

## Prevention of Infective Endocarditis Following Dental Practices

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### ABSTRACT

**Introduction:** Different guidelines and different regimens for prevention of infective endocarditis following operative procedures have been recommended. The purpose of this review was to explore the effectiveness of using antibiotics as prophylaxis in the prevention of IE in dental practice.

**Methods:** The systematic search was conducted in the Medline, Science direct, CINAHL databases using search terms of (Infective endocarditis) AND (Epidemiology OR Bacteriology OR Prevention) AND (Dent\*). The relevant information was extracted from eligible studies. The irrelevant, duplicated studies were excluded.

**Results:** The antibiotic prophylaxis efficacy to prevent IE has never been assessed in a randomized controlled trial (RCT), and the profession has hedged far from such investigation on the grounds of numbers of patients required and ethical concerns. Perhaps the time has come for address this issue, a staged approach could be useful that is focusing a specific cardiovascular condition such as mitral valve prolapse in relation to operative dental procedures with low risk include endodontics and supragingival scaling.

**Conclusions:** A multi-center approach will be required, but at least an RCT would confirm whether antibiotic prophylaxis is required and also assess the (risk/benefits) of the antimicrobial administered.

**Keywords:** Infective Endocarditis, Dental, Prevention, Antibiotic, Prophylaxis.

### INTRODUCTION

Infective endocarditis (IE) or Bacterial endocarditis is an infection of the lining epithelium tissue of the heart chambers (endocardium) or heart valves. It may involve one or more valves, mural endocardium, or a septal defect. Whilst IE is a rare and uncommon, it is a life-threatening infection <sup>(1)</sup>. During the past 50 years the incidence of IE increased significantly (2-4 cases per 100,000 individuals per year). However, from 1998-2009 the rate increased 2.4% per year and in the year 2009 the incidence of IE was 12.7 cases per 100,000 individuals annually. More than 50% of patients with IE are older than 50 years. Females are 3 times less likely to have IE than males. However, no association between race and IE has been predicted <sup>(2)</sup>.

Despite advances in the diagnostic measures, instruments, and devices, antimicrobial therapy and surgical techniques, infective endocarditis still has a substantial role in morbidity and mortality. Although any one can be infected with this disease, it is much more common in subjects who have a risk to develop IE (certain heart defects/diseases, biomechanical devices implanted in the heart, have had IE before). Intravascular devices lines have been determined as the primary risk factor for bloodstream infections (BSIs). Staphylococcus aureus, however, has become the primary pathogen of IE <sup>(10)</sup>. Extensive use of the biomechanical devices implanted in the heart for

treatment of defects or abnormalities and the increase of the organisms' number resistant to drugs put some difficulties in the treatment of IE <sup>(3)</sup>.

Bacteria in the oral cavity may cause IE especially among those who at high risk. Blood from oral cavity, therefore, is the only way for bacteria to reach the heart. Dental treatment which results in blood in the oral cavity (oral surgery, periodontal treatment, endodontics, or even anesthesia) can lead to IE in susceptible patients if necessary precautions have been neglected <sup>(4)</sup>.

Prophylaxis with antibiotic has been suggested as a preventive measure to decrease the tendency of having infective endocarditis. Different guidelines and different regimens have been followed. The purpose of this review was to explore the effectiveness of using antibiotics as prophylaxis in the prevention of IE in dental practice.

### METHODS

The systematic search was conducted in the Medline, Science direct, CINAHL databases using search terms of (Infective endocarditis) AND (Epidemiology OR Bacteriology OR Prevention) AND (Dent\*). The relevant information was extracted from eligible studies. The irrelevant, duplicated studies were excluded. The findings of the included studies were summarized in a narrative

manner. The protocol of the review was approved by the technical and ethical committee.

**The study was done after approval of ethical board of Umm Al-Qura university.**

## RESULTS

The Gram-positive cocci of the enterococcus, staphylococcus, and streptococcus species represent 80– 90% of bacterial endocarditis. *S. aureus* is the most common microorganism related to bacterial endocarditis. Staphylococcal bacterial endocarditis affects high risk groups, for example, patients on haemodialysis and intravenous medication patients, and can affect both local and prosthetic valves. Furthermore, it is responsible for emerging of meticillin-resistance strains world widely<sup>(5)</sup>.

Coagulase-negative staphylococci (*Staphylococcus lugunensis*, *Staphylococcus capitis*, and *Staphylococcus epidermidis*) are universal skin commensals. They colonize inward lines and devices and are the most well-known isolate in early prosthetic valve endocarditis. Coagulase-negative staphylococci are common causative agent of hospital acquired native valve endocarditis. The characteristics of these bacteria include biofilm production, high rates of sore development, and multi-anti-toxin protection<sup>(6)</sup>.

Streptococcal infective endocarditis caused by the oral viridans bunch is more common in low income countries. These organisms are commensals of the oral, gastrointestinal, and urogenital tract. Gathering streptococci such as *Streptococcus bovis* and *Streptococcus gallolyticus* usually predispose to bacterial endocarditis related to underlying colonic tumor, which gives the portal of entry. Enterococci represent 10% of all infective endocarditis cases. *Enterococcus faecium* conveys expanding protection from ampicillin, vancomycin, and aminoglycosides<sup>(7)</sup>. Other organisms that can cause infective endocarditis include zoonotic bacteria, fungi and fastidious bacteria. The microorganisms *haemophilus*, *aggregatibacter*, *cardiobacterium*, *eikenellacorrodens*, *kingella* (HACEK) which cause around 3% of IE cases, are slow developing organisms that colonize the oropharynx. Other uncommon causes of infective endocarditis represent Gram-negative microorganisms (*Pseudomonas aeruginosa*, *Acinetobacter* spp), *Tropherymawhippily*, *Legionella* spp, and *Mycoplasma* spp. Fungal endocarditis, typically *Candida* or *Aspergillus*, is uncommon but often fatal,

emerging in patients who are immunosuppressed or after cardiovascular surgery, commonly on prosthetic valves<sup>(8)</sup>.

Various factors predispose to the development of IE include structural heart disease, prosthetic heart valves and intra uterine devices. However, a population based study that conducted in Philadelphia failed to identify aspiratory, cardiovascular, gastrointestinal, and genitourinary methods or surgery as risk factors for the development of infective endocarditis<sup>(9)</sup>. In addition, they found patients with poor oral hygiene, who did not floss, were at higher risk of infective endocarditis. Injection drug use, beside the injection itself, was also found as risk factors of IE, which regularly includes the right side of the heart<sup>(28)</sup>. Patients with hemodialysis are at critical risk for IE. Other predisposing factors for IE include pregnancy, ventriculoatrial shunts for the administration of hydrocephalus,<sup>(59)</sup> and peritoneovenous shunts for the control of immovable ascites<sup>(10)</sup>.

The bacteremia is known to be affected by the invasiveness, duration, and type of dental surgeries. Dental extraction is the most common dental procedures that can lead to bacteremia, ranging from 10% to 94% in different studies. Different case definitions and methodologies used by the researchers were responsible of this wide variation<sup>(11)</sup>. A transient bacteremia happens with control of dental plaque, utilization of irrigation system or other periodontal strategies including root planning and gingivectomy are accounted for bacteremia in 55% to 80 % of cases. Routine dental cleaning (scaling) likely causes disturbance of a largersurface of gingival tissues than an extraction and in this manner, might be more related to occurrence, nature, size and span of bacteremia<sup>(7)</sup>.

A case can be made for the possibility that the genuine risk bacterial endocarditis originates from normally occurring bacteremia such as that arising from chewing food and toothbrushing as opposed to intrusive techniques. One report proposes that a few people may produce bacteremia for 90 hours for each month from ordinary exercises, contrasted with 6 minutes for the normal dental extraction. Thus, if the toothbrushing produces bacteremia comparable to that delivered by routine dental hygiene practices the recommendations for prophylactic anti-microbial agents before dental techniques should be re-assessed<sup>(12)</sup>.

**Table 1.** Activity of various antimicrobials on periodontal pathogens <sup>(8)</sup>

	<b>Aa Actinobacillus Actinomycetemco mitans</b>	<b>Porphy- romonas</b>	<b>prevotella</b>	<b>Fuso- bacterium spp</b>	<b>Pepto- strepto- coccuspp</b>	<b>Oral Streptococci</b>
<b>Penicillin G</b>	±	±	±	+	+	+
<b>Amoxicillin</b>	+	±	±	+	+	+
<b>Amoxicillin/ Clavulanate</b>	+	+	+	+	+	+
<b>Doxycycline</b>	+	±	±	+	±	±
<b>Clindamycin</b>	<b>O</b>	+	+	+	+	+
<b>Metronidazole</b>	<b>O</b>	+	+	+	+	<b>O</b>
<b>macrolides</b>	±	±	±	±	±	±

(+: More than 80% of strains sensitive; O: Less than 30% of strains sensitive; ±: 30-80% of strains sensitive)

## DISCUSSION

The America Dental Association (ADA), the American Heart Association (AHA) set the rules for prevention of bacterial endocarditis in 2017. These rules support bacterial endocarditis premedication for a reasonably little subset of patients. This depends on a survey of scientific evidence, which demonstrated that the risk of antagonistic effects to antibiotic agents mostly exceed the advantages of prophylaxis for some patients who might have been eligible for prophylaxis<sup>(13)</sup>.

These rules taking in the consideration the risk of infective endocarditis that usually associated with exposure to oral microorganisms during essential daily exercises, for example, brushing or flossing. The valvular disease administration guidelines<sup>44</sup> prescribe that people in risk of creating bacterial infective endocarditis establish and keep up the most ideal oral health to reduce potential sources of bacterial seeding. They found that optimal oral health is sustained through professional dental care and the utilization of proper dental items<sup>(14)</sup>.

The present bacterial endocarditis/valvular coronary disease guidelines considered the use of preventive antibiotics before certain dental strategies is important for patients with prosthetic cardiovascular valves, including homografts and transcatheter-embedded prostheses, patients with prosthetic material use for cardiovascular valve repair such as in harmonies and annuloplasty rings. In addition to patients with history of bacterial

endocarditis, patients with cardiac transplant with valve regurgitation, and patients with congenital

heart diseases. According to the literature, infective endocarditis is commonly associated with heart transplant patients rather to general population. The highest risk of infective endocarditis was found in the first six months after transplant due to endothelial disruption, high-potent immunosuppressive treatment, frequent central venous catheter access, and common endomyocardial biopsies. Except for the conditions mentioned above, anti-microbial prophylaxis is never again suggested for other types of congenital coronary disease. Prophylaxis is prescribed for the patients recognized in the previous section for all dental procedures that include perforation of the oral mucosa, or teeth periapical area or manipulation of gingival tissue<sup>(15)</sup>.

The microscopic organisms that cause odontogenic contaminations are mainly saprophytes; during advancement of dental caries, the microorganisms infiltrating dentinal tubules are essentially opportunistic anaerobes, for example, staphylococcus, Streptococcus and lactobacilli species. At the point when the pulp is dead (necrotic), the microscopic organisms progress along the root canal and the process progress into inflammation of periapical area. Prevailing in this stage are Porphyromonas, prevotella, Peptostreptococci species and fusobacterium spp. The microbiology of irresistible intricacies is shifted: there are numerous combinations of all these microscopic organisms, with various

qualities, yet both aerobic and anaerobic bacteria are routinely present<sup>(16)</sup>.

## CONCLUSION

The antibiotic prophylaxis efficacy to prevent IE has never been assessed in a randomized controlled trial (RCT), and the profession has hedged far from such investigation on the grounds of numbers of patients required and ethical concerns. Perhaps the time has come for address this issue, a staged approach could be useful that is focusing a specific cardiovascular condition such as mitral valve prolapse in relation to operative dental procedures with low risk include endodontics and supragingival scaling. A multi-center approach will be required, but at least an RCT would confirm whether antibiotic prophylaxis is required and also assess the (risk/benefits) of the antimicrobial administered.

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