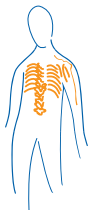
93

Infections of the Heart and Blood Vessels



Cheston B. Cunha and Eleftherios Mylonakis

INFECTIVE ENDOCARDITIS

Definition

Infective endocarditis (IE) is an infection of the endocardium of one or more cardiac valves or, less commonly, the mural endocardium. The pathologic lesion of IE is the vegetation (infected platelet and fibrin thrombus). The pathologic findings of IE were first described in 1646 by Lazare Rivière, a French physician at the University of Montpellier. At autopsy, Rivière described "small round outgrowths resembling the lungs in texture, the largest of which was about the size of a hazelnut, which blocked the aortic valve." The term *endocarditis* was first used in 1835 by the French physician Jean-Baptiste Bouillaud, but it was not until the 1880s that Sir William Osler was able to synthesize many of the prior clinical, pathologic, and microbiologic findings into a unified description of the disease.

Over the past 6 decades, the epidemiology, risk factors, and treatment of endocarditis have changed significantly. In the preantibiotic era, IE was uniformly fatal. Since the advent of antibiotics and valve replacement surgery, IE can be effectively treated and mortality can be significantly reduced, provided the diagnosis is made early. Despite progress, new challenges continue to arise in diagnosis and treatment. As more patients undergo intravascular manipulation, have intracardiac or intravascular devices placed, and harbor more resistant organisms, effective therapy for IE remains a challenge.

Traditionally, IE has been classified, based on the acuteness of onset, as subacute bacterial endocarditis (SBE) or acute bacterial endocarditis (ABE). This classification reflects the virulence of the causative agent: *Staphylococcus aureus* is a common cause of ABE, whereas low-virulence organisms such as viridans streptococci are more likely to be the cause of SBE. IE may also be subdivided according to the nature of the involved valve, as native valve endocarditis (NVE) or prosthetic valve endocarditis (PVE), or by the number of valves involved (multivalvular IE). Some hosts, particularly intravenous drug abusers, are predisposed to IE. IE from invasive procedures is classified as health care–associated IE or nosocomial IE. Endocarditis may be further divided according to the causative organism. These categories are often combined (e.g., *S. aureus* tricuspid valve nosocomial ABE).

Epidemiology

SBE is most common in older adults, and over the last 50 years, the average age of patients diagnosed with IE has gradually increased. More than one half of all cases of IE occur in patients older than 50 years of age. Rheumatic heart disease has decreased in the modern era and is now a less common predisposing factor.

Recent estimates are that the overall annual incidence of IE in the United States is 12.7 cases per 100,000 persons, a significant increase from prior years. The age-adjusted hospital admission rate has increased by 2.4% annually, mirroring this increase in incidence. SBE usually involves the mitral valve or, less commonly, the aortic valve. IE of the pulmonic valve is relatively rare, and right-sided ABE occurs primarily in intravenous drug abusers. Individuals with congenital heart disease may be predisposed to IE, depending on the lesion.

Pathogenesis

Normal cardiac endothelium is relatively resistant to bacterial invasion. If the cardiac endothelium is damaged, an uninfected platelet and fibrin thrombus may form. This nonbacterial thrombotic endocarditis may become infected due to bacteremia, forming a vegetation. Endothelial damage may result from degenerative valvular disease, rheumatic heart disease, congenital heart disease, or intracardiac instrumentation or devices.

Predisposing Cardiac Factors

Approximately 15% of patients diagnosed with NVE have underlying congenital heart disease. Of these diseases, tetralogy of Fallot has the highest IE potential. Other lesions that predispose to IE include ventricular septal defect, bicuspid valves, and coarctation of the aorta. Significant mitral valve regurgitation is the most important predisposing factor for IE, with mitral valve prolapse accounting for 20% of NVE cases. Degenerative valvular disease predisposes to SBE in the elderly, and the mitral valve is most frequently involved. Aortic valve IE is rare in hypertrophic cardiomyopathy or asymmetric septal hypertrophy.

Noncardiac Predisposing Factors

Central venous catheters and intracardiac devices can cause endocardial injury, predisposing to IE. The most frequent nosocomial IE pathogens are *S. aureus*, coagulase-negative staphylococci, group D enterococci, and aerobic gram-negative bacilli. Infections with these organisms usually occur less than 1 month after the procedure. Nosocomial IE may affect normal or abnormal valves. Because ABE pathogens are more virulent, nosocomial IE is associated with a high mortality rate.

Low-virulence and noninvasive organisms (e.g., viridans streptococci) are the most common SBE pathogens. The SBE