

LDI *Issue Brief*

Volume 6, Number 6
March 2001

Leonard Davis Institute of Health Economics

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When Data Conflict with Practice: Rethinking the Use of Prophylactic Antibiotics before Dental Treatment

Editor's note: Concern is growing about the overuse of antibiotics and the subsequent rise in antibiotic-resistant bacteria. Antibiotics are commonly used to prevent heart valve infections in susceptible patients undergoing dental or other surgical procedures. Although this practice has been standard for nearly 50 years, little evidence exists that it works. This Issue Brief summarizes a population-based study that challenges the link between dental procedures and heart valve infections, and illustrates the difficulty in incorporating new evidence into existing guidelines and longstanding practices.

The use of antibiotics to prevent endocarditis is not proven effective

Clinicians routinely prescribe antibiotics to certain patients before dental treatments to prevent infective endocarditis, a rare but potentially fatal infection of the heart's inner lining or valves. Conventional wisdom suggests that patients with cardiac abnormalities are at risk for endocarditis from dental and other procedures that might introduce bacteria into their bloodstream. However, the effectiveness of this practice (known as antibiotic prophylaxis) has not been proven.

- The clinical recommendations are based on anecdotes, studies of bacteria in the bloodstream after procedures, and animal models. The low incidence of disease has made randomized human trials of antibiotic effectiveness impractical.
- The incidence of infective endocarditis has remained the same even after the introduction of widespread antibiotic prophylaxis. This could imply that antibiotic prophylaxis is not effective, or not given to the appropriate "at-risk" population.
- The risks and benefits of antibiotic prophylaxis on an individual and community level are undergoing increasing scrutiny. Does the cost of antibiotics, and the rare but real risk for adverse reactions, outweigh the possible benefit to the patient? On a population level, does widespread antibiotic prophylaxis reduce the incidence of infective endocarditis enough to justify the possible development of drug-resistant bacteria?

Professional guidelines have evolved slowly, but the basic premise remains the same

Since 1955, the American Heart Association (AHA) and other professional organizations have recommended that antibiotic prophylaxis be given to at-risk patients before dental procedures. The AHA's guidelines have been revised nine times, with the latest update in 1997. The last revision narrowed the range of patients considered at risk for endocarditis, specified the dental procedures thought to be high risk, and simplified the recommended dosages.

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- The guidelines continue to assume a link between many dental procedures and the onset of endocarditis. They presume the effectiveness of antibiotics in preventing endocarditis in patients at risk, including those with congenital heart malformations, acquired valvular defects (such as rheumatic heart disease), prosthetic valves, and previous endocarditis.
 - The guidelines target dental procedures that involve the greatest risk of bleeding, assuming that these procedures also pose the greatest risk of introducing bacteria into the bloodstream.
 - Although the guidelines have produced a clinical and legal standard of care, compliance with these standards vary. A recent study of patients undergoing cardiac evaluation found that about 40% of those meeting the AHA criteria for antibiotics did not get them, and about 25% of those not meeting the criteria received antibiotics anyway.

Population-based study compares patients with endocarditis to a random sample of healthy community residents

Strom and colleagues conducted a case-control study to evaluate and quantify risk factors for infective endocarditis, especially those considered by the AHA to be indications for using antibiotics prophylactically.

- From August 1988 to November 1990, the investigators identified adults with infective endocarditis in 54 hospitals in Philadelphia and surrounding counties. These patients were interviewed by telephone to ascertain possible risk factors. Medical and dental records were obtained to validate self-reported information.
- The study included 379 patient with definite, probable or possible endocarditis. The investigators excluded endocarditis associated with intravenous drug use or acquired in the hospital; this left 287 patients. Of these, 273 (95%) completed the study interview. These patients were compared with an equal number of randomly selected community residents matched for age, sex and neighborhood of residence.
- The study compared the relationships between previous dental work performed on “case-patients” (those with infective endocarditis) and previous dental work performed on “controls” (community residents without endocarditis).

Study confirms that heart valve abnormalities are risk factors for endocarditis

The study confirmed the importance of preexisting cardiac abnormalities as principal risk factors for endocarditis.

- A patient-reported history of heart valve abnormality was highly associated with infective endocarditis. Case-patients were nearly 17 times more likely than controls to report any valvular abnormality; they were 75 times more likely than controls to report previous heart valve surgery, 37 times more likely to report previous endocarditis, 19 times more likely to report mitral valve prolapse, and 7 times more likely to report a heart murmur.
- Only a small proportion (10.6%) of case-patients had both a known cardiac abnormality and recent dental treatment. This indicates that the proportion of endocarditis even theoretically preventable with antibiotics is small.

Results suggest that dental procedures are not a risk factor for endocarditis, even in at-risk patients

The results showed that neither dental work, in general, nor any individual procedure, was significantly associated with infective endocarditis except, possibly, tooth extraction.

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- In the previous two months, about 17% of the case-patients and 14% of the controls had dental treatment; this increased to 23% of both case-patients and controls in the three months prior to the study date. The similar percentages of previous dental procedures among people with and without endocarditis suggests that dental procedures are not a risk factor for endocarditis.
 - Even among patients and controls with known cardiac abnormalities—the target of antibiotic prophylaxis—the risk for endocarditis was not increased by dental treatment. Of the case-patients with a valvular abnormality, about 20% had had dental treatment within two months of the study date; about 24% of the controls had a similar exposure.
 - Tooth extractions in the previous two months were reported in 6 case-patients, but no controls, indicating a possible risk. However, the number is too small to eliminate the possibility that this occurred by chance. In addition, this risk did not occur in the group of participants with valvular abnormalities, the target of antibiotic prophylaxis.
 - Few participants in the study received antibiotic prophylaxis; however, the risk for endocarditis remained the same, regardless of the use of antibiotics.

Flossing teeth daily may reduce risk of endocarditis

Strom and colleagues conducted analyses within certain groups in the study to identify other potential risk factors for infective endocarditis, including underlying medical conditions and oral hygiene practices. Because of small numbers of patients in certain groups, these results are suggestive, but not conclusive.

- Flossing daily was associated with a slightly reduced risk for endocarditis. This suggests that patients with heart valve abnormalities should be vigilant about oral hygiene.
- No association was found between endocarditis and frequency of routine dental care, use and frequency of tooth brushing, or use of a toothpick, oral irrigator, or gum stimulator.
- Case-patients were nearly 17 times more likely than controls to have severe kidney disease, and many of them were undergoing dialysis. The study could not determine whether the underlying disease itself or the procedures used to treat the disease were independent risk factors for endocarditis.

POLICY IMPLICATIONS

This study provides the most compelling evidence to date that antibiotic prophylaxis in at-risk patients is not effective in preventing endocarditis. Furthermore, given the expense and difficulty of doing further studies on this rare condition, this evidence is unlikely to be supplemented for a long time. Given the low incidence of the disease, the failures that occur even with recommended antibiotics, and the cost and risk of adverse reactions to the antibiotics, the study should lead professional organizations to reconsider their recommendations. However, changing standards and clinical practice is not an easy thing to accomplish.

- The guideline development process is often long and cumbersome. Since this study was originally published in 1998, the American Heart Association and American Dental Association have indicated that they will consider the evidence when they update the 1997 guidelines, which has not yet occurred. International guidelines are evolving even more slowly, with British guidelines last published in 1993.

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POLICY IMPLICATIONS

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- A number of commentators have suggested that the guidelines be refocused to recommend antibiotic prophylaxis only for patients at greatest risk for endocarditis and its resulting complications, namely, patients with previous endocarditis or those with prosthetic valves. Doing so might retain most of the potential benefits of antibiotic prophylaxis, while minimizing overall exposure to unnecessary antibiotics.
- Until professional guidelines are changed, it will be difficult to change clinical practice. Clinicians will likely follow their professional association's guidelines when faced with fear of malpractice claims and lingering uncertainty about how to apply population-based results to individual patients.
- Recognizing that clinicians need more information about the therapies they prescribe, the federal Agency for Healthcare Research and Quality has recently funded seven universities to develop Centers for Education and Research in Therapeutics (CERTs). One of the CERTs' primary goals is increase awareness of the risks and benefits of new and existing drugs; the University of Pennsylvania's center, funded in September 2000, is focusing on appropriate use of antibiotics.

This Issue Brief is based on the following articles: B.L. Strom, E. Abrutyn, J.A. Berlin, J.L. Kinman, R.S. Feldman, P.D. Stolley, M.E. Levison, O.M. Korzeniowski, D. Kaye. Risk factors for infective endocarditis: oral hygiene and nondental exposures. Circulation, December 2000, vol. 102, pp. 2842-2848; B.L. Strom, E. Abrutyn, J.A. Berlin, J.L. Kinman, R.S. Feldman, P.D. Stolley, M.E. Levison, O.M. Korzeniowski, D. Kaye. Dental and cardiac risk factors for infective endocarditis: a population-based, case-control study. Annals of Internal Medicine, Nov. 15, 1998, vol. 129, pp. 761-769.

Published by the Leonard Davis Institute of Health Economics, University of Pennsylvania, 3641 Locust Walk, Philadelphia, PA 19104-6218, 215-898-5611.

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Leonard Davis Institute
of Health Economics
University of Pennsylvania

Issue Brief



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