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Introductory Chapter: Endocarditis – Diagnosis and Treatment

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1. Introduction

1.1 Endocarditis at a glance

Infective endocarditis (IE) is a major health challenge. The incidence is approximately 14 cases (1 death) per 100,000 individuals [1]. The rising numbers of IE are due to the increased population at risk, but increased awareness and availability of diagnostic tools also accounts for higher rates of diagnosed IE. Echocardiography is the cornerstone among diagnostic tools, while computerized tomography and nuclear imaging techniques have sharpened diagnostic accuracy. In patients with cardiac devices such as pacemakers and among prosthetic valve patients, modern imaging techniques are especially helpful.

The complex interplay between several conditions can lead to IE. If a surface is colonized by a pathogen *via* the bloodstream and the immunological response is ineffective, this may lead to IE. The entry of the pathogen can be skin, mouth, gastrointestinal, and urogenital as well as intravenous drugs, vascular access, or catheterization and surgical techniques. Unfortunately, antibiotic prophylaxis lacks convincing evidence. Although procedure-related antibiotics may reduce bacteremia, it may not result in the reduction of IE in general. High-risk individuals undergoing dental procedures seem to have benefited from prophylactic antibiotics according to recent data [2, 3]. Current guidelines recommend antibiotics prophylactically in four groups: previous IE and those with prosthetic valves, congenital heart disease, or ventricular assist devices [4].

For high-risk patients undergoing dental procedures, manipulating the gingiva or scaling of the root canal is recommended. Typically, streptococci should be covered; amoxicillin or cephalexin is a preferred regimen. Non-dental procedures may be associated with IE among high-risk individuals, but data are very limited still. Current guidelines have changed from no recommendation toward possible use. In cardiac or cardiovascular interventions, perioperative antibiotics are recommended. In addition, patient education regarding adequate dental and skin hygiene is crucial. Being mindful about risk groups and providing them with written educational information is advisable.

Imaging is an essential part of the diagnostic workup. Transthoracic echocardiography and transesophageal echocardiography are initial steps and often conclusive. Even though these tools are widely accessible, the quality may differ. Vegetation

characteristics and size will guide therapeutic decisions. Perivalvular complications include abscess, pseudoaneurysm, valve instability, fistulas, and perforations of valves. Computerized tomography provides additional information regarding perivalvular complications. Moreover, detection of distant lesions and sources of emboli can be facilitated by computerized tomography. Magnetic resonance imaging has less spatial resolution than computerized tomography but is helpful in the detection of neurological complications in the brain of spinal cord. Position emission tomography shows high sensitivity and specificity (both more than 80%) [5].

The definitions of IE have been revised. The major criteria are blood cultures positive for IE (typical microbes from two cultures) and confirmatory imaging (echocardiography, computerized tomography, and positron emission tomography). Minor criteria are predisposing conditions, fever higher than 38 C, embolic events with vascular disseminations, immunological phenomena, and microbiological evidence. A definite diagnosis of IE requires two major criteria, or one major and three minor, or five minor criteria. A possible diagnosis is defined as one major and at least one minor or three minor without a major criteria.

Effective antibiotic therapy in IE is important for successful treatment. Typically, the bactericidal approach is beneficial. Aminoglycosides are combined with cell membrane inhibitors but may cause side effects. Often 2–6 weeks in non-valvular cases is standard treatment, whereas 6 weeks or even longer periods are used when prosthetic valves are affected. Traditionally, intravenous treatment has been advocated. However, an oral regimen after and initial phase of intravenous therapy can be used in about a fifth of the IE patients [6].

Staphylococcus aureus is the main culprit in acute and fulminant IE. Coagulase negative streptococci cause protacted valve affections [7]. Prosthetic valve endocarditis confers a high risk of death; about half of patients will die [8]. Many of these patients need surgery. Methicillin-resistant S-aureus (MRSA) is resistant to many antibiotics. Fungi are occasionally seen, most often among immunosuppressive patients, and is associated with poor outcomes.

Patients with IE have extended hospital stays that can be reduced by outpatient intravenous or oral antibiotic treatment. It is necessary to exclude patients with abscesses, heart failure, septic emboli, and stroke. The course should be stable.

Open-heart surgery is essential in some patients and results in 20% improved survival [9]. The main groups of surgical candidates are patients with acute heart failure, uncontrolled infection, and those at increased risk of septic embolization. The procedure is indicated within hours in some groups, within a few days in others, or during the hospital stay in yet another group. If antibiotics are effective, valve replacement follows the same guidelines as elective valve replacement [4].

Neurological complications can be the first manifestation of IE, or these complications may occur during treatment. Unexplained fever in conjunction with symptoms of stroke should raise the suspicion of IE with embolization. Symptomatic cerebrovascular complications occur in one third of IE patients, and four-fifths have silent neurological effects. Stroke associated with IE carries an increased risk of mortality.

Cardiac rhythm disturbances may complicate the manifestation of IE. The anatomical proximity of the valves and the conduction system makes the atrioventricular node vulnerable. Paravalvular abscess or aortic valve manifestations are more likely to be associated with severe bradycardia. Bradycardia may be caused by the spread of the infection or even by the surgery itself and may be severe enough to necessitate pacemaker implantation.

An emerging group of IE patients has transcatheter aortic valve endocarditis. The risk of IE is similar to the risk of those with surgical prostheses. The majority is elderly with less typical symptoms; for example, fever may be absent.

Cardiac devices, pacemakers, and implantable defibrillators are susceptible to infections. These patients present with fever, embolic events, and signs of pocket infections. Careful evaluations using echocardiography as well as positron emission tomography may be useful. The treatment involves early and complete removal of the entire system. This procedure should be carried out at experienced centers.

Endocarditis is a severe diagnosis and involves decision-making among specialties. Uncomplicated cases may be managed at the local level, depending on the size of the hospital. In more complicated cases, the patient should be transferred to a hospital with expertise in thoracic surgery.

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References

- [1] Momtazmanesh S, Saeedi Moghaddam S, Malakan Rad E, Azadnajafabad S, Ebrahimi N, Mohammadi E, et al. Global, regional, and national burden and quality of care index of endocarditis: The global burden of disease study 1990-2019. *European Journal of Preventive Cardiology*. 2022;**29**:1287-1297
- [2] Thornhill MH, Crum A, Campbell R, Stone T, Lee EC, Bradburn M, et al. Temporal association between invasive procedures and infective endocarditis. *Heart*. 2023;**109**:223-231
- [3] Thornhill MH, Gibson TB, Yoon F, Dayer MJ, Prendergast BD, Lockhart PB, et al. Antibiotic prophylaxis against infective endocarditis before invasive dental procedures. *Journal of the American College of Cardiology*. 2022;**80**:1029-1041
- [4] Delgado V, Marsan N, Waha S, Bonaros N, Brida M, Burri H, et al. ESC guidelines for the management of endocarditis: Developed by the task force on the management of endocarditis of the European Society of Cardiology (ESC) endorsed by the European Association for Cardio-Thoracic Surgery (EACTS) and the European Association of Nuclear Medicine (EANM). *European Heart Journal*. 2023:ehad193
- [5] Holcman K, Szot W, Rubis P, Lesniak-Sobelga A, Hlawaty M, Wisniowska-Smialek S, et al. ^{99m}Tc-HMPAO-labeled leukocyte SPECT/CT and transthoracic echocardiography diagnostic value in infective endocarditis. *The International Journal of Cardiovascular Imaging*. 2019;**35**:749-758
- [6] Iversen K, Ihlemann N, Gill SU, Madsen T, Elming H, Jensen KT, et al. Partial oral versus intravenous antibiotic treatment of endocarditis. *The New England Journal of Medicine*. 2019;**380**:415-424
- [7] Sandoe JA, Kerr KG, Reynolds GW, Jain S. *Staphylococcus capitis* endocarditis: Two cases and review of the literature. *Heart*. 1999;**82**:e1
- [8] Fernandez-Hidalgo N, Ribera A, Larrosa MN, Viedma E, Origen J, de Alarcon A, et al. Impact of *Staphylococcus aureus* phenotype and genotype on the clinical characteristics and outcome of infective endocarditis. A multicentre, longitudinal, prospective, observational study. *Clinical Microbiology and Infection*. 2018;**24**:985-991
- [9] Iung B, Doco-Lecompte T, Chocron S, Strady C, Delahaye F, Le Moing V, et al. Cardiac surgery during the acute phase of infective endocarditis: Discrepancies between European Society of Cardiology guidelines and practices. *European Heart Journal*. 2016;**37**:840-848