

Bacteremia during Periodontal Flap Surgery, with and without Prophylactic Antibiotic Administration: A Comparative Study

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ABSTRACT

Background: Many times in clinical periodontology, the decision whether to prescribe prophylactic antibiotics or not, is perplexing. The present study was conducted to compare the bacteremias induced during periodontal flap surgeries with and without prophylactic antibiotics.

Materials and Methods: The occurrence of bacteremia during periodontal flap surgery was studied in 60 patients. On these patients, 60 quadrant wise flap surgeries were carried out without any preoperative prophylactic antibiotics and 60 surgeries carried out after prophylactic administration of amoxycillin preoperatively. A blood sample was taken from each patient at the time of maximum surgical trauma and was cultured for microorganisms and antibiotic sensitivity.

Results: 35 out of 120 blood samples were positive for micro-organisms. There was a significant reduction in post operative bacteremia after amoxycillin prophylaxis (Chi-square value of 21.32 with $P < 0.05$) as bacteremia was found in 29 of the non medicated patients as compared to

only 6 of the pre medicated patients. The micro-organisms encountered in the study were *Staphylococcus albus* coagulase negative, alpha hemolytic *streptococcus*, *Pseudomonas aeruginosa*, *Streptococcus viridans* and *Klebsiella*

Conclusion: On the basis of the study, it was concluded that the incidence of bacteremia during periodontal flap surgery is not as high as previously reported. Amoxicillin is highly effective in reducing postoperative bacteremia in periodontal flap surgery.

Keywords: Bacteremia, periodontal flap surgery, prophylactic antibiotic administration

INTRODUCTION

Bacteria have been isolated from the blood stream for varying periods of time following such surgical procedures as tonsillectomy, orthopedic surgery, manipulations of the genitourinary tract, and ear operations. There are also reports of transient bacteremia associated with gingival massage, periodontal infection, periodontal scaling, gingivectomies, root canal therapy, use of oral irrigation devices, dental flossing, mastication, rocking and extraction of teeth. These bacteremias are said to be of varying duration, ranging from five minutes to several hours after operation.¹

Bacteremia of oral origin is considered to be important in the pathogenesis of infective endocarditis (IE) because oral *Streptococci* account for 20% of cases of native valve IE and 26% of cases of late prosthetic valve endocarditis. IE caused by viridians streptococci has been reported to have a mortality rate of 6-16%. Thus, European, American and Australian guidelines for prevention of IE recommend that antibiotic prophylaxis should be given to individuals in specified cardiac risk groups before having dental treatment likely to cause bacteremia [Infective Endocarditis Prophylaxis (IEP) Expert Group 2008]. The recent British guidelines are the exception and do not recommend antibiotic prophylaxis for dental procedures [National Institute For Health And Clinical Excellence (NICE) Guideline Development group 2008].² In order to solve this dilemma, the present study was done to



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compare the bacteremia induced during periodontal surgery with and without administration of prophylactic antibiotics.

MATERIALS AND METHODS

This investigation was carried out on 60 patients in the 35-45 years age group at the Department of Periodontology, Mamata Dental College and Mamata General Hospital, Khammam, Andhra Pradesh. After clinical and roentgenographic examination they were diagnosed with generalized chronic periodontitis and periodontal flap surgery was planned. Exclusion criteria were patients with history of periodontal treatment in the preceding 12 months, history of congenital or acquired cardiac defects, history of hematologic or immune defect, patients who had taken antibiotics in the previous month, patients with history of smoking habit. Routine laboratory based investigations for hemoglobin, bleeding time, clotting time, total leukocyte count, differential leukocyte count were carried out. The patients were put on plaque control, which included brushing and rinsing the mouth with 0.02 % chlorhexidine mouth wash twice daily. Full mouth scaling was accomplished by hand instruments followed by polishing with rubber cup and polishing paste. Four quadrant-wise, flap surgeries were performed in 60 patients each. Of these, one quadrant wise periodontal flap surgery from each patient was performed without any prophylactic antibiotic and was labeled Group I while the other three quadrant-wise periodontal flap surgeries in each patient were carried out after prophylactic administration of 500 mg Amoxicillin orally, two hours prior to the surgery. Of the three, one quadrant-wise periodontal flap surgery was labeled group II and included in the study. The study was set up so that the patients participated twice, in this way they could serve as their own controls.

Modified Widman flap (Ramfjord and Nissle, 1974) was performed quadrant-wise in each of the participants. The blood was collected in the following manner during the flap surgery at the stage of degranulation, scaling and root planing, which was designed to be the point of maximum trauma i.e., 25 min from the initial incision. Ten cc of blood was withdrawn from a vein in the cubital fossa. The blood was then transferred into already labeled bottle containing 50 cc of Brain Heart Infusion broth with cooked meat particles [Fig. 1], making a liberal use of the flame during the procedure. The bottles were incubated at 37°C for 18 to 24 hours.

RESULTS

The significance of the data of the study was also tested by means of the chi square test, appropriate for a 2x2 table. The demonstration of chi square value of 21.32 with $P < 0.05$ indicates a highly significant reduction in the incidence of post operative bacteremia in the patients given amoxicillin prophylactically. Of the 120 samples taken, 35 i.e. 30% were



Figure 1: Brain Heart infusion broth with cooked meat particles

positive for micro-organisms. Of these 29, positive cultures were obtained in group I, a percentage of 48.3% and six positive blood cultures in group II, a percentage of 10%. A comparison of 29 positive cultures (48.3%) in group I to six positive cultures (10%) in group II shows a significant inhibition of bacteremia following premedication with amoxicillin.

The following micro-organisms were encountered [Table 1]: *Staphylococcus albus* coagulase negative [Fig. 2], Alpha hemolytic *Streptococcus* [Fig. 3], *Pseudomonas aeruginosa* [Fig. 4], *Streptococcus viridians*, and *Klebsiella* [Fig. 5]

Table 1: Frequency of occurrence of micro-organisms in Group 1 and 2

Organisms	Frequency of occurrence		Total
	Group 1 (without preoperative prophylactic antibiotics)	Group 2 (with preoperative prophylactic antibiotics)	
<i>Staphylococcus albus</i> coagulase negative	15 (25%)	2 (3.3%)	17 (14.1%)
Alpha Hemolytic <i>Streptococcus</i>	5 (8.3%)	0	5 (4.1%)
<i>Pseudomonas aeruginosa</i>	4 (6.6%)	1 (1.6%)	5 (4.1%)
<i>Streptococcus Viridans</i>	3 (5.0%)	1 (1.6%)	4 (3.3%)
<i>Klebsiella</i>	2 (3.3%)	2 (3.3%)	4 (3.3%)



Figure 2: *Staphylococcus albus* coagulase negative



Figure 5: *Klebsiella*



Figure 3: Alpha hemolytic streptococcus

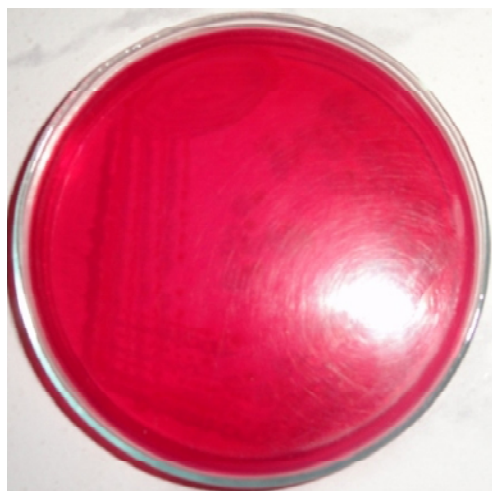


Figure 4: *Pseudomonas aeruginosa*

Staphylococcus albus was the most frequently isolated microorganism occurring fifteen times. Unlike previous reports, *Streptococcus viridans* was not the most frequently isolated microorganism. Prophylactic amoxicillin was effective against all the micro-organisms except *Klebsiella*, whose frequency remained same after premedication with amoxicillin.

DISCUSSION

During periodontal surgery, the microbial challenge to the patient is enormous. The occurrence of bacteremia varies with amount of trauma inflicted. Hence, the lengthy periodontal procedures, particularly involving surgical trauma, may be associated with a high percentage of transient bacteremia. The opinion regarding the occurrence of bacteremia during various non surgical and surgical manipulations of the oral tissues is varied. Recognizing the possibility of bacteremic conditions existing in patients, prior to above mentioned procedures, the desirability of taking preoperative blood samples was considered. The literature review, however, suggested that this was unnecessary. Frequently investigators taking preoperative blood samples early in their work discontinued the procedure after a long series of negative result.³

In the present study, 29.16% of the 120 blood cultures were positive for microorganism after a periodontal flap surgery. Of these 120 blood cultures, 60 of the non-prophylactically medicated cases, bacteremia was encountered in 48.3% cases. When compared with previous studies these occurrences are fairly low. In 1960, Rogosa *et al.*,⁴ demonstrate that 88% of all blood cultures are positive after periodontal procedures. As regards to other surgical procedures in the oral cavity, Okell and Elliot⁵ found that 60.9% of their cases showed bacteremia after extractions, carried out under general anesthesia.

Table 2: Incidence of bacteremia in Groups 1 and 2

	Frequency of occurrence		Total
	Group 1 (without preoperative prophylactic antibiotics)	Group 2 (with preoperative prophylactic antibiotics)	
Number of Surgeries	60	60	120
Frequency of Bacteremia	29	6	35
Percentage	48.33	10	29.16

Lazansky *et al.*¹ have reported the lowest incidence of bacteremia is in the age group of 30-59 years. This could, in part, explain the low incidence of bacteremia in the present study as the age of the participants falls within the above mentioned age group and the preparation of the patients by scaling and institution of oral hygiene measures could have drastically reduced the number of microorganisms in the oral cavity thus reducing the chances of post operative bacteremia.

In the present study, half of the surgeries were performed with antibiotic prophylaxis, further reducing the incidence of bacteremia. We used local anesthesia (2% lignocaine) with 1:200000 adrenaline. As adrenalin is a potent vasoconstrictor, this could partially explain the low incidence of bacteremia in the present study.

The blood sample was taken at the time of maximum trauma, which usually occurred after 20 minutes of the initial incision. According to Vargas *et al.*,⁶ the incidence of bacteremia is highest in the 20-60 minute interval. However, others like Lazansky *et al.*¹ have shown that no bacteremia was detected after 10 minutes from the time of starting of instrumentation. If the latter study is to be believed, this time factor may also be responsible for lower incidence of bacteremia in the present study.

'Rocking of teeth' as mentioned by Coffin and Thompson⁷ a major factor in the causation of bacteremia after exodontia, which was not the case in the present study, thus accounting for reduced incidence of bacteremia. About 48.3% bacteremia noticed in the study in non-prophylactically medicated - group I is, however, comparable to post extraction bacteremia reviewed by Khairat⁸.

In the prophylactically medicated patients i.e. group II, the occurrence of bacteremia was 10%. The present study shows a highly significant reduction in the occurrence of positive blood cultures in patients given amoxicillin prophylactically. The value of 7.96 with $P < 0.01$ by chi square test, for present study is contradictory to the results obtained by Appleman *et al.*⁹ who reported non-significant reduction ($P < 0.8$) in the incidence of positive blood culture after cephalixin

premedication following periodontal surgery.

Streptococcus viridans has been documented to be the most frequently encountered microorganism responsible for post operative bacteremia by various authors.^{5,6} However, in the present study *Staphylococcus albus* coagulase negative was the most frequently isolated microorganism. Okel and Elliot⁵ considered *Staphylococcus albus* coagulase negative as contaminants. However, McEntegart and Porterfield¹⁰ considered *Staphylococcus albus* coagulase negative as pathogenic micro-organisms.

De leo *et al.*,¹¹ have reported an incidence of three positive cultures for *Staphylococcus albus* out of 28 blood cultures of pediatric patients undergoing prophylaxis, a percentage of 10% approximately which is in conformity with our study. There was a total inhibition of *Staphylococcus albus* by pre operative amoxicillin prophylactically as compared to seven times in the non premedicated group. It is of interest to know that *Klebsiella* was recovered same in patients given amoxicillin prophylactically and in the non premedicated group. This could be because of in vivo and in vitro sensitivity of various strains of *Klebsiella* may vary; the dose of amoxicillin may not have reached the required levels in the blood; the strain may be resistant to the antibiotics in vivo and majority of the *Klebsiella* isolates are resistant to ampicillin and carbenicillin. It may also be resistant to amoxicillin because of the same mode of action. Hospital strains of *Klebsiella* display multiple resistance.¹²

Khairat⁸ reported one positive blood culture out of 155 samples for *Klebsiella* species, whereas in our study it occurred 4 times in a total of 120 samples. In the present study, *Pseudomonas* was encountered as pathogenic microorganism in 4.1% of blood samples. It occurred thrice in non pre medicated patients and was encountered once in patients administered amoxicillin prophylactically.

Gutverg and Haberman¹² isolated *Pseudomonas* from the periodontal pockets of 5 out of 231 patients. In this study, *Streptococcus viridans* was encountered in four out of the 120 blood samples, occurring thrice in non premedicated patients and once in patients given amoxicillin prophylactically. This finding is contradictory to the results of several authors namely Vargas *et al.*,⁶ and Khairat⁸ who have reported a high incidence for *Streptococcus viridans* after surgical manipulation of the oral tissues.

Alpha hemolytic *Streptococcus* occurred five times in the present study. It was never encountered in the premedicated group. Alpha hemolytic *Streptococcus* was isolated 21 times in 22 positive blood samples out of 221 operations (extractions and periodontal scaling) by Lazansky *et al.*¹ So according to them alpha hemolytic *Streptococci* was the most frequently found organism which is not the case in the study.

CONCLUSION

On the basis of study, it was concluded that the incidence of bacteremia during periodontal flap surgery is not as high as previously reported. The causes for this finding could be the age group of the patients, antibiotic prophylaxis and the vasoconstriction at the operative site owing to the adrenalin content of the local anesthetic used. Amoxicillin is highly effective in reducing post operative bacteremia in periodontal flap surgery and thus in preventing the possible sequelae (infective endocarditis and other systemic maladies) in susceptible patients. Further studies are required with other antibiotics (cefotaxime and cephalexin) and with more sample size to prove the effectiveness in preventing the same. It is concluded that pre operative prophylactic antibiotic is a pre requisite to prevent the bacteremia and its possible sequelae following periodontal surgery.

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