Review

DENTAL CARE AND INFECTIVE ENDOCARDITIS. A REVIEW

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ABSTRACT

Infective endocarditis is a relatively rare infection of the inner layer of the heart's valves and chambers. Most cases of endocarditis are caused by streptococci, which is a normal oral flora and is associated with plaque, dental caries, gingivitis, and periodontitis. Guidelines for preventing infective endocarditis recommend good oral hygiene for people at higher risk because of a pre-disposing cardiac condition, and prophylactic oral antibiotics when undergoing specific dental procedures. The objective of this article was therefore to review the currently available literature regarding oral health and infective endocarditis and to unfold the latest recommendations. A multidisciplinary approach including the patient's cardiologist is fundamental and can potentially reduce complications and improve dental treatment results.

KEYWORDS: *bacteremia, oral health, heart*, *endocarditis*

INTRODUCTION

The medical history of the patient is the first step of any dental treatment. A compromised medical status can alter the dental treatment plan and lead to severe consequences. Cardiovascular diseases are the leading global cause of death (1-3). With extensive improvement in healthcare facilities and an increase in life expectancy, dentists are encountering more and more elderly and medically compromised patients. In dental practice, though syncope is the most common medical emergency reported (4), cardiovascular events are not very infrequent (5, 6). So, it is very critical for dental practitioners to possess adequate knowledge, skills, and resources to address the problem. The spread of microorganisms from the oral cavity to other sites has been associated with the occurrence of systemic diseases such as infective endocarditis (7, 8).

Infective endocarditis is a severe disease that affects the surface of the endocardium (9-11), occurring more frequently in the vicinity of acquired or congenital heart defects (12, 13). The pathogenesis has been associated with the occurrence of bacteremia, the source of which can include periodontal infection sites (14, 15), dental and oral tissues manipulation (16, 17) and even daily lifestyle habits (brushing and flossing) (18). In the presence of infection, tooth-supporting tissues became highly vascularized and enter an intimate relationship with microbial biofilm, increasing the risk of bacteremia (19). Mounting evidence has indicated that dental treatment in patients at risk of developing infective endocarditis could be beneficial.

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DISCUSSION

Infective endocarditis

Infective endocarditis is an infective disease affecting a native or prosthetic heart valve, the endocardial surface, or an indwelling cardiac device that affects approximately 1 to 11 per 100,000 people every year (20), with typical age shifting from 40 years old in the 1980s to 70 years old in the new century (21). Several risk factors have been described like poor oral hygiene, alcoholism, and disorders causing immunological changes (cancer, systemic lupus erythematosus, renal insufficiency, diabetes mellitus, or chronic inflammatory intestinal disease) (22). Despite its low incidence, infective endocarditis is an issue of concern representing a life-threatening disease with a reported mortality rate of 19% during hospitalization, increasing to 41% after five years. However, it substantially varies depending on microbiology and clinical circumstances (23). Unfortunately, the complication rate is high (24). Congestive heart failure has a relevant impact on prognosis, while peri-annular abscesses, systemic embolization, and neurological complications are very common (24). Based on these assumptions, it seems clear that proper prevention and an early and accurate diagnosis are key factors when facing infective endocarditis (25).

Several microorganisms have been identified as being responsible for infective endocarditis development. While up to 90% of infective endocarditis are caused by gram-positive Staphylococcus sp. (species), Streptococcus sp. and Enterococcus sp. (26, 27), Staphylococcus aureus is considered the most common in high-income countries (28). However, 90% of them are transient or stable components of oral microbiota (Staphylococcus aureus, Streptococcus viridians, Streptococcus bovis, and Enterococcus faecalis) (26, 27).

Additionally, the detection of low-pathogenic gram-negative bacteria that reside in the oral-pharyngeal regions (haemophilus sp., aggregatibacter sp., cardiobacterium hominis, eikenella corrodens, kingella sp.) and fungi (candida sp. being predominant in this group) in blood culture of patients with infective endocarditis strongly support the role of oral microbiota in development and progression of this disorder (28). Indeed, infective endocarditis is usually correlated to bacteremia, and as suggested by some authors, tooth brushing, chewing, and dental procedures allow the dissemination of these microorganisms into the bloodstream (29). Therefore, understanding the pathophysiology and participation of both the host and the bacteria is a major challenge to improve the methods used to prevent infective endocarditis.

Infective endocarditis and dental procedures

There is controversial data about the differences in oral health in normal patients and patients with congenital heart diseases. Some research findings have shown that oral streptococci, the main cariogenic and causative organisms of infective endocarditis, grow more in the oral cavity of cardiac patients (30). Viridans streptococci are responsible for dental caries, pericoronitis, and subacute infective endocarditis.

The most frequently isolated viridans streptococcus from infective endocarditis patients is S. sanguinis, followed by S. oralis (31). In dental infections, the risk increases, and it has been estimated that 10% of infective endocarditis is related to oral infections with no oral bleeding treatment. This is due to the permeability of the epithelium surrounding the tooth-gingival tissue interface and the prostaglandins in blood that increase the number of leukocytes and fibrinogen. Blood circulation is reduced, and bacteria may enter (16).

The prevalence of caries and gingivitis among children with congenital heart diseases is much higher than in healthy children (30). Periodontal disease is another risk of endocarditis in patients suffering from congenital heart diseases (32). Oral hygiene habits such as brushing, toothpicks, flossing, or chewing can result in bacteremia during non-exposure periods. The microtrauma caused by these daily activities induces bacteremia in similar proportions to those of invasive oral procedures. The fact that the cumulative non-exposure periods are much longer than the exposure periods strongly suggests that most cases of infective endocarditis are due to everyday life bacteremia (33).

The incidence of bacteremia for tooth extraction ranges from 18% to 85%, periodontal surgery from 60% to 90% and toothbrushing or irrigation from 7% to 50%. Routine daily activities unrelated to a dental procedure are associated with a similar risk of bacteremia (34). These activities are shorter and more frequent than dental procedures. Moreover, most people only visit a dentist once or twice per year, and therefore, only exposed to a bacteremia related to dentist or dental hygienist manipulations on rare occasions. In contrast, daily activities expose them to transient bacteremia very frequently. Even though this daily transient bacteremia is of low grade and short duration, it is of high incidence.

There is only a small percentage of infective endocarditis related to dental procedures; most infective endocarditis is associated with oral hygiene habits. According to the American Heart Association, the biggest causes of infective endocarditis include poor oral hygiene, minor gum injury caused by tooth brushing, and dental procedures.

The incidence of bacteremia ranges from 20% to 68% for toothbrushing and flossing, from 20% to 40% for the use of wooden toothpicks, from 7% to 50% for the use of water irrigation devices, and from 7% to 51% for chewing food (34). It is not realistic to administer prophylaxis against this random daily physiological bacteremia. Therefore, if prophylaxis is administered before a once yearly or twice-yearly dental procedure, even if it is effective, only an exceedingly small proportion of cases of infective endocarditis would be prevented (34).

It is estimated that only a small percentage of cases would have been potentially prevented if antibiotic therapy were given to all patients at risk in dental treatment (16). Furthermore, it has been observed that in many cases the onset of endocarditis occurred many months after the procedure or that the causative agent was not a bacterial species that lives in the oral cavity (34). The prevalence and intensity of bacteremia vary among different surgical procedures.

The oral cavity is a reservoir of hundreds of different species of bacteria. Therefore, any procedure capable of causing a breach in the oral mucosal barrier places the internal body environment in contact with the highly contaminated oral cavity, resulting in potentially harmful microorganisms penetrating the systemic circulation. All surgical dental procedures are characterized by a significantly higher prevalence of bacteremia compared to non-surgical procedures (35). Bacteremia peaks during the first minutes following tooth extraction or an invasive dental procedure and falls over time (36). However, blood culture reveals that antibiotic therapy reduces viable cultivable bacteria in the bloodstream after tooth extraction (37).

Some research has studied the effect of the duration of surgery on bacteremia and found that the prevalence is higher in longer surgery than when the duration of surgery is shorter (38).

Prevention of infective endocarditis

Antibiotic prophylaxis to prevent infective endocarditis before dental and other non-cardiac interventions is not warranted. The recent guidelines for the prevention of infective endocarditis emphasize that all people who are at risk of developing this infection need to take particular care to remain free of dental disease (39). People with high-risk cardiac conditions are considered those who have a prosthetic heart valve, previous endocarditis, unrepaired cyanotic congenital heart disease or a repair procedure within the last six months and cardiac shunts or conduits for palliation. For an unknown reason, infective endocarditis occurs twice as often in males as females, although females are more likely to have a worse prognosis.

Prophylactic antibiotics are recommended for people at high risk of developing infective endocarditis who undergo dental procedures involving manipulation of either gingival tissue or tooth root region or perforation of the oral mucosa (39). People at high-risk who are undergoing the following routine dental procedures do not require prophylactic antibiotics: routine dental anesthetic injections through non-infected tissue, dental x-rays, placement of removable prosthodontic or orthodontic appliances, adjustment of orthodontic appliances, placement of orthodontic brackets, losing deciduous teeth and treatment of bleeding due to trauma to the lips or oral mucosa (39).

Amoxicillin is the first-line prophylactic antibiotic for people undergoing invasive dental procedures at high risk of developing endocarditis. Clindamycin or clarithromycin are possible alternatives for people in whom amoxicillin treatment is inappropriate or potentially ineffective. To ensure that levels in the blood are maximal at the time of procedure, the antibiotic should be given in the following timeframes: orally, one hour before the procedure; intramuscularly, 30 minutes before the procedure; intravenously, immediately before the procedure. If the patient carelessly does not receive an antibiotic before the dental procedure, it may be administered up to two hours later, although the effectiveness of the prophylaxis may be reduced (39).

The routine use of prophylactic antibiotics for infective endocarditis prevention began in the 1950s. There was a change in thinking when the American Heart Association produced guidance (2007) recommending that antibiotics should be limited to patients who had the highest lifetime risk of infective endocarditis and specifically only before invasive dental procedures. The European Society of Cardiology also produced similar guidelines (39). The principal reason for the reduction in antibiotic use was that the risk of a person developing infective endocarditis following a dental procedure is very low, even for those with a high lifetime risk (40). Based on these, it was argued that the use of prophylactic antibiotics for people other than those at the highest lifetime risk of infective endocarditis would prevent very few cases of infective endocarditis (41). Also, widespread use of antibiotics would result in an increased number of adverse reactions and contribute to the growing problem of antimicrobial resistance (42).

The UK National Institute for Health went one step further. It recommended that antibiotics should no longer be prescribed solely to prevent infective endocarditis, regardless of the patient's risk (43). Subsequently, in 2008 antibiotic prophylaxis was completely abolished for all patients in the UK, posing the basis for a revision of the guidelines in other countries including Europe with a reduction of types of cardiac conditions requiring prophylaxis.

The recommendation was based on clinical evidence and strongly influenced by the possibility that the use of antibiotics for infective endocarditis prevention may result in a net loss of life due to adverse effects associated with antibiotic use (43). One study after the introduction of the guidelines failed to detect a significant increase in the incidence of infective endocarditis compared with before the guidelines (44, 45). The study from England was not the first to examine the relationship between antibiotic prescribing and rates of infective endocarditis. Studies conducted in the USA following the introduction of the modified guidelines from the American Heart Association, also did not detect an increase in the incidence of infective endocarditis (46-57).

Decades of published data still do not provide evidence on which to make strong recommendations for antibiotic prophylaxis against endocarditis at the time of dental procedures (49). The association between origin of the IE causing bacteria and findings during oral infection screening might be uncertain and may suggest that the benefit of screening and elimination of oral infections in patients admitted with IE might be overestimated.

Since a change in this confusing and contradictory recommendation situation is not foreseeable, clinicians faced with the decision to prescribe antibiotic prophylaxis in patients with an increased risk should consider national guidelines and international recommendations (58, 59). To ensure responsible therapy, practitioners should regularly observe scientific discussion and review the latest updates (60-62).

CONCLUSIONS

Dental treatment, although considered safe, can be life-threatening if medical problems of the patient, especially cardiac disorders, are ignored. A detailed medical and drug history from each patient at every appointment and vast knowledge of the risk factors and clinical manifestations of various cardiac diseases can prevent many medical consequences in the dental clinic. A comprehensive treatment plan prepared in collaboration with the patient's cardiologist can help avoid potential dangers during dental treatment for a cardiac patient. All drug prescriptions, surgical interventions, and overall management approaches should adhere to the latest guidelines and protocols.

Conflicts of interest

The authors declare no conflict of interest.

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