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Antibiotic Prophylaxis before dental procedures in patients at risk of Bacterial Endocarditis, a review article

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ABSTRACT

Several studies show that dental procedures especially in case of gingivitis, peri-apical lesions and periodontitis with inflamed periodontal tissues or infected pocket epithelium surrounding the teeth may be a cause of bacterial invasion through the bloodstream and resulting in Infective endocarditis which is a severe disease that may affect the heart valves or the endocardium. The most common bacteria responsible for bacterial endocarditis are alpha-hemolytic streptococci like Streptococcus viridians but oral pathogens like Eikenella corrodens, Aggregatibacter actinomycetemcomitans, Capnocytophaga, and Lactobacillus species can cause bacterial endocarditis. In this review, we searched the United States National Library of Medicine at the National Institutes of Health (PubMed) to make out all articles that included the terms endocarditic, prophylaxis, oral or dental in the title. Several published sources of information relating to dental procedures, bacteremia, and infective endocarditis were reviewed. This review is focused on the patients that need prophylactic antibiotics and the recommended antibiotics for adults and children for dental procedures in which the prophylaxis is necessary. Antibiotic prophylaxis is indicated for patients with prosthetic cardiac valve, history of infective endocarditis, distinct Congenital Heart Diseases (CHD) and Cardiac transplant recipients with cardiac valvular disease. The most important pathogen responsible for endocarditis during dental procedures is S viridans (alpha-hemolytic streptococci). Antibiotic regimens for endocarditis prophylaxis are used against S viricians, and the recommended standard prophylactic regimen is a single dose of oral amoxicillin. For patients with high cardiac risk, antibiotic prophylaxis is recommended for all dental procedures like manipulation of gingival tissue or the periapical area of teeth or perforation of the oral mucosa.

Keywords— *Bacteremia, Infective Endocarditis, Oral, Dental procedures*

1. INTRODUCTION

Periodontitis is characterized by the inflammation of tooth-supporting structures caused by several bacterial pathogens. The invasion of Bactria through host tissues lead to the production of enzymes that is responsible for the destruction of epithelial and connective tissue cells. Periodontitis is diagnosed by gingival redness, bleeding on probing, crestal bone loss and at the advanced stages result in tooth mobility. Several factors can modify or exacerbate the progression of periodontal disease including poor oral hygiene, smoking, genetic susceptibility, nutrition, stress and etc. In addition, systemic conditions such as immune, hematologic and genetic disorders may accelerate the initiation and progression of periodontal destruction by affecting neutrophils, monocytes, macrophages and lymphocytes function. [1-5].

In 1900, William Hunter described the concept of focal infection that bacteria in the oral cavity can have an important role in the etiology of systemic diseases in other body organs. Although some authors didn't accept Hunter's theory of focal infection at that time, today's evidence-based medicine and dentistry have approved the possibility of relationships between periodontitis and systemic disorders. [6-9].

Bacterial endocarditis is a disease in which microorganisms affects the heart valves or the endocardium. The most common bacteria responsible for bacterial endocarditis are alpha-hemolytic streptococci like *Streptococcus viridians*. Recent studies have demonstrated that non-streptococcal periodontal pathogens can cause bacterial endocarditis including *Eikenella corrodens*, *Aggregatibacter actinomycetemcomitans*, *Capnocytophaga*, and *Lactobacillus* species. The most important pathogen responsible for endocarditis during dental procedures is *S viridans* (alpha-hemolytic streptococci). Antibiotic regimens for endocarditis prophylaxis are used against *S viricians*, and amoxicillin is the recommended in standard prophylactic regimen as a single dose orally. Amoxicillin is a semi-synthetic penicillin that has widely used since 1972 and is one of the most commonly prescribed antibiotics in children and adults with a wide range of anti-infective spectrum that includes both gram-positive and gram-negative

bacteria. It is also used in the treatment of other organ infections, including head, nose, throat, urinary tract, lung, skin and periodontal infections. That's why penicillin is used for prophylaxis to prevent bacterial endocarditis in high-risk individuals before dental treatments such as endodontic treatments, tooth extractions, gingival or mucosal surgeries, sub-gingival scaling and root planning. High-risk individuals include artificial heart valves, major and congenital heart defects and a history of previous endocarditis [10-14].

Generally, due to the severity and extension of the disease, it may be used alone or together with another antibiotic called combination therapy. In periodontal practice, amoxicillin may be useful for the management of patients with localized and generalized aggressive periodontitis and advanced forms of other periodontitis. Ampicillin and penicillin V can be used instead but amoxicillin is preferred because of higher gastrointestinal absorption that provides higher and more sustained serum levels. Table 1 and 2 represents the recommended prophylactic antibiotics for adults and children. The first choice is taking a single dose of amoxicillin 30 to 60 minutes before dental procedure [15- 20].

2. HIGH-RISK CARDIAC CONDITIONS

Antibiotic prophylaxis is indicated for the following high-risk cardiac conditions:

- Prosthetic cardiac valve
- History of infective endocarditis
- Special Congenital heart disease (CHD)
- Cardiac transplant recipients with cardiac valvular disease

3. DENTAL PROCEDURES

For patients with high cardiac risk, antibiotic prophylaxis is recommended for all dental procedures like manipulation of gingival tissue or the periapical area of teeth or perforation of the oral mucosa.

The following dental procedures do not need endocarditis prophylaxis:

- Routin anaesthetic injections through non-infected tissue
- Placement of removable prosthodontic or orthodontic appliances
- Taking dental radiographs
- Adjustment of orthodontic appliances
- Placement of orthodontic brackets

The most important pathogen responsible for endocarditis during dental procedures is *S viridans* (alpha-hemolytic streptococci). Antibiotic regimens for endocarditis prophylaxis are used against *S viricians*, and the recommended standard prophylactic regimen is a single dose of oral amoxicillin. Amoxicillin, ampicillin, and penicillin V can be used instead but amoxicillin is preferred because of higher gastrointestinal absorption that provides higher and more sustained serum levels [21- 25].

Table 1: The ADA recommended a prophylactic antibiotic regimen for adults

Situation	Single Dose of 30 to 60 min. Before Procedure	
	Agent	**Adults**
Oral	Amoxicillin	2 g
Unable to take oral medication	Ampicillin OR Cefazolin or ceftriaxone	2 g IM or IV 1 g IM or IV
Allergic to penicillins or ampicillin oral	Cephalexin OR Clindamycin OR Azithromycin/clarithromycn	2 g 600 mg 500 mg
Allergic to penicillins or ampicillin and unable to take oral medication	Cefazolin/ ceftriaxone OR Clindamycin	1 g IM or IV 600 mg IM or IV

Table 2: The ADA recommended a prophylactic antibiotic regimen for children.

Situation	Single Dose of 30 to 60 min. Before Procedure	
	Agent	**Children**
Oral	Amoxicillin	50 mg/kg
Unable to take oral medication	Ampicillin OR Cefazolin or ceftriaxone	50 mg/kg IM or IV 50 mg/kg IM or IV
Allergic to penicillins or ampicillin oral	Cephalexin OR Clindamycin OR Azithromycin/clarithromycn	50 mg/kg 20 mg/kg 15mg/kg
Allergic to penicillins or ampicillin and unable to take oral medication	Cefazolin or ceftriaxone OR Clindamycin	50 mg/kg IM or IV 20 mg/kg IM or IV

4. CONCLUSION

For Preventing and reducing the risk of bacterial endocarditis the following items should be considered:

- Recognizing the susceptible patients by meticulous assessment of past medical history will help the dentist to reduce the risk of bacterial endocarditis during dental practice. The dentist or periodontist should cover the history of all potential available risks. If any doubt exists do not hesitate to consult the patient's physician.
- Do not forget about oral hygiene instruction. Oral hygiene should be practised on a regular basis for improving oral, periodontal and gingival health. In patients with excessive gingival inflammation, it should be first limited to use oral rinses and mild tooth brushing with a soft brush to reduce gum bleeding and avoid bacterial endocarditis. The more gingival health improves the less would be the risk of bacterial endocarditis. Generally, oral irrigators are not recommended because they may induce bacteremia. High-risk patients should be educated to maintain the highest level of oral hygiene once gingivitis or periodontitis is controlled.
- Before above mentioned dental procedures that are considered risky, updated recommended antibiotic prophylactic regimens (Table 1 and 2) should be practised with all high-risk patients. If questionable susceptibility exists, the patient's physician should be consulted.
- In patients that have been taking continuous oral amoxicillin or penicillin for other purposes or as a part of periodontal therapy, penicillin-resistant α-hemolytic streptococci may be found in the oral cavity. In this situation, an alternate antibiotic regimen is recommended.
- For maintaining oral and gingival health regular recall visits with an emphasis on oral hygiene instruction and plaque control are extremely important for patients susceptible to bacterial endocarditis.

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