

Circulation

JOURNAL OF THE AMERICAN HEART ASSOCIATION



Bacterial Endocarditis: The Disease, Treatment, and Prevention

Christopher H. Cabell, Elias Abrutyn and Adolf W. Karchmer

Circulation 2003;107;185-187

DOI: 10.1161/01.CIR.0000071082.36561.F1

Circulation is published by the American Heart Association, 7272 Greenville Avenue, Dallas, TX 72514

Copyright © 2003 American Heart Association. All rights reserved. Print ISSN: 0009-7322. Online ISSN: 1524-4539

The online version of this article, along with updated information and services, is located on the World Wide Web at:

<http://circ.ahajournals.org/cgi/content/full/107/20/e185>

Subscriptions: Information about subscribing to *Circulation* is online at
<http://circ.ahajournals.org/subscriptions/>

Permissions: Permissions & Rights Desk, Lippincott Williams & Wilkins, a division of Wolters Kluwer Health, 351 West Camden Street, Baltimore, MD 21202-2436. Phone: 410-528-4050. Fax: 410-528-8550. E-mail:
journalpermissions@lww.com

Reprints: Information about reprints can be found online at
<http://www.lww.com/reprints>



Bacterial Endocarditis

The Disease, Treatment, and Prevention

Christopher H. Cabell, MD; Elias Abrutyn, MD; Adolf W. Karchmer, MD



Endocarditis is a disease characterized by inflammation or infection of the inner surface of the heart (the endocardium). This article will focus on endocarditis that is the result of infection (infective endocarditis). Endocarditis commonly affects heart valves, but may also involve nonvalvular areas or mechanical devices that are implanted in the heart, such as artificial heart valves, pacemakers, or implantable defibrillators.

Infective endocarditis is an uncommon, but not rare, disease affecting about 10 000 to 20 000 persons in the United States each year.¹ Although uncommon, endocarditis is important because, despite antimicrobial therapy, it can result in serious complications such as stroke, the need for open heart surgery, or even death.

What Does Infective Endocarditis Look Like?

When endocarditis occurs, small masses called vegetations form at the site of infection (Figure 1 and Figure 2). When vegetations are viewed under a microscope, generally one sees the microorganism that causes the infection embedded in a meshwork of fibrin and other cellular material similar to

that used by the body to form blood clots. White blood cells that the body uses to fight infection are uncommon, a finding which explains the need to give antibiotics over many weeks to kill the infecting organism and cure endocarditis. The absence of white blood cells in vegetations is not fully explained but likely relates in part to the dense nature of the vegetation tissue, which in turn restricts the migration of these cells. Also, the bacteria causing endocarditis are buried in a nongrowing state deep in the vegetation. In this state they do not generate the intense chemical signals that usually promote the migration of white cells to a site of infection.

Who Gets Endocarditis?

Endocarditis occurs when bacteria enter the bloodstream (bacteremia) and attach to a damaged portion of the inner lining of the heart or abnormal heart valves. Not all bacteria entering the bloodstream are capable of causing endocarditis. Only those bacteria that are able to stick to the surface lining of the heart and to abnormal valves tend to cause endocarditis. The ability of these bacteria to stick to the surface lining is aided by a preexisting micro-

scopic clot that often forms at these abnormal sites.

Endocarditis most often occurs in people with preexisting heart disease (which may or may not be known to patients or their physicians) and less commonly in people with normal hearts.²

PREEXISTING HEART CONDITIONS ASSOCIATED WITH ENDOCARDITIS

- Previous cardiac valve surgery
- Previous infective endocarditis
- Mitral valve prolapse with valve leakage
- Abnormal valves caused by rheumatic fever and degenerative conditions
- Certain congenital heart diseases

Some congenital heart defects (eg, ventricular septal defect, atrial septal defect, or patent ductus arteriosus) can be repaired surgically. Once repaired, they are not associated with an increase in the risk of subsequent endocarditis.

From Duke University School of Medicine and Duke Clinical Research Institute (C.H.C.), Durham, NC; Drexel University College of Medicine (E.A.), Philadelphia, Pa; and the Harvard University School of Medicine and the Beth Israel-Deaconess Medical Center (A.W.K.), Boston, Mass.

Correspondence to Adolf W. Karchmer, MD, Chief, Division of Infectious Diseases, Beth Israel Deaconess Medical Center, 330 Brookline Avenue, Kennedy-6, Boston, MA 02215. E-mail akarchme@bidmc.harvard.edu

(*Circulation*. 2003;107:e185-e187.)

© 2003 American Heart Association, Inc.

Circulation is available at <http://www.circulationaha.org>

DOI: 10.1161/01.CIR.0000071082.36561.F1

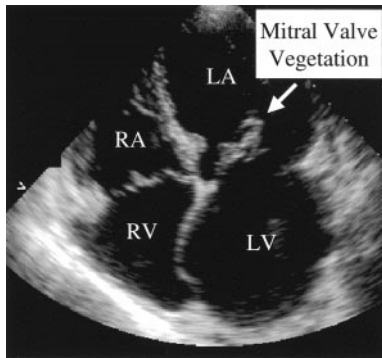


Figure 1. Mitral valve vegetation shown by echocardiogram. The vegetation is the mass seen in the dark space between the left atrium (LA) and left ventricle (LV). RA indicates right atrium; RV, right ventricle.

How Does Bacteremia Occur?

Bacteremia occurs as part of our daily living when bacteria that normally live on the skin, the lining of the mouth, or the lining of the intestinal tract enter the bloodstream through small cuts, abrasions, or breakdowns. Bacteria can enter the bloodstream as a result of minor trauma during typical daily activities such as brushing teeth or chewing. Thus, the mouth is a common source of bacteremia, and good oral hygiene appears to lower the risk of bacteremia and subsequent endocarditis.

Certain invasive medical procedures are also known to cause bacteremia, particularly if they injure sites where bacteria are normally found. For peo-

ple with heart conditions that are associated with endocarditis, it has been recommended that antibiotics be given before these procedures in an effort to limit bacteremia, to prevent bacteria from sticking to the heart, and to protect against endocarditis.³ As discussed below, however, this common practice is controversial.

MEDICAL PROCEDURES FOR WHICH ANTIBIOTIC PREVENTION (PROPHYLAXIS) IS RECOMMENDED

- Dental procedures likely to cause significant bleeding, including professional teeth cleaning
- Tonsillectomy or adenoidectomy
- Certain types of surgery on the respiratory passageways, the gastrointestinal tract, or the urinary tract
- Surgery on infected tissues or structures

What Symptoms Should Lead to Evaluation?

The presenting signs and symptoms of infective endocarditis are highly variable, and the severity of illness ranges from mild to severe. Fever is almost always a symptom. Other symptoms

are loss of appetite, unexplained weight loss, new rashes (both painful and painless), headache, backache, joint pain, confusion, shortness of breath, or sudden weakness in the face or limbs suggestive of a stroke.

During a medical examination, a new heart murmur may be heard, and new skin, fingernail, or eye changes noted. The combination of certain symptoms with particular findings on physical examination will prompt the treating physician to consider endocarditis as the source of the problem. The next steps will be to draw blood for culture and to perform an echocardiogram to evaluate the heart.

What Can Happen to Patients With Endocarditis?

Untreated, most patients with infective endocarditis will die. The infection can lead to damage of the heart valve(s) that in turn causes severe leaking (regurgitation) of blood back through the valve(s) and an inability of the heart to efficiently pump blood to the body. This in turn may lead to congestive heart failure and can cause symptoms such as shortness of breath or swelling of the ankles. In addition, small pieces of the vegetation that we described in our introductory paragraph can break off and travel through the blood vessels to other parts of the body. These pieces, called emboli, can cause damage to organs such as the brain (a stroke), eyes, lungs, kidneys, spleen, liver, and intestines. Endocarditis can also cause heart rhythm changes that may require a pacemaker for correction.

How Is Endocarditis Treated?

Treatment of endocarditis requires intensive antimicrobial therapy, sometimes for 2, but often for 4 to 6 weeks.⁴ For some patients, surgery is required to remove the infected tissue from the heart, to correct preexisting heart disease, or to repair the heart or valve damage caused by the infection. To accomplish these goals, replacement of an infected heart valve with an artificial valve may be needed.⁵

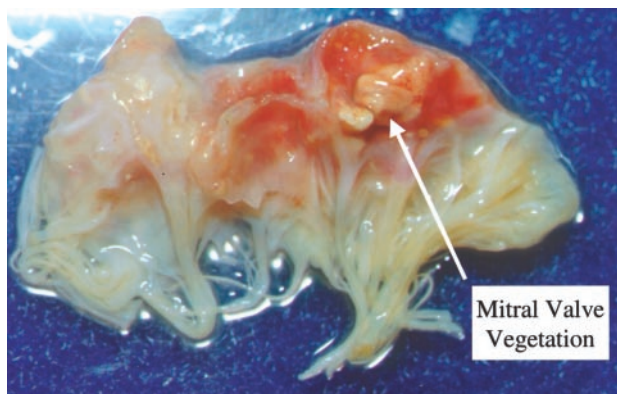


Figure 2. This figure shows one portion (called a leaflet) of the mitral valve of the heart. The valve has been excised surgically in the course of treating endocarditis. There is a large mass or vegetation on the valve, and it is surrounded by bleeding into the valve tissue that has resulted from valve damage.

COMMON REASONS FOR CARDIAC SURGERY DURING ENDOCARDITIS

- Heart failure
- Uncontrolled infection
- Significant valve dysfunction
- Artificial valve infection
- Extension of the infection into the heart (abscess formation)
- Recurrent emboli

Can Endocarditis Be Prevented?

Because infective endocarditis can have serious consequences, it is important to try to prevent the development of the disease, if possible. People with good oral hygiene, including those who floss daily, may be less likely to develop endocarditis.³

Doctors have used antibiotics to prevent endocarditis. Many organizations have published guidelines on the use of antibiotics for this purpose (prevention or prophylaxis). These guidelines target patients with a known heart abnormality that predisposes them to infections and those who are having a medical procedure associated with bacteremia with organisms that commonly cause endocarditis. In the United States, the American Heart Association guidelines, last published in 1997, are widely followed.³ The scientific rationale for antibiotic prophylaxis can be found in the guidelines. Unfortunately, there are no studies in humans proving that this practice prevents endocarditis, nor are such studies likely to be performed.

Antibiotic prophylaxis for the prevention of endocarditis, however, has

become more controversial because some studies provide evidence questioning its benefit.⁶ Moreover, there is a concern that widespread use of antibiotics for this purpose might contribute to promoting antibiotic resistance, an important issue today, as well as needlessly expose patients to antibiotic side effects such as allergic reactions.

It is important to recognize that even if antibiotics effectively prevented infective endocarditis and were used according to current guidelines, only a small percentage of cases could be prevented. This is because most people with endocarditis have not had a prior invasive procedure for which antibiotic prophylaxis would have been recommended; some have unrecognized heart disease and would not have been recognized as candidates for antibiotic prophylaxis; and occasionally patients are infected with organisms not treated by the antibiotics recommended for use. The medical and dental communities await future publication of newly revised guidelines that consider the issues outlined above.

It is important for patients to talk to their physicians, dentists, and other health care providers if there is a concern about the development of infective endocarditis. These professionals can work with patients to assess individual risk and develop an appropriate management plan. Nothing is better than close communication between patients and health care providers.

Conclusion

Endocarditis is a serious disease. Good oral hygiene, including daily flossing, is an important preventive measure that all patients should follow. If you have a history of structural heart disease or believe that you

are at risk for the development of endocarditis, you should discuss this with your primary care physician. It is important to discuss this potential risk with your dentist or other health care providers that may be performing invasive procedures.

Acknowledgments

This work was supported by the following grants: NIH K23 HL70861 (C.H.C.), AHA BGIA 0265405U (C.H.C.), and Tenet Healthcare Foundation (E.A.).

References

1. Bayer AS, Scheld WM. Endocarditis and intravascular infection. In: Mandell GL, Bennett JE, Dolin R, eds. *Principles and Practice of Infectious Diseases*. 5th ed. Philadelphia, Penn: Churchill Livingstone; 2000:857–902.
2. Strom BL, Abrutyn E, Berlin JA, et al. Dental and cardiac risk factors for infective endocarditis. *Ann Intern Med*. 1998;129:761–769.
3. Dajani AS, Taubert KA, Wilson W, et al. Prevention of bacterial endocarditis. Recommendations by the American Heart Association. *JAMA*. 1997;277:1794–1801.
4. Wilson WR, Karchmer AW, Bisno AL, et al. Antibiotic treatment of adults with infective endocarditis due to viridans streptococci, enterococci, other streptococci, staphylococci, and HACEK microorganisms. *JAMA*. 1995;274:1706–1713.
5. Bayer AS, Bolger AF, Taubert KA, et al. Diagnosis and management of infective endocarditis and its complications. *Circulation*. 1998;98:2936–2948.
6. Strom BL, Abrutyn E, Berlin JA, et al. Risk factors for infective endocarditis: oral hygiene and nondental exposures. *Circulation*. 2000;102:2842–2848.

Additional Resources

American Heart Association. Bacterial endocarditis. Available at: <http://www.americanheart.org/presenter.jhtml?identifier=4436>. Accessed April 24, 2003.

National Institutes of Health. Medical encyclopedia: infective endocarditis. Available at: <http://www.nlm.nih.gov/medlineplus/ency/article/000681.htm>. Accessed April 24, 2003.

Centers for Disease Control and Prevention. CDC health topics search page. Available at: <http://www.cdc.gov> (search on “endocarditis” for specific scientific articles). Accessed April 24, 2003.