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# Dental Infection as a Cause of Bacteraemia in Infective Endocarditis

**Abstract:** Infective endocarditis is a life-threatening disease that not only involves the heart, but can also affect other organs. Bacteria enter the bloodstream from a source such as a dental infection, and travel through the blood to form vegetations on compromised heart valves. C-reactive Protein (CRP) levels and blood cultures are valuable markers in diagnosing infective endocarditis and the latter can also provide valuable insight into the type of bacteria causing sepsis and which antibiotics are best prescribed. Dental infection has been implicated in over a third of cases of infective endocarditis, and therefore it is important to treat carious, periapically infected or periodontally involved teeth as soon as possible to prevent further deterioration of the patient.

**CPD/Clinical Relevance:** There is much evidence that suggests that dental extractions are a way of introducing bacteria into the bloodstream. However, it is important also to be aware that carious and infected teeth can be a cause of sepsis in a patient with infective endocarditis and may need to be removed to prevent further deterioration.

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Infective endocarditis is an infection of the inner surface of the heart, the endocardium, and can include the heart valves, mural endocardium or a septal defect. There are three factors that contribute to the development of infective endocarditis; the introduction of bacteria into the bloodstream, a predisposing valve defect, and the virulence of the bacteria. Due to a pre-existing valve defect, such as congenital defects, rheumatic fever or prosthetic heart valves, a sterile thrombus forms and it is this thrombus that bacteria adhere to and invade and eventually form vegetations. Increased numbers of bacteria from the bloodstream accumulate, the vegetation grows and prevents normal valvular function. Eventually this can lead to

congestive heart failure. Sometimes, parts of these vegetations can break off and enter the bloodstream where they can cause cerebral infarction, aneurysms and can cause infections in distant organs.<sup>1</sup>

Oral bacteria can be introduced into the bloodstream from carious or infected teeth. *Staphylococcus aureus* and *Streptococcus viridans* can be present in the oral cavity and are the most common organisms responsible for infective endocarditis. *Streptococcus viridans* are highly cariogenic and have been isolated from blood cultures and from vegetations on heart valves in a significant proportion of infective endocarditis cases.<sup>2</sup>

## Case history

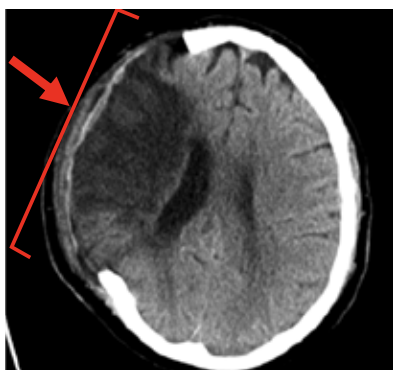
A 45-year-old male presented to hospital with an 8-week history of fever, malaise, shortness of breath and weight loss. Bloods were taken and his CRP level on admission was 130 mg/L (Normal range 0–5 mg/L). The provisional diagnosis was sepsis of unknown origin and treated with Piperacillin/tazobactam and Gentamycin, according to hospital antibiotic policy. The following day his Glasgow Coma Scale (GCS) dropped and he developed a left-sided hemiparesis. A

Computerized Tomography (CT) scan of his brain was done which showed a right middle cerebral artery infarct (Figure 1). The patient underwent a decompressive craniectomy to relieve the increased intracranial pressure.

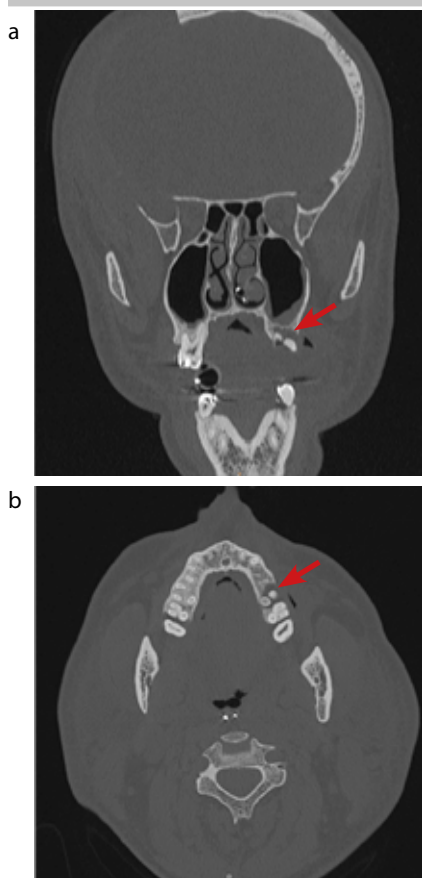
A TransThoracic Echocardiogram (TTE) showed severe aortic and mild mitral regurgitation. Blood cultures were positive for *Streptococcus viridans*. Following microbiology advice, the antibiotics were changed to Benzylpenicillin and Gentamycin. The patient continued to have seizures, pyrexia and was tachycardic.

A dental review was sought due to *Streptococcus viridans* in the blood culture. On clinical examination, the UL6 and UL7 were carious and Grade I mobile. A CT of facial bones revealed a periapical lucency around the residual roots of UL6 and UL7, suggesting ongoing dental infection (Figure 2). As a result of both clinical and radiological examination, both the UL6 and UL7 were subsequently extracted under local anaesthetic as atraumatically as possible. Three days post-operatively, the CRP dropped down to 19.00 mg/L (normal range 0–5 mg/L). Blood cultures from these extracted teeth grew Gram positive cocci of *Streptococcus anginosus* (a subgroup of viridans streptococci) and *Propionibacterium*

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**Figure 1.** CT scan of the brain showing a right middle cerebral artery infarct as highlighted by the arrow.



**Figure 2.** (a) Coronal and (b) sagittal views of the CT scan of the facial bones showing the periapical lucency indicative of bone loss due to infection surrounding the roots of the UL6 and UL7 (indicated by the red arrows)

*acnes*. Based on sensitivities, Benzylpenicillin and Gentamycin were continued.

The patient's overall condition began to improve and he was slowly weaned off the sedation and respiratory support and continued his recovery on the cardiology ward.

## Discussion

The association between oral bacteria and infective endocarditis has been the topic of many studies over the years. Initially, in 1909, Horder's study highlighted that 'oral sepsis' was an important factor in the development of infective endocarditis.<sup>3</sup> However, since then, most focus has been on the prevention of bacteraemia, by avoiding carrying out invasive dental procedures such as extractions and deep scaling. Many studies have shown that transient bacteraemia can follow dental extraction, which led to the introduction of antibiotics prior to the dental procedure being carried out.<sup>4</sup> However, in March 2008, new National Institute of Clinical Excellence (NICE) guidelines were brought out that stated that antibiotic prophylaxis was not necessary. This was due to further research showing that bacteraemia from daily activities, such as toothbrushing and mastication, posed a greater risk to patients than transient bacteraemia associated with invasive dental procedures.<sup>4,5</sup> In addition to this, a further case-control study concluded that dental treatment does not seem to be a risk factor for infective endocarditis and there are limited cases of infective endocarditis that would actually have been preventable with antibiotic prophylaxis.<sup>6</sup>

The patient in this case already had a positive blood culture for *Streptococcus viridans* and therefore it was a case of determining the source of the infection rather than preventing an infection. It has been found that oral bacteria are implicated in 35-45% of cases of infective endocarditis.<sup>5</sup> With regard to this patient, other sources had been discounted and therefore, due to much evidence linking oral bacteria to infective endocarditis, the teeth were examined. The cultures grown from the teeth also grew *Streptococcus viridans*, increasing the association between positive blood culture and dental caries. Having been aware of the literature, the tooth was removed as atraumatically as possible to minimize the risk of further contamination,<sup>7</sup> although studies have shown that bacteraemia would have only been transient.<sup>8</sup> In this case, it was felt that the carious teeth with periapical infection and periodontal disease were strongly associated with the positive blood cultures and were therefore removed. Studies have also shown that CRP is not only useful as a diagnostic marker for infective endocarditis but also in predicting the outcome.<sup>9</sup> The CRP level

dropped considerably following extraction of the infected teeth, which was another indicator that the source of the infection had been removed and strengthened the provisional diagnosis of oral sepsis.

## Conclusion

Regular dental reviews and maintaining good oral hygiene are essential for patients' general health. This is emphasized in a patient with a history of previous cardiac disease and infective endocarditis. It is important for dentists to be aware of the association of an unwell patient with such a history and the risk that dental caries and periodontal health pose to their wellbeing.

Bacteria can be introduced into the bloodstream through toothbrushing, mastication and dental procedures, however, bacteraemia from a simple periapical infection cannot be underestimated or overlooked. In this case, the benefit of extraction outweighed the risk of bacteraemia from the invasive dental procedure and the patient began to improve slowly. Further research needs to be carried out to determine fully the level of bacteraemia from a dental extraction compared to that of a persistent periapical infection and how big a part antibiotics play within the treatment of this type of infective endocarditis.

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