

Comparative study of detection of bacteremia after different oral surgical procedures

TABISHUR RAHMAN, SYED S. AHMED, HARRIS M. KHAN¹, GHULAM S. HASHMI, SAJJAD A. RAHMAN, KALIM M. ANSARI

Abstract

Introduction: The purpose of this study is to compare the efficiency of culture methods in detecting microorganisms appearing in the bloodstream after various oral surgical procedures and effect of preoperative antibiotics and antiseptic rinses on bacteremia.

Materials and Methods: The prevalence of bacteremia at various intervals of time (pre- and post-surgical) was studied in three different groups presenting with indications to surgical intervention. Two of the groups were given presurgical prophylaxis (systemic antibiotic and antiseptic rinse) while, in one group, no prophylactic measure was adopted. Blood samples were withdrawn from the subjects at specific pre- and post-surgical time intervals, and microbiological analysis was done. The findings were compared with a control group involving healthy individuals and a group involved in maxillofacial trauma where the breach of oral mucosal integrity was not surgically planned. **Results:** The presence of bacteremia was not observed in all five groups at baseline while postsurgery (30 min, 60 min, and 90 min) in only three groups (preoperative antibiotic, without prophylaxis, and 1% Povidone iodine rinse). At all postsurgery periods (30 min, 60 min and 90 min), the presence of bacteremia was evident highest in without prophylaxis group followed by 1% Povidone iodine rinse and preoperative antibiotic the least.

Keywords: Bacteremia, prevalence, surgery

Introduction

The oral ecosystem has plethora of microorganisms. Any breach in the oral mucosal barrier places the internal body environment in contact with a highly contaminated ecosystem resulting in penetration of microorganisms into the bloodstream that is termed as bacteremia.

One unique feature of this oral bacterial biofilm, particularly the subgingival plaque biofilm, is its close proximity to the underlying vasculature.^[1] There are several procedures for the microbiological analysis of blood cultures taken after dental

procedures.^[2,3] Various studies have been conducted to study the association of bacteremia with dental procedures and to establish any correlation with factors like age, gender, type of procedure, duration of surgery, etc.^[4-7]

The purpose of this study is to compare the efficiency of culture methods in detecting microorganisms appearing in the bloodstream after various oral surgical procedures and effect of preoperative antibiotics and antiseptic rinses on bacteremia. We also studied the association of bacteremia with age, gender, and duration of surgery and also the aggressiveness of the procedure.

Materials and Methods

This study was a cohort investigation carried out over a duration of 2 years from October 2012 to October 2014 in which the subjects were divided into the following groups: Group 1: Control group (10 patients). Blood samples were collected from healthy volunteers and screened for bacteremia. Group 2: Trauma group (10 patients). Patients of maxillofacial trauma without any post-trauma antibiotic administration with only baseline blood sample collection at the time of reporting. Group 3: Antibiotic prophylaxis group (10 patients). Patients undergoing oral surgical intervention with blood sample collection prior to prophylactic antibiotic administration ½ h before surgery and subsequent blood sample collection after ½, 1, and 1½ h of surgery. The antibiotic administered was ceftriaxone 1 g intravenously (i.v) in adults and 50 mg/kg i.v in children. Group 4: Without prophylaxis group (10 patients). Patients undergoing oral surgical intervention without any preoperative prophylaxis with blood sample collection prior

Department of Oral and Maxillofacial Surgery,
Dr. Ziauddin Ahmed Dental College and Hospital, Aligarh Muslim
University, ¹Department of Microbiology, Surgery Aligarh Muslim
University Jawaharlal Nehru medical College and Hospital,
Aligarh Muslim University, Aligarh, Uttar Pradesh, India

Correspondence: Dr. Tabishur Rahman,
Department of Oral and Maxillofacial Surgery,
Dr. Ziauddin Ahmed Dental College and Hospital, Aligarh Muslim
University, Aligarh - 202 002, Uttar Pradesh, India.
E-mail: tabishalig05@gmail.com

Access this article online	
Quick Response Code: 	Website: www.contempclindent.org
	DOI: 10.4103/0976-237X.161903

to the surgery and subsequent blood sample collection after ½, 1, and 1½ h of surgery. Group 5: 1% Povidone iodine rinse group (10 patients). Patients undergoing oral surgical intervention with blood sample collection prior to prophylactic rinsing of oral cavity with 30 ml of 1% Povidone iodine gargle ½ h before surgery and subsequent blood sample collection after ½, 1, and 1½ h of surgery.

Patients who received any antimicrobial agents for the 6 weeks preceding the treatment or used antiseptic mouthwash or gargles during 6 weeks preceding the treatment were excluded from the study and so were the patients of maxillofacial trauma with other associated injuries as well as immune-compromised and pregnant patients.

Institutional ethical clearance was obtained prior to any intervention on the subjects, and informed consent was also obtained from all the participants in the study.

All the surgical interventions were done in the operation theater under aseptic conditions. Blood samples were obtained at intervals specified previously under aseptic conditions. Five milliliters of blood was withdrawn everytime the sample was taken. The withdrawn blood was immediately transferred into the brain heart infusion broth (M210 manufactured by HiMedia Laboratories) and sent at the earliest to the lab for culture. The broth bottles containing the blood samples were incubated at 37°C for 7 days. Cultures were examined every day for evidence of macroscopic growth (turbidity, hemolysis, gas production, surface colony formation, or change in blood color). Subculturing to chocolate agar was done after 48 h of incubation, and the culture plates were further incubated under aerobic conditions under the presence of 5% CO₂. If the growth of microorganisms was observed, the bacteria were identified using conventional methods including colonial morphology, gram stain appearance, and biochemical reactions.

At the end of the study, statistical analyses were performed on SPSS software (SPSS Inc. Released 2008. SPSS Statistics for Windows, Version 17.0. Chicago: SPSS Inc). Continuous data were summarized as mean ± standard deviation (SD) while discrete (categorical) in number and percentage. Continuous groups were compared by one-way analysis of variance and the significance of mean difference between the groups was done by Tukey's *post-hoc* test. Categorical groups were compared by Chi-square (χ^2) test. A two-tailed ($\alpha = 2$) $P < 0.05$ was considered as statistically significant.

Observations and Results

The age of control, trauma, preoperative antibiotic, without prophylaxis, and 1% Povidone iodine rinse groups ranged from 19 to 42 years, 19–52 years, 14–62 years, 8–55 years, and 11–44 years, respectively with mean ± SD 28.00 ± 6.27 years, 31.60 ± 10.08 years, 24.90 ± 13.81 years,

22.20 ± 13.51 years, and 24.90 ± 10.94 years, respectively. The mean age of trauma group was slightly higher than other groups. Although the study comprised five groups, surgery was done in only three groups (preoperative antibiotic, without prophylaxis, and 1% Povidone iodine rinse).

The duration of surgery of preoperative antibiotic, without prophylaxis, and 1% Povidone iodine rinse ranged from 32 to 284 min, 19–148 min, and 21–135 min, respectively with mean ± SD 80.00 ± 79.97 min, 72.20 ± 40.85 min, and 75.60 ± 38.72 min, respectively. The presence of bacteremia was not observed in all five groups at baseline while postsurgery (30 min, 60 min, and 90 min) in only three groups (preoperative antibiotic, without prophylaxis, and 1% Povidone iodine rinse). At all postsurgery periods (30 min, 60 min and 90 min), the presence of bacteremia was evident highest in without prophylaxis group followed by 1% Povidone iodine rinse and preoperative antibiotic the least. Further, the presence of bacteremia decreased over the periods similarly in all three groups. Comparing the presence of bacteremia of three groups at three postperiods, χ^2 test revealed similar presence of bacteremia among the three groups at all three postperiods ($\chi^2 = 1.31$, $P = 0.860$) that is not differed statistically [Table 1].

Of the three groups presenting with bacteremia, 16 cases showed bacteremia either single or multiple at 30 min accounting total 23 bacteremia. Similarly, at 60 min, 8 cases showed bacteremia either single or multiple accounting total 17 bacteremia. Further, at 90 min, 2 cases exhibited the presence of bacteremia either single or multiple accounting total 5 bacteremia.

Comparing the prevalence of bacteremia over the periods, χ^2 test revealed similar prevalence of bacteremia at all periods ($\chi^2 = 3.49$, $P = 0.900$) that is, not differed statistically [Table 2].

At all periods, the prevalence of the bacteremia was higher in lower age group (age ≤22 years) than higher age group (age >22 years). Also, at all periods, the prevalence of the bacteremia was higher in females than males except *Streptococcus viridans*. Prevalence of the bacteremia was higher in higher duration of surgery (>65 min) than lower duration of surgery (≤65 min) except *Streptococcus salivarius*.

Discussion

There are several procedures for the microbiological analysis of blood cultures taken after dental procedures.^[2,3] Our study was based on a variety of maxillofacial surgical procedures including transalveolar extraction, cyst enucleation, gap arthroplasty, tumor resection, genioplasty, vestibuloplasty, etc. Our results showed that the incidence of bacteremia decreased over the periods similarly in all three groups, the highest at 30 min postoperatively followed by 60 min and 90 min postoperatively.

Table 1: Frequency distribution of presence of bacteremia and effect of treatments on bacteremia over the periods

Periods	Control (n=10) (%)	Trauma (n=10) (%)	Preoperative antibiotic (n=10) (%)	Without prophylaxis (n=10) (%)	1% povidone iodine rinse (n=10) (%)	χ^2	P
Baseline	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1.31	0.860
30 min	ND	ND	4 (40.0)	7 (70.0)	5 (50.0)		
60 min	ND	ND	2 (20.0)	4 (0.0)	2 (20.0)		
90 min	ND	ND	1 (10.0)	2 (0.0)	0 (0.0)		

ND: Not detected

Table 2: Prevalence of bacteremia over the periods

Bacteremia	30 min (n=23) (%)	60 min (n=17) (%)	90 min (n=5) (%)	χ^2	P
<i>Staphylococcus albus</i>	1 (4.3)	1 (5.9)	1 (20.0)	3.49	0.900
<i>Streptococcus milleri</i>	2 (8.7)	2 (11.8)	1 (20.0)		
<i>Streptococcus salivarius</i>	1 (4.3)	1 (5.9)	0 (0.0)		
<i>Streptococcus sanguis</i>	7 (30.4)	6 (35.3)	2 (40.0)		
<i>Streptococcus viridans</i>	12 (52.2)	7 (41.2)	1 (20.0)		

This could be attributed to the fact that under physiological conditions, the bacteria are transferred from the bloodstream into tissues and are rapidly cleared by the reticuloendothelial system. The absence of bacteremia in trauma patients could be explained by the fact that majority of the patients in this group reported after a certain period had elapsed giving up sufficient time to the reticuloendothelial system to clear the bacteria from the bloodstream.

Diz *et al.*^[4] showed that the bacteria most frequently isolated from blood cultures obtained after surgical dental interventions in adults (mainly dental extractions) were obligate anaerobic bacteria (50%), *Streptococcus* spp. (30%) and *Staphylococcus* spp. (5%); however, Lockhart *et al.*^[5] applying polymerase chain reaction techniques, detected a high percentage of streptococcal isolates responsible for postextraction bacteremia. In the present study, the bacteria with highest prevalence was *S. viridans* followed by *Streptococcus sanguis*, *Streptococcus milleri*, *Staphylococcus albus* and *S. salivarius* in the decreasing order of prevalence. All these microorganisms are the part of the normal residential flora of the oral cavity. Hence, it can be inferred that it is the resident flora rather than possible environmental or procedural contamination that results in bacteremia. Many studies have reported a frequency of postextraction bacteremia in children as significantly lower than the figures reported for adults.^[5,6] In 2009, Lockhart *et al.*^[5] using a logistic regression model, found that the prevalence of bacteremia following dental extractions increased significantly with age. In contrast to these studies, we found that at all periods, the prevalence of the bacteremia was higher in lower age group than higher age group.

The studies showing the influence of gender on the prevalence of oral bacteremia are scarce. Okabe *et al.*^[7] reported no statistically significant gender-related differences in the

prevalence of bacteremia following dental extractions. However, Tomás *et al.*^[8] detected a significantly higher prevalence of postextraction bacteremia at 15 min in females (with a higher value also observed at 1 h) though no significant differences were observed in the oral health status between females and males. In this study, at all postsurgical periods, the prevalence of the bacteremia was higher in females than males except with that related to *S. viridans*.

Okabe *et al.*^[7] studied the effect of the duration of surgery on bacteremia and found that when the operation exceeded 100 min the frequency of postextraction bacteremia was 96% compared to 67% when the surgery was of shorter duration. Our study revealed that at all periods, the prevalence of the bacteremia was higher in higher duration of surgery (>65 min) than lower duration of surgery (≤65 min).

Conclusion

Following the present study, it can be concluded that the prevalence of bacteremia is reduced whenever preoperative antibiotic or antiseptic rinse prophylaxis is given as compared to no preoperative prophylaxis. Also, the prevalence of bacteremia had a direct relation with duration of surgery but the type of the surgery had no influence on it. Again, the prevalence of bacteremia was higher in lower age group population and also, females were more prone to bacteremia after surgical intervention.

References

- Nanci A, Bosshardt DD. Structure of periodontal tissues in health and disease. *Periodontol* 2000 2006;40:11-28.
- Loza Fernández de Bobadilla E, Planes A, Rodríguez M.

- Procedures in Clinical Microbiology. Recommendations Spanish Society of Infectious Diseases and Microbiology Clinic. 3 blood cultures, In: Spanish Society of Diseases Infectious Clinical Microbiology.
3. Romero J, Bouza E, Loza E, Planes A, Rodríguez A. Procedures in Clinical Microbiology. Society recommendations Spanish Infectious Diseases and Clinical Microbiology. 3 blood cultures. In: Spanish Society of Diseases Infectious Clinical Microbiology Available from: <http://www.seimc.org/documentos/protocolos/microbiologia/>. [Last accessed on Aug 2012.]
 4. Diz P, Tomás I, Limeres J. Bacteremias caused by dental procedures. Periodontal disease and Cardiovascular. Their interrelations and implications for health, Spanish Society of Periodontology and Osseointegration and Spanish Society of Cardiology 2010;159-67.
 5. Lockhart PB, Brennan MT, Thornhill M, Michalowicz BS, Noll J, Bahrani-Mougeot FK, *et al.* Poor oral hygiene as a risk factor for infective endocarditis-related bacteremia. J Am Dent Assoc 2009;140:1238-44.
 6. Shanson DC, Akash S, Harris M. Clinical comparison of glucose broth with nutrient broth blood cultures for the detection of "*Streptococcus viridans*" bacteraemia. J Med Microbiol 1983;16:497-9.
 7. Okabe K, Nakagawa K, Yamamoto E. Factors affecting the occurrence of bacteremia associated with tooth extraction. Int J Oral Maxillofac Surg 1995;24:239-42.
 8. Tomás I, Alvarez M, Limeres J, Potel C, Medina J, Diz P. Prevalence, duration and aetiology of bacteraemia following dental extractions. Oral Dis 2007;13:56-62.

How to cite this article: Rahman T, Ahmed SS, Khan HM, Hashmi GS, Rahman SA, Ansari KM. Comparative study of detection of bacteremia after different oral surgical procedures. Contemp Clin Dent 2015;6:405-8.

Source of Support: Nil. **Conflict of Interest:** None declared.