An Assessment of the Oral Health Aspects of Inpatient Children with Infective Endocarditis

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ABSTRACT

Background/Aims: The relationship between oral microorganisms and development of infective endocarditis (IE) was recognized in the past. IE is an insidious disease of the endocardium and constitutes a life-threatening condition. The aim of the present work is to assess the oral health pattern in a small group of children with congenital heart disease (CHD)-mediated IE. Subjects and Methods: Three children patients admitted to children’s hospital/Benghazi with recent infective endocarditis were examined for the presence of dental caries and gingival inflammation using non-invasive procedures based on visual examination. The children experienced raised temperature and were on intravenous antibiotic treatment. Results: Laboratory investigations revealed Staphylococcus infective endocarditis. Oral examination showed some oral infections due to dental caries and gingival inflammation. Conclusion: Development of infective endocarditis can ensue without any dental procedures being carried out in the past. This could raise the suspicion that IE developed from infective foci in the oral cavity rather than the treatment procedures per se.

Keywords: oral bacteria, infective endocarditis (EI), Gingivitis extent (GE), Gingivitis severity (GS), congenital heart disease

1. INTRODUCTION

Congenital heart disease (CHD) is among the most common form of major congenital anomalies, representing a global health problem. Out of all major congenital anomalies, 28% consist of heart defects (30). CHD is the single most common underlying condition in the etiology of infective endocarditis (29). Dental procedures in the presence of marked gum disease may induce more bacteremia than those with the clean mouth (10,26). The less the degree of gingivitis the less likely is the frequency and severity of transient bacteremia (15). Microorganisms in the oral cavity have been reported to be responsible for the causation of most cases of post-surgical endocarditis (20). Therefore periodontal infection and dental decay should be diagnosed and eliminated before any open heart surgery to minimize the risk of IE.

Oral and dental procedures have often been recognized as the cause of cases of infective endocarditis. However, poor oral health may actually cause more cases of infective endocarditis than do mere dental procedures. The mouth is the site for different kinds of microorganisms such as bacteria, viruses, parasites, and fungi. More than 500 bacterial strains have been identified in the oral cavity, and about 150 strains have been cultivated infected dental pulps (16).
The aim of presenting these three infective endocarditis cases is to highlight the importance of maintaining optimum oral health care among children with CHC and at risk of infective endocarditis.

2. METHODS

Ethical approval was obtained from The Cardiology Department Group in Paediatric Hospital, Benghazi/Libya. The main examiner was accompanied by the pediatric cardiologists in the cardiology ward. Parental permission was taken prior to the examination, following explanation of the purpose of the oral health evaluation. Each child patient was examined separately and seated either on the bed or on the parents’ lap. Non-invasive procedures based on visual examination only by using a sterile disposable plastic mirror in the patient’s room in the natural daylight / and artificial room light. Caries experience was evaluated using the guidelines of Palmer et al. and based on the visual presentation of cavitations. No radiographs were taken.

**Periodontal health evaluation**
The upper and lower anterior segments were used to evaluate the periodontal health of the examined patients. The evaluation of periodontal health was done using gingivitis extent (GE) as modified from previous indices\(^1\), and the degree of gingivitis severity (GS) using visual examination without probing.

Due to lack of proper periodontal indices for children with heart diseases and owing to their debilitating health status as medically compromised children, the periodontal health evaluation was assessed using gingivitis extent (GE) and Gingivitis severity scores (GS)

The extent of gingivitis (GE) scores is demonstrated in the following scores for the purpose of presentation and analysis:

- GE 1= no inflammation in units
- GE 2= scores from (1-6) inflamed units.
- GE 3= scores from (7-14) inflamed units.
- GE 4 = scores from (15-18) inflamed units.

The degree of gingivitis severity evaluation was done using gingivitis severity scores (GS):

1. GS0= No gingivitis characterized by pale color pink: texture-firm, no bleeding on firm digital pressure.
2. GS1= Mild inflammation with slight change in color and little loss of contour
3. GS2= Moderate inflammation with swelling, glazing, and redness. Papillae or margins appear rounded.
4. GS3= Severe inflammation with more swelling, redness and spontaneous bleeding. Slight ulceration.
5. GS4= very severe more than above including sloughing and ulceration.

3. RESULTS

**Case One**
A 1-year-old male child previously diagnosed with tetralogy of Fallot (TOF). Oral examination revealed no carious lesions (dmft = 0), and gingivitis extent score (GE) was 2 in addition to mild gingivitis (GS1).

**Case Two**
A 9-year-old boy had a previous ventricular septal defect (VSD) operated 7 years back and presented with high temperature (41 C\(^\circ\)) and ESR (92). Oral examination revealed recent exfoliation of left lower canine. The fever started before shedding of the primary tooth. Examination revealed three papillary (P=3) and two marginal gingivitis (M=2) were inflamed with moderate severity (GS2).

**Case Three**
A female child aged 1.9 years old had previous cardiac surgery for three months and recently developed infective endocarditis. Oral examination revealed no caries (dmft = 0), and she had 2 (P) that was moderately inflamed (GS2).

4. DISCUSSION

Three children, with known congenital heart disease and recent infective endocarditis, were admitted as inpatients in Paediatric Hospital in Benghazi. The main cause of their critical condition was bacteremia without previous history of dental procedures, and the cultured organism was Staphylococcus aureus bacteria which are the common oral cavity flora. Two of them had previous cardiac surgery (one case with TOF), and both suffered from gingivitis. Owing to their debilitated health status, simplified and non-invasive examination procedures were carried out to examine their oral health. Probing of the gingiva was avoided as the change in contour and color has been noticed to precede bleeding in early gingivitis\(^3,12\).
Infective endocarditis due to S. aureus is considered an extremely lethal disease\(^{30}\). The importance of congenital heart disease in pediatric dental treatment resides in the fact that the risk of infective endocarditis is associated with transient bacteremia during certain dental procedures\(^{44}\). Dental procedures are known to cause bacteremia include tooth extraction, manual and ultrasonic periodontal scaling, gingivectomy, subgingival hand instrumentation, mastication, needle injection for the administration of local anesthesia, tooth brushing, adjustment of orthodontic appliances, crown and during clamp and rubber dam application\(^{14,15,28}\). The sources of bacteremia in terms of frequency found to be highest for dental and oral procedures. Many studies have demonstrated variations in the frequency of transient bacteremia in different dental procedures and manipulations such as spontaneous bacteremia (0-3 %)\(^{12}\), tooth extraction (18-100 %)\(^{27}\), periodontal surgery (50-90%)\(^{17,23}\), tooth brushing (7-50%)\(^{5,21,19,20}\), tooth rocking (12-86%)\(^{9,21}\), dental prophylaxis\(^{17}\) (28-40%), oral irrigation (7-50%)\(^{2,11,22}\), chewing paraffin (7.50%), chewing hard candy (17.4%)\(^{5}\), chewing bubble gum 22%\(^{8}\), unwaxed dental floss 20%\(^{17}\), periodontal scaling\(^{6}\), in healthy gingiva (21.6%), in gingivitis (29%) and in periodontitis (51.2%), ultrasonic instrument\(^{1}\) (79.2%).

The route of entry of experimental bacteremia in human was found to be through the gingival crevice. An experimental transient bacteremia by toothbrushing was demonstrated in a total of 96 healthy adults who were assigned to one of four groups according to the severity of gingival inflammation and bacterial accumulation on the teeth\(^{28}\). In that experimental the percentage of subjects demonstrating bacteremia increased with increasing severity of gingival inflammation, whereas subjects with only minimal gingival inflammation showed a low incidence of bacteremia. Three subjects had detectable transient bacteremia following tooth brushing out of thirty-six during the investigation of occurrence of transient bacteremia in thirty-six healthy subjects without any signs of clinical gingival inflammation as demonstrated by scores of zero using the modified gingival index. From two subjects Propionibacterium species was isolated whilst Actinomyces species, Streptococcus sanguis and Streptococcus mitis were isolated from the third subject. The implications would be obvious for patients susceptible to infective endocarditis.

The absence of bacterial culture in the two youngest children may usually be attributed to having been treated with antibiotics prior to the blood cultures being taken.

The causative organism of infective endocarditis in most cases comes from the S. viridans species; in particular S. sanguis\(^{25,29}\). In one study, the organisms isolated from 26 out of 83 patients were common oral commensals and dentally related\(^{20}\). Oral commensal organisms such as S. Bovis, S. mitis, and S. sanguis are types of S. viridans. Non-haemolytic Streptococci, haemolytic Streptococci, Staphylococci and anaerobic bacteria are also identified among the oral organisms implicated in infective endocarditis. Out of these, Staphylococci has been reported to be predominant in some studies\(^{24}\). Bacteremia following dental manipulation was estimated to occur in 86% of cases of marked gum disease, whereas in the infection-free mouth was about 25%\(^{9}\). The recurrence status after the initial episode of infective endocarditis due to S. viridans was 5% over a mean follow-up period of 4.3 years in the 42 of 57 survivors with retained teeth, whereas, recurrence from Staphylococcus (which is reported to be harbored in the oral cavity) endocarditis was 10%7.

5. CONCLUSION

1. The importance of development of early dental health promotion programme for early identified cardiac disease should be encouraged at early age.
2. The pre-existing decay and gingivitis should be diagnosed and treated before any cardiac surgery to eliminate any possible oral foci of infection.
3. Many studies are needed in such countries to reflect the essential needs of oral health in children with cardiac diseases.

CONFLICT OF INTEREST
The authors report no conflict of interest.
REFERENCES