

## Assessment of transient bacteremia following various oral and dental interventions

**Mohammad Kh Hasouni<sup>1</sup>**  
BDS, FDSRCPS (Lect)

**Wael T Al-Wattar<sup>1</sup>**  
BDS, MSc (Lect)

**Mahmoud YM Taha<sup>2</sup>**  
BVM&S, MSc, PhD (Assist Prof)

**<sup>1</sup>Department of Oral and Maxillofacial Surgery**  
College of Dentistry, University of Mosul

**<sup>2</sup>Department of Basic Sciences**  
College of Dentistry, University of Mosul

### ABSTRACT

The incidence of bacteremia following various dental interventions of 280 selected patients were studied using blood culture technique with aerobic and anaerobic cultivation. The incidence of bacteremia after multiple teeth extraction was higher (51.72%) than those single tooth extraction (44%). The incidence of bacteremia after local anaesthetic injection differs according to the type of injections significantly. In scaling and root planning the use of local prophylactic solution reduced the incidence of bacteremia from 37.7% to 13.9%.

Poor oral hygiene had an effect on incidence of bacteremia at different dental interventions. The role of sex and age in bacteremia was variable.

Aerobic bacteria were more than anaerobic and the most common bacteria isolated were *Streptococcus viridans* (30.5%) and *Staphylococcus aureus* (19.7%).

**Key Words:** Bacteremia, prophylaxis, blood culture.

### INTRODUCTION

Bacteremia is induced by many clinical procedures and manipulations including mucous membranes and infected sites. These procedures result in the translocation and release of microorganisms from the oral cavity into blood stream.<sup>(1, 2)</sup> Dental procedure is one of important cause of bacteremia.<sup>(3)</sup>

Bacteremia following dental extrac-

### الخلاصة

تم دراسة احتمالية حدوث التلوث الجرثومي للدم بعد مختلف التداخلات الجراحية للأسنان لـ ٢٨٠ مريض باستعمال طرق تنمية الجراثيم الهوائية واللاهوائية. كانت نسبة تلوث الدم بعد قلع سنين أو أكثر (٥١.٧٢%) أعلى من نسبة التلوث بعد قلع سن واحد (٤٤%)؛ كما كانت حالة التلوث الجرثومي للدم بعد الزرق بالمخدر الموضعي مختلفة اختلافاً معنوياً حسب نوعية الزرق. أظهرت النتائج أن لاستخدام الغرغرة تأثير في تقليل نسبة احتمالية حدوث التلوث بعد تنظيف الأسنان وجلي الجذور من ٣٧.٧% إلى ١٣.٩%.

كان لنظافة الفم تأثير على نسبة حدوث تلوث الدم بعد مختلف التداخلات الجراحية للأسنان بينما كان لدور الجنس والعمر تأثيراً متبايناً؛ كما أظهرت نتائج الدراسة نسبة عزل الجراثيم الهوائية أعلى من اللاهوائية وكانت البكتيريا الأكثر شيوعاً هي المكورات السبحية الخضراء (٣٠.٥%) والعنقوديات الذهبية (١٩.٧%).

tion, both single and multiple, have been evaluated.<sup>(4-7)</sup> Periodontal work has the same role of extraction in the development of bacteremia.<sup>(8)</sup> Endodontic work is another cause of bacteremia. It is related to the over instrumentation and involvement of infected periapical area.<sup>(9)</sup> The role of local anaesthetic injection in the development of bacteremia is not fully evaluated.

In dental bacteremia, the source of

bacteria is in the oral flora<sup>(10)</sup> and the most common bacteria are *Streptococcus* and *Staphylococcus* species. These bacteria are transient and so they can be eliminated from the blood of normal patients in about 10–15 minutes by the action of host defense mechanism.<sup>(6)</sup> In patients with congenital or acquired heart diseases and/or immunosuppressed patients, a dangerous sequelae may be developed.<sup>(11, 12)</sup> Therefore, different prophylactic measures have been used to avoid such danger. These include appropriate antibiotic cover prior to dental treatment together with maintenance of good oral hygiene<sup>(13)</sup> and use local antiseptic solution as mouthwash and irrigation.<sup>(4)</sup>

The present work was conducted to evaluate bacteremia following dental extraction, local anaesthetic injection, scaling and root planning.

## MATERIALS AND METHODS

### Patients

Two hundred eighty patients who attended College of Dentistry, Mosul University and specialized dental health center. Patients were divided into three groups. Group I (79 patients) involved those needing extraction either single tooth or more than one tooth. Group II (105 patients) were given local anaesthesia at three sites (inferior dental nerve block, intraligament and infiltration). Finally, group III (96 patients) had at least mild gingival disease subjected to scaling and root planning with and without local prophylaxis.

### Blood Samples

Blood samples were collected from patients 5 minutes before and 5 minutes after different dental interventions.

### Blood Cultures

Inject 4 ml of blood into brain heart infusion (BHI) and 2 ml into thioglycolate broth and incubate at 37° C for one week. On the seventh day, all broth cultures were

sub-cultured on two blood agar and two MaConkey agar plates and incubated under aerobic and anaerobic conditions at 37° C.

### Bacterial Identification

After 48 hrs of incubation, positive cultures were identified by colony morphology, Gram's stain and biochemical tests. The latter involved catalase, oxidase and coagulase. Additional biochemical tests and selective media were used such as Quellung test for *Diplococcus*, Rogosa media for *Lactobacillus*, mannitol salt agar for *Staphylococcus aureus* and chocolate agar for *Haemophilus influenzae*.

### Data Collection and Statistical Analysis

Data were collected and managed by Lotus and SAS (statistical analysis system) on IBM computers. Chi-square and Dun-can's Multiple Range Analysis were used.<sup>(14)</sup>

## RESULTS

The incidence of bacteremia in relation to all types of treatments is shown in Table (1). In group I, it is clear that the incidence of bacteremia in multiple teeth extraction (51.72%) was higher than single tooth extraction (44%). In group II, the incidence of bacteremia was much higher in intra-ligament injection (56%) than inferior dental nerve block (8%). While in infiltration injection no positive result was recorded. The incidence of bacteremia in group III was 27.08%. A statistical analysis showed a high significant difference between the type of treatment and incidence of bacteremia ( $\chi^2 = 49.787$ , d.f= 5,  $p \leq 0.01$ ).

In scaling and root planning patients, the use of local prophylaxis reduced the incidence of bacteremia from 37.37% (in without prophylaxis) to 13.95% (Figure 1). Statistical analysis showed high significant difference between with and without local prophylaxis ( $\chi^2 = 6.749$ , d.f= 1,  $p \leq 0.01$ ).

Table (1): Incidence of bacteremia in relation to sex for each treatment

Treatment	+ ve			- ve			Total
	Males	Females	Total	Males	Females	Total	
	(Number)			(Number)			
	Percentage			Percentage			
Single Tooth Extraction	(18) <sup>de</sup> 36%	(4) <sup>klma</sup> 8%	(22) 44%	(20) <sup>bc</sup> 44%	(8) <sup>hij</sup> 16%	(28) 56%	50
Multiple Teeth Extraction	(9) <sup>hj</sup> 31.03%	(6) <sup>ijkl</sup> 20.69%	(15) 51.72%	(8) <sup>hij</sup> 27.6%	(6) <sup>ijkl</sup> 20.69%	(14) 48.28%	29
Inferior Dental Nerve Block Injection	(3) <sup>lmno</sup> 6%	(1) <sup>no</sup> 2%	(4) 8%	(27) <sup>a</sup> 54%	(19) <sup>cd</sup> 38%	(46) 92%	50
Intraligamental Injection	(8) <sup>hij</sup> 32%	(6) <sup>ijkl</sup> 24%	(14) 56%	(7) <sup>ijk</sup> 28%	(4) <sup>klmn</sup> 16%	(11) 44%	25
Infiltration Injection	(0) <sup>o</sup> 0%	(0) <sup>o</sup> 0%	(0) 0%	(28) <sup>a</sup> 93.33%	(2) <sup>mno</sup> 6.67%	(30) 100%	30
Scaling and Root Planning Without Local Prophylaxis	(15) <sup>jkl</sup> 28.3%	(5) <sup>jklm</sup> 9.43%	(20) 37.74%	(22) <sup>bc</sup> 41.51%	(11) <sup>gh</sup> 29.75%	(33) 70.27%	53
Scaling and Root Planning With Local Prophylaxis	(5) <sup>jklm</sup> 11.63%	(1) <sup>no</sup> 2.35%	(6) 13.46%	(23) <sup>b</sup> 53.49%	(14) <sup>fg</sup> 32.56%	(37) 86.04%	43
<b>Total</b>		(81) 28.93%		(199) 71.07%			280

Numbers with the same letter have no significant difference.

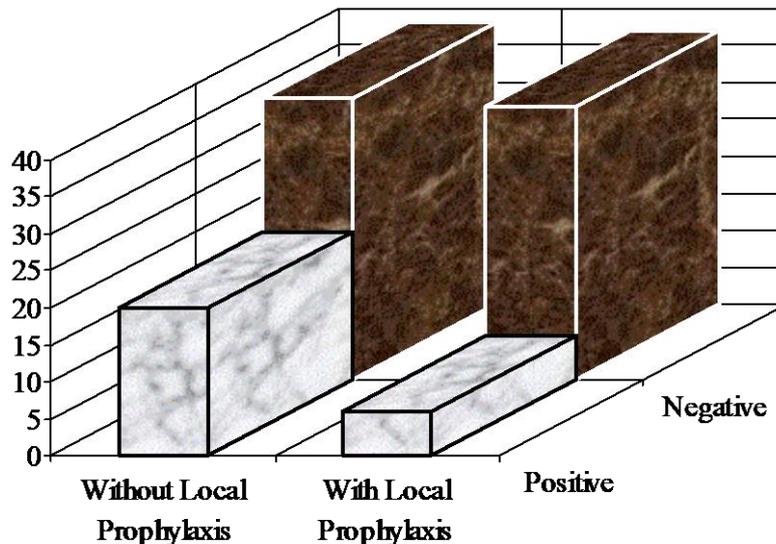


Figure (1): Comparison between without and with local prophylaxis

Bacteremia in relation to the age group for all treatments is shown in Figure (2). The age group 21–30 years old showed high incidence of bacteremia, which is statistically significant.

The incidence of bacteremia in relation to sex is also shown in Table (1). In group I with single tooth extraction, positive result in male (47.4%) was more

than female (33.33%), while in multiple teeth extraction the incidence of bacteremia was nearly the same in both sexes. In group II, with local anaesthetic injection, there was no significant difference between male and female. Group III with and without local prophylaxis showed significant difference between male and female in the positive results.

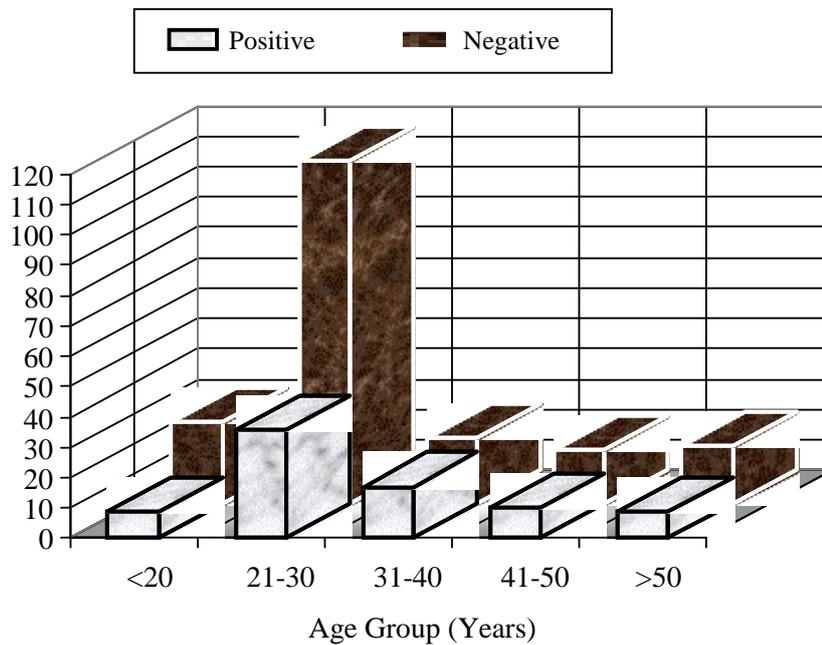


Figure (2): Incidence of bacteremia in relation to the age groups for all treatments

According to oral hygiene index, patients were divided into three groups of oral hygiene as follows: Good, moderate and poor oral hygiene. The results of effect of oral hygiene on the incidence of bacteremia in relation to different treatments are shown in Table (2). In group I the majority of cases of poor oral hygiene with high incidence of bacteremia both in single (54.16%) and multiple (61%) teeth extractions. Whereas moderate oral hygiene showed highest incidence of bacteremia in single tooth (66%) and lower in multiple teeth (42.85%) extractions. The results were statistically significant in poor and moderate oral hygiene comparing to good oral hygiene. In group II the effect of oral hygiene on the incidence of bacteremia following different local anaesthetic techniques was not statistically significant although the incidence of bacteremia was higher in poor and moderate oral hygiene especially in intra-ligament injection (58% and 63.63%, respectively). In group III the incidence of bacteremia

increased in poor oral hygiene in both without and with local prophylaxis (50% and 23.8%, respectively). The result of poor oral hygiene in without local prophylaxis was not significant but with local prophylaxis group, poor oral hygiene had significant difference in the incidence of bacteremia between positive and negative results.

The isolated bacteria are presented in Table (3). The most common bacteria isolated were *Streptococcus viridans* (34.57%), *Staphylococcus aureus* (19.75%), *Bacteroid* and *Diphtheroid* species (9.88%), *Haemophilus influenzae* (7.41%), *Actinomyces* species and *Niesseria catarrhalis* (4.94%), *Peptococcus* species (3.7%) and finally *Streptococcus epidermidis* and *Lactobacillus* species (2.47%). The results showed high significant difference in the percentage of these bacteria isolated in all positive results from all treatments ( $\chi^2 = 8.485$ , d.f= 1,  $p \leq 0.01$ ).

Table (2): Incidence of bacteremia in relation to oral hygiene for each treatment

Treatment	Good		Moderate		Poor		Total
	+ ve	- ve	+ ve	- ve	+ ve	- ve	
	(Number) Percentage	(Number) Percentage	(Number) Percentage	(Number) Percentage	(Number) Percentage	(Number) Percentage	
Single Tooth Extraction	(0) <sup>n</sup> 0%	(11) <sup>cde</sup> 22%	(9) <sup>efg</sup> 18%	(6) <sup>hij</sup> 12%	(13) <sup>c</sup> 26%	(11) <sup>cde</sup> 22%	50
Multiple Teeth Extraction	(1) <sup>mn</sup> 3.45%	(3) <sup>klm</sup> 10.34%	(3) <sup>klm</sup> 10.34%	(4) <sup>jkl</sup> 13.79%	(11) <sup>cde</sup> 37.93%	(7) <sup>gh</sup> 29.14%	29
Inferior Dental Nerve Block Injection	(0) <sup>n</sup> 0%	(4) <sup>jkl</sup> 8%	(1) <sup>mn</sup> 2%	(18) <sup>b</sup> 36%	(3) <sup>klm</sup> 6%	(24) <sup>a</sup> 48%	50
Intraligamental Injection	(0) <sup>n</sup> 0%	(2) <sup>lmn</sup> 8%	(7) <sup>ghi</sup> 28%	(4) <sup>jkl</sup> 16%	(7) <sup>gh</sup> 28%	(5) <sup>jki</sup> 20%	25
Infiltration Injection	(0) <sup>n</sup> 0%	(4) <sup>jkl</sup> 13.33%	(0) <sup>n</sup> 0%	(17) <sup>b</sup> 56.67%	(0) <sup>n</sup> 0%	(9) <sup>efg</sup> 30%	30
Scaling and Root Planning Without Local Prophylaxis	(2) <sup>lmn</sup> 3.77%	(6) <sup>hij</sup> 11.32%	(8) <sup>fgh</sup> 15.09%	(17) <sup>b</sup> 32.09%	(10) <sup>def</sup> 18.87%	(10) <sup>def</sup> 18.87%	53
Scaling and Root Planning With Local Prophylaxis	(0) <sup>n</sup> 0%	(9) <sup>efg</sup> 20.43%	(1) <sup>mn</sup> 2.33%	(12) <sup>cd</sup> 27.9%	(5) <sup>jkl</sup> 11.63%	(16) <sup>b</sup> 37.2%	43
<b>Total</b>		(42) 15%	(107) 38.2%	(131) 46.79%			280

Numbers with the same letter have no significant difference.

Table (3): Types of bacteria isolated from positive cultures

Bacteria	Single Extraction	Multiple Extraction	Block Injection	Intra-ligamental Injection	Scaling and Root Planning	Total
	(Number) Percentage					
<i>Haemophilus influenzae</i>	(3) <sup>d</sup> 3.7%	(2) <sup>de</sup> 2.47%	(0) <sup>e</sup> 0%	(0) <sup>e</sup> 0%	(1) <sup>de</sup> 1.23%	(6) <sup>cd</sup> 7.4%
<i>Bacteroid</i>	(3) <sup>d</sup> 3.7%	(2) <sup>de</sup> 2.47%	(0) <sup>e</sup> 0%	(1) <sup>de</sup> 1.23%	(2) <sup>de</sup> 2.47%	(8) <sup>c</sup> 9.88%
<i>Streptococcus viridans</i>	(8) <sup>ab</sup> 9.88%	(6) <sup>c</sup> 7.41%	(1) <sup>de</sup> 1.23%	(6) <sup>c</sup> 7.41%	(7) <sup>bc</sup> 8.46%	(28) <sup>a</sup> 34.57%
<i>Peptococcus</i>	(1) <sup>de</sup> 1.23%	(1) <sup>de</sup> 1.23%	(0) <sup>e</sup> 0%	(0) <sup>e</sup> 0%	(1) <sup>de</sup> 1.23%	(3) <sup>d</sup> 3.7%
<i>Diphtheroid</i>	(3) <sup>d</sup> 3.7%	(1) <sup>de</sup> 1.23%	(0) <sup>e</sup> 0%	(2) <sup>de</sup> 2.47%	(2) <sup>de</sup> 2.47%	(8) <sup>c</sup> 9.88%
<i>Actinomyces</i>	(1) <sup>de</sup> 1.23%	(1) <sup>de</sup> 1.23%	(0) <sup>e</sup> 0%	(1) <sup>de</sup> 1.23%	(1) <sup>de</sup> 1.23%	(4) <sup>d</sup> 4.44%
<i>Niesseria catarrhalis</i>	(1) <sup>de</sup> 1.23%	(1) <sup>de</sup> 1.23%	(0) <sup>e</sup> 0%	(0) <sup>e</sup> 0%	(2) <sup>de</sup> 2.47%	(4) <sup>d</sup> 4.44%
<i>Staphylococcus aureus</i>	(2) <sup>de</sup> 2.47%	(1) <sup>de</sup> 1.23%	(3) <sup>d</sup> 3.7%	(1) <sup>de</sup> 1.23%	(9) <sup>a</sup> 11.11%	(16) <sup>b</sup> 19.75%
<i>Streptococcus epidermidis</i>	(0) <sup>e</sup> 0%	(0) <sup>e</sup> 0%	(0) <sup>e</sup> 0%	(1) <sup>de</sup> 1.23%	(1) <sup>de</sup> 1.23%	(2) <sup>d</sup> 2.47%
<i>Lactobacillus</i>	(0) <sup>e</sup> 0%	(0) <sup>e</sup> 0%	(0) <sup>e</sup> 0%	(1) <sup>de</sup> 1.23%	(1) <sup>de</sup> 1.23%	(2) <sup>d</sup> 2.47%
<b>Total</b>	(22) <sup>a</sup> 27.16%	(15) <sup>b</sup> 18.52%	(4) <sup>c</sup> 4.44%	(13) <sup>b</sup> 16.05%	(27) <sup>a</sup> 33.33%	(81) 100%

$\chi^2= 8.485$ , d.f= 1,  $p\leq 0.01$ ; Numbers with the same letter have no significant difference.

## DISCUSSION

The results of studies of post-operative transient bacteremia vary from one study to another depending on the type of surgical treatments and methods used for isolation of bacteria from the blood.<sup>(1)</sup> In the present study, the incidence of bacteremia following single tooth extraction (44%) was comparable with others.<sup>(15,16)</sup> Some studies showed high incidence of bacteremia (94–100%).<sup>(1, 6)</sup> This is probably due to the modern techniques used for isolation of bacteria. Following multiple teeth extraction, the incidence of bacteremia was 51.72%. It is noticed that this incidence is higher than in single tooth extraction and this may be due to more injury to the soft and hard tissues during extraction of more than one tooth.<sup>(17)</sup>

The source of bacteria during local anaesthetic injection is due to introduction of microorganisms from the top of the needle to the bloodstream. These microorganisms are found in the gingival sulcus and deep pockets.<sup>(18)</sup> The incidence of bacteremia in inferior dental nerve block was 8%. This low incidence might be due to small number of entered bacteria that was difficult to be isolated in a single blood culture.<sup>(19)</sup> High incidence of bacteremia (56%) was noticed with intra-ligamental injection of anaesthesia which might be due to excessive pressure applied to inject local anaesthetic agent into periodontal spaces which were heavily colonized by microorganisms. In infiltration injection of local anaesthesia, which is not previously evaluated, the incidence of bacteremia was 0%. This probably is due to the fact that patients in this group were pioneer dental students and there was no

dental work done before and after injection.

In scaling and root planning, the incidence of bacteremia was much lower using local prophylaxis (13.95%) than those without local prophylaxis (37.74%). This might reflect the action of chlorhexidine as antiseptic solution that reduced the number of bacteria present in the oral cavity.<sup>(8, 20)</sup>

This study showed that poor oral hygiene increased the incidence of bacteremia in single and multiple tooth extraction. Similar results were obtained by other workers<sup>(21)</sup> and concluded that the presence of inflammation and increase gingival diseases made the oral tissue more vascular and heavily colonized therefore incidence of bacteria increased accordingly. The present study did not show any effect of oral hygiene on the incidence of post-injection bacteremia although the incidence of bacteremia was higher in poor oral hygiene. In scaling and root planning group, the incidence of bacteremia increased with poor oral hygiene in without local prophylaxis, while the incidence was lower with local prophylaxis due to the action of chlorhexidine.

The most common bacterium isolated in this study was *Streptococcus viridans* (34.37%) followed by *Staphylococcus aureus* (19.75%). This may be due to the fact that the most prominent type of bacteria which inhabit oral cavity are *Streptococcus* species which are found in about half of total viable counts in saliva and dorsum of the tongue and about quarter of viable counts in plaque and gingival sulcus and so have a chance to invade bloodstream during dental intervention.<sup>(1, 22)</sup>

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