater resistance to commonly used antimicrobials than other pathogens, clinicians must have knowledge of the resistance patterns at their institutions to choose appropriate therapy.
- Catheter-Related Bloodstream Infection** 463
- Matthew R. Goede and Craig M. Coopersmith
- Catheter-related bloodstream infections (CR-BSIs) are a common, frequently preventable complication of central venous catheterization. CR-BSIs can be prevented by strict attention to insertion and maintenance of central venous catheters and removing unneeded catheters as soon as possible. Antiseptic- or antibiotic-impregnated catheters are also an effective tool to prevent infections. The diagnosis of CR-BSI is made largely based on culture results. CR-BSIs should always be treated with antibiotics, and except in rare circumstances the infected catheter needs to be removed.
- Nosocomial Urinary Tract Infection** 475
- Michael F. Ksyycki and Nicholas Namias
- Nosocomial urinary tract infection, a common complication in surgical patients, is primarily related to the use of indwelling urinary catheters. Discontinuation of catheter usage within 2 days, whenever possible, is the cornerstone to avoiding these infections. Patients with asymptomatic

bacteriuria may be treated with catheter removal only, and do not necessarily require antibiotic therapy. Patients with symptomatic infections should receive effective antimicrobial therapy, but removal of the catheter is also fundamental to clearing the urinary tract of infection. Antibiotic therapy of urinary tract infections is facilitated by the renal concentration of many antibiotics, permitting very high antibiotic concentrations to be achieved in the urine.

***Clostridium difficile* Colitis**

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Philip A. Efnorn and John E. Mazuski

Clostridium difficile is the most common cause of infectious diarrhea in hospitalized patients. Its effects are mediated by *C difficile* toxins A and B. Recent outbreaks of severe colitis have been associated with a new strain of the bacterium that produces large amounts of the toxins. Although oral metronidazole and oral vancomycin can be used to treat *C difficile*-associated disease, intraluminal vancomycin is preferable for more severe *C difficile* colitis. Early surgical intervention can improve outcomes with fulminant colitis, although overall mortality remains high.

Preventing Bacterial Resistance in Surgical Patients

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Heather L. Evans and Robert G. Sawyer

The development of antimicrobial resistant pathogens in surgical patients is a significant problem, and infections caused by these organisms are associated with increased morbidity and mortality. Programs to prevent the spread of resistant organisms emphasize standard infection control practices and appropriate antibiotic prescribing practices. Antibiotic restriction and selective reporting of bacterial susceptibilities have had limited success in decreasing development of resistance, and are difficult to maintain effectively in the absence of widespread clinician acceptance. Potentially more promising are integrated decision support tools, which can support optimal antibiotic selection while preserving the sense of clinician autonomy. The use of antibiotic cycling programs for critically ill patients may be another approach to preserving the efficacy of the currently antimicrobial against the continued pressure of increasing bacterial resistance.

A Systems Approach to the Prevention of Surgical Infections

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Donald E. Fry

Infection after surgery continues to be a major source of morbidity and expense despite extensive efforts with educational programs, guidelines, and hospital-based policies and procedures. The public and the government are demanding better performance and greater accountability. Our system operations within our institutions have failed. We need to adopt a culture dedicated to quality control through better information technology and data-driven initiatives to achieve improved clinical outcomes from infectious complications in surgery.

Future Diagnostic and Therapeutic Approaches in Surgical Infections 539

Barbara Haas and Avery B. Nathens

Despite ongoing efforts to standardize therapy and improve management, the morbidity and mortality associated with surgical infections remain high. Continued innovation is required to improve outcomes further, particularly in the face of the increasing prevalence of multidrug resistant organisms. Although they remain in the experimental stages, a number of recent advances have the potential to have significant impact on the management and outcomes of surgical infections. These include novel diagnostic strategies, antimicrobials targeting microbial virulence factors, novel vaccines, and risk stratification based on genetic profiling.

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