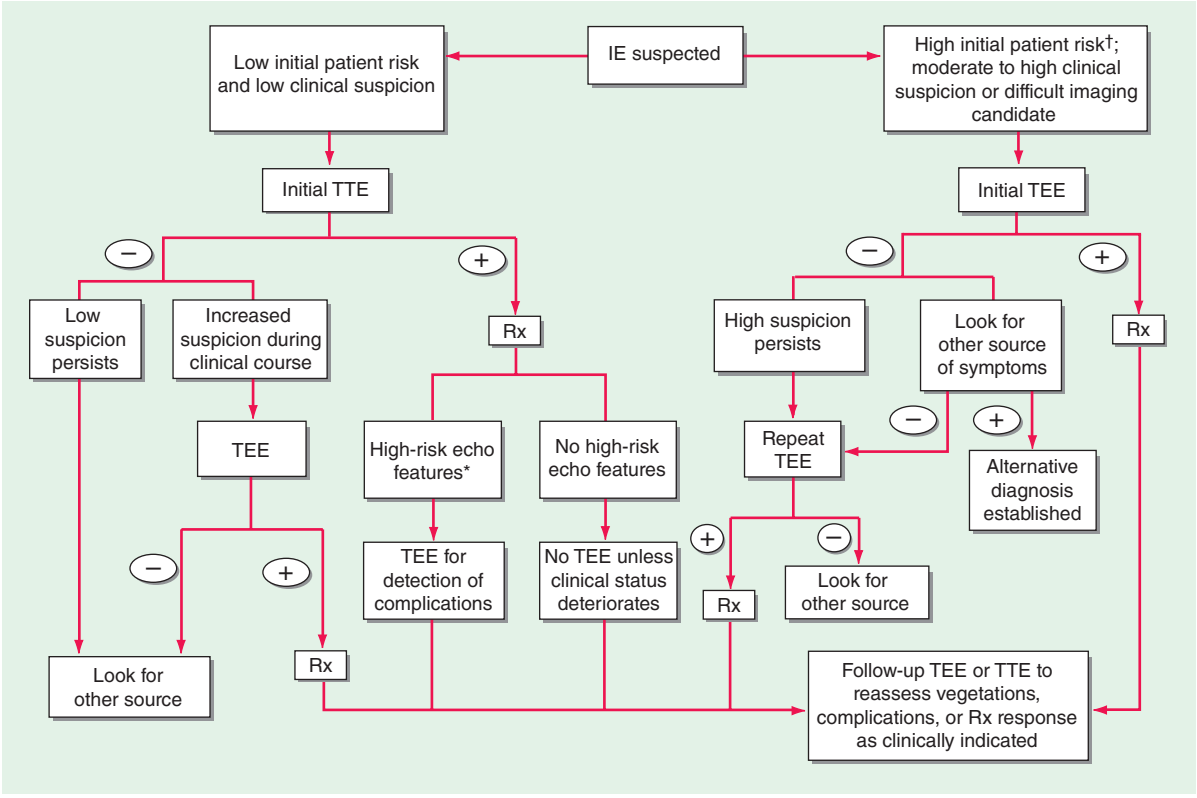

FIGURE 155-4 The diagnostic use of transesophageal and transtracheal echocardiography (TEE and TTE, respectively). †High initial patient risk for infective endocarditis (IE), as listed in Table 155-8, or evidence of intracardiac complications (new regurgitant murmur, new electrocardiographic conduction changes, or congestive heart failure). *High-risk echocardiographic features include large vegetations, valve insufficiency, paravalvular infection, or ventricular dysfunction. Rx indicates initiation of antibiotic therapy. *(Reproduced with permission from Diagnosis and Management of Infective Endocarditis and Its Complications. Circulation 98:2936, 1998. © 1998 American Heart Association.)*

unless alterations are required by end-organ dysfunction or adverse events.

Organism-Specific Therapies • ***STREPTOCOCCI*** Optimal therapy for streptococcal endocarditis is based on the minimal inhibitory concentration (MIC) of penicillin for the causative isolate (Table 155-4). The 2-week penicillin/gentamicin or ceftriaxone/gentamicin regimens should not be used to treat PVE or complicated NVE. Caution should be exercised in considering aminoglycoside-containing regimens for the treatment of patients at increased risk for aminoglycoside toxicity. The regimens recommended for relatively penicillin-resistant streptococci are advocated for treatment of group B, C, or G streptococcal endocarditis. Nutritionally variant organisms (*Granulicatella* or *Abiotrophia* species) and *Gemella* species are treated with the regimens for moderately penicillin-resistant streptococci, as is PVE caused by these organisms or by streptococci with a penicillin MIC of >0.1 μg/mL (Table 155-4).

ENTEROCOCCI Enterococci are resistant to oxacillin, nafcillin, and the cephalosporins and are only inhibited—not killed—by penicillin, ampicillin, teicoplanin (not available in the United States), and vancomycin. To kill enterococci requires the synergistic interaction of a cell wall–active antibiotic that is effective at achievable serum concentrations (penicillin, ampicillin, vancomycin, or teicoplanin) and an aminoglycoside (gentamicin or streptomycin) to which the isolate does not exhibit high-level resistance. An isolate's resistance to cell wall–active agents or its ability to replicate in the presence of gentamicin at ≥500 μg/mL or streptomycin at 1000–2000 μg/mL—a phenomenon called *high-level aminoglycoside resistance*—indicates that the ineffective antimicrobial agent cannot participate in the interaction to produce killing. High-level resistance to gentamicin predicts that tobramycin, netilmicin, amikacin, and kanamycin also will be ineffective. In fact, even when enterococci are not highly resistant to gentamicin, it is difficult to predict the ability of these other aminoglycosides to participate in synergistic killing; consequently, they should not, in general, be used to treat enterococcal endocarditis. High concentrations of ampicillin plus ceftriaxone or cefotaxime, by expanded binding of penicillin-binding proteins, also kill *E. faecalis* in vitro and in animal models of endocarditis.

Enterococci must be tested for high-level resistance to streptomycin and gentamicin, β-lactamase production, and susceptibility to penicillin and ampicillin (MIC, <8 μg/mL) and to vancomycin (MIC, ≤4 μg/mL) and teicoplanin (MIC ≤2 μg/ml). If the isolate produces β-lactamase, ampicillin/sulbactam or vancomycin can be used as the cell wall–active component; if the penicillin/ampicillin MIC is ≥8 μg/mL, vancomycin can be considered; and if the vancomycin MIC is ≥8 μg/mL, penicillin or ampicillin can be considered. In the absence of high-level resistance, gentamicin or streptomycin should be used as the aminoglycoside (Table 155-4). Although the dose of gentamicin used to achieve bactericidal synergy in treating enterococcal endocarditis is smaller than that used in standard therapy, nephrotoxicity (or vestibular toxicity with streptomycin) is not uncommon during treatment lasting 4–6 weeks. Regimens in which the aminoglycoside component is given for only 2–3 weeks have been curative and associated with less nephrotoxicity than those using longer courses of gentamicin. Thus regimens wherein gentamicin is administered for only 2–3 weeks are preferred by some.

If there is high-level resistance to both gentamicin and streptomycin, a synergistic bactericidal effect cannot be achieved by the addition of an aminoglycoside; thus no aminoglycoside should be given. Instead, an 8- to 12-week course of a single cell wall–active agent can be considered; for *E. faecalis* endocarditis, high doses of ampicillin combined with ceftriaxone or cefotaxime are suggested (Table 155-4). Nonrandomized comparative studies suggest that ampicillin-ceftriaxone may be as effective as (and less nephrotoxic than) penicillin or ampicillin plus an aminoglycoside in the treatment of *E. faecalis* endocarditis. Given the reduced risk