

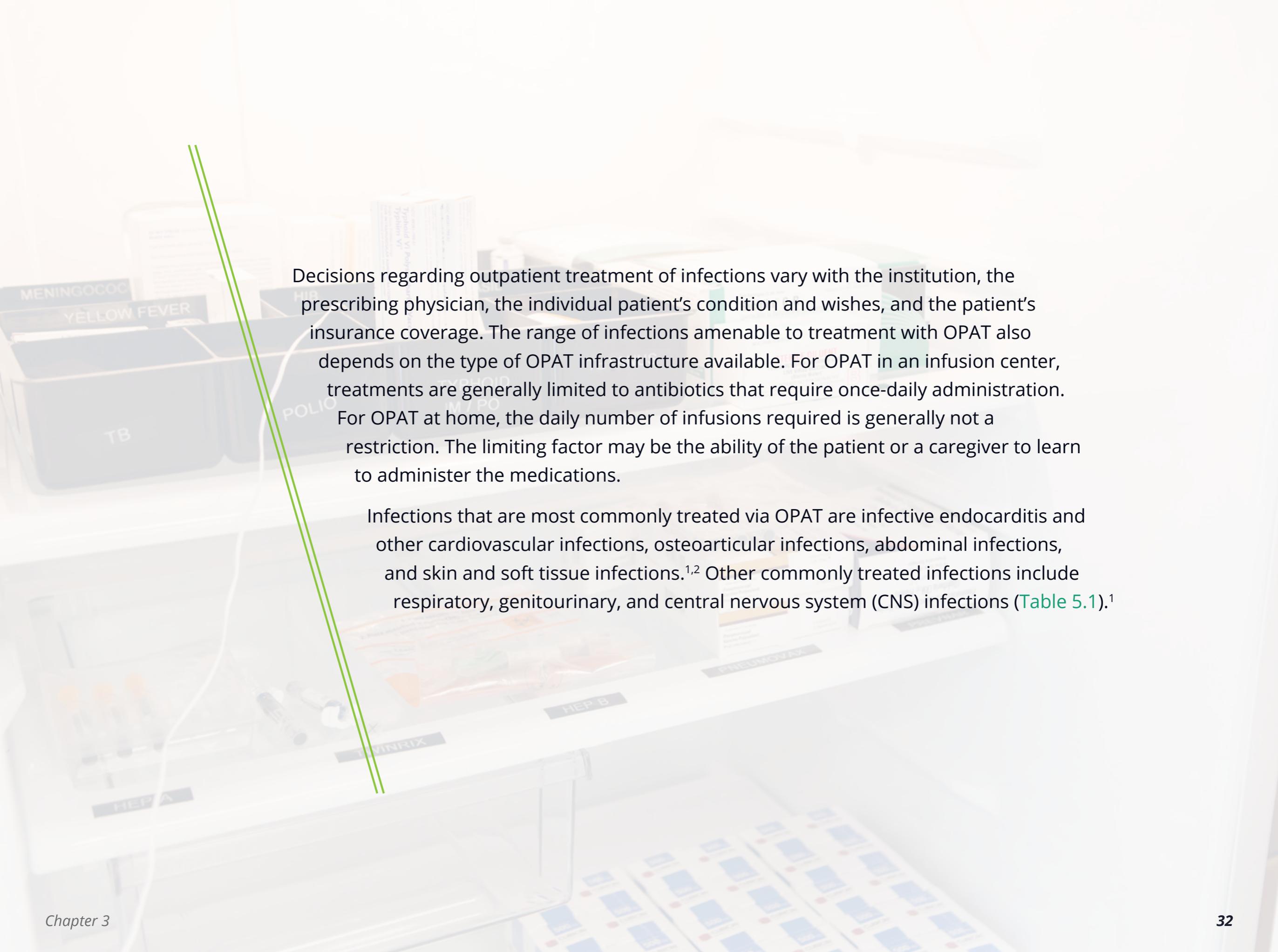


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Infections Amenable to OPAT

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Decisions regarding outpatient treatment of infections vary with the institution, the prescribing physician, the individual patient's condition and wishes, and the patient's insurance coverage. The range of infections amenable to treatment with OPAT also depends on the type of OPAT infrastructure available. For OPAT in an infusion center, treatments are generally limited to antibiotics that require once-daily administration. For OPAT at home, the daily number of infusions required is generally not a restriction. The limiting factor may be the ability of the patient or a caregiver to learn to administer the medications.

Infections that are most commonly treated via OPAT are infective endocarditis and other cardiovascular infections, osteoarticular infections, abdominal infections, and skin and soft tissue infections.^{1,2} Other commonly treated infections include respiratory, genitourinary, and central nervous system (CNS) infections ([Table 5.1](#)).¹

INFECTIVE ENDOCARDITIS AND CARDIAC DEVICE INFECTIONS

Infective endocarditis has an annual incidence of about 3 to 9 cases per 100,000 persons in developed countries.³ Staphylococci, streptococci, and enterococci are responsible for the majority of these infections.⁴ In recent years, *Staphylococcus aureus* has become the most common cause of infective endocarditis, driven largely by advances in treatments that require vascular invasion, such as prolonged vascular access, hemodialysis and cardiac pacing.⁵

Patients at increased risk for infective endocarditis include those with preexisting valvular heart disease, those with cardiac hardware, those with injection drug use, and those with indwelling vascular access devices. All patients with infective endocarditis should be hospitalized for an adequate evaluation. In the past, patients with infective endocarditis received all their treatment in an inpatient setting. With the evolution of OPAT, this has changed. Several studies have shown that selected patients with infective endocarditis can be safely treated via OPAT.⁶⁻⁸ It is now accepted practice for patients to be initially treated in the hospital and then discharged on OPAT once clinically stable, to complete the remainder of the treatment course as OPAT.⁹⁻¹¹

Advances in cardiac care have led to a proliferation of cardiac devices such as cardiovascular implantable electronic devices (CIEDs; eg, pacemakers and defibrillators) and left ventricular assist devices. Many of the infections associated with these devices involve infective endocarditis.

Evaluation

Successful outpatient treatment depends largely on an appropriate inpatient evaluation. Evaluation of infective endocarditis includes identifying the causative pathogen and determining the extent of valvular damage caused by the infection. In the preoperative period and in medically treated patients, identification of the causative pathogen is done via blood cultures. Determining the extent of valvular damage requires echocardiographic examination. Transesophageal echocardiography is more sensitive than transthoracic echocardiography in finding lesions caused by infective endocarditis and should always be performed in the evaluation unless contraindicated by comorbid conditions.¹²

Many patients with infective endocarditis require surgery for their care, and medical therapy alone is futile. The presence of prosthetic heart valves or perivalvular abscesses makes it unlikely that a cure can be achieved without surgery. The presence of large vegetations ([Figure 3.1](#)), ongoing embolic complications, or persistent bacteremia despite antibiotic therapy also portends trouble with continued medical therapy alone. Infections with pathogens such as *Staphylococcus aureus*, *Staphylococcus lugdunensis*, and *Candida* species are more likely to require surgery.

Treatment

The traditional course of treatment for infective endocarditis is 4 to 6 weeks of IV antibiotic(s) to which the causative microorganism is susceptible. Treatment guidelines for infective endocarditis have been published by various societies, such as the [American Heart Association](#), the [European Society for Cardiology](#), and the [British Society for Antimicrobial Chemotherapy](#).¹³⁻¹⁶ Most viridans group streptococci are susceptible to penicillin. They may also be treated with ceftriaxone, which allows for the convenience of once-daily dosing.

Staphylococcal infections are best treated with oxacillin or nafcillin, if susceptible. Both of these require multiple infusions per day. Their administration is greatly facilitated by the availability of programmable multidose infusion pumps; these can be loaded with the daily dose of medication, which is then administered by the pump in divided doses according to the instructions provided. It is possible but very inconvenient, and frankly impractical, to expect a patient or his/her caregiver to faithfully administer a medication every four hours for several weeks, which is what would be required to administer oxacillin or nafcillin in the absence of a programmable multidose infusion pump (see [Chapter 7: Infusion Administration Methods](#)).

The most commonly used antibiotic for the treatment of methicillin-resistant staphylococcal infections is vancomycin. The advantage of vancomycin over other options is its low cost. The drug cost of alternative antibiotics could be 10 to 50 times higher. Alternative antibiotics are daptomycin and ceftaroline. Disadvantages of vancomycin over the other treatment options include more adverse reactions, need for therapeutic drug monitoring, and more effort in monitoring treatment.



Enterococcal infections are best treated with ampicillin, if susceptible. If ampicillin is not an option owing to resistance or allergy, the next treatment option is vancomycin. If vancomycin is not an option, the treatment of choice is daptomycin. The endocarditis treatment guidelines recommend addition of aminoglycosides in the treatment of enterococcal endocarditis. Such treatment places patients at substantial risk of aminoglycoside toxicity, and patients so treated should be closely monitored.

It has been suggested that patients with uncomplicated infective endocarditis caused by viridans group streptococci could be discharged on OPAT after 1 week of hospitalization. This is a reasonable suggestion for uncomplicated infective endocarditis caused by any pathogen, provided the patient has been adequately evaluated for complications.

Treatment of cardiac device infections includes removal of the cardiac device when possible, and antibiotic therapy, usually parenteral. [Guidelines for treatment of CIED](#) infections have been published.¹⁷

OSTEOARTICULAR INFECTIONS

Infections of bones and joints lend themselves well to OPAT because patients may otherwise be healthy, and a prolonged 4- to 6-week course of treatment is necessary.^{18,19}

Studies have shown that the likelihood of failure and amputation are higher with concomitant diabetes mellitus and peripheral arterial disease, but not clearly with increasing age.¹⁸ Patients may also experience severe pain and spasms that require hospitalization for pain control and subsequent physical therapy. They may also be in a cumbersome body jacket or cast that limits the motion of the spine.

Evaluation

The purpose of evaluation is to confirm a diagnosis of an osteoarticular infection, identify the causative microorganism, and define the anatomical extent of infection. Radiographic imaging provides an anatomical picture of the site and extent of involvement. X-rays reveal presence of bony destruction and sometimes evidence of soft-tissue swelling. Computed tomography (CT) and magnetic resonance imaging (MRI) are more sensitive than plain radiographs in detecting the presence of osteomyelitis and associated abscesses, and defining extent of involvement (Figure 3.2).

Blood cultures are not sensitive in identifying the causative pathogen in patients with osteoarticular infections, but they should always be done in patients who appear ill. When possible, a sample of bone from an affected area should be obtained for microbiological examination before initiation of antibiotics. Identification of the causative pathogen will allow for more directed therapy.

Treatment

Common pathogens causing osteoarticular infections include both gram-positive and gram-negative microorganisms. The most common bacteria that cause osteomyelitis are *S. aureus*, coagulase-negative staphylococci, and gram-negative bacilli.

Treatment of infections associated with prosthetic implants includes removing the prosthetic material whenever possible. Patients with prosthetic joint infections treated while retaining the prosthesis should be treated with lifelong suppressive antibiotic therapy (see [IDSA Guidelines](#)).²⁰

Osteoarticular infections with *S. aureus* and coagulase-negative staphylococci are best treated with parenteral antibiotics. Oxacillin or nafcillin are the best antibiotics for methicillin-susceptible strains. The treatment options for osteoarticular infections caused by methicillin-resistant staphylococci are the same as those for infective endocarditis.

Many gram-negative osteoarticular infections can be treated with an oral quinolone. Associated debilitation may be a factor in selecting the site of OPAT because treatment in an infusion center may not be possible owing to the patient's inability to get there on account of pain. Self-administration at home or treatment in skilled nursing facilities may be more appropriate for such patients.

The duration of antimicrobial treatment depends on the extent and depth of infection, the bones and microorganisms involved, the extent of surgical debridement, and host comorbid conditions.