

## Bacteraemia during tonsillectomy

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### Abstract

The aim of this study was to determine the incidence of bacteraemia during tonsillectomy and investigate the effect of the timing of culture sampling on the incidence of bacteraemia associated with it. Sixty-four consecutive patients who had been admitted for elective tonsillectomy were included in the study. Patients were randomly classified into two groups. Blood cultures as well as tonsillar surface and deep tissue cultures were obtained from all patients before tonsillectomy and 60 minutes after tonsillectomy. In addition, blood cultures were taken within two minutes following tonsillectomy for group 1 and 15 minutes after tonsillectomy for group 2. In group 1, the cultures obtained within two minutes were positive in nine patients, while only two of the blood cultures taken post-operatively were positive in group 2. The difference between the two groups was statistically significant ( $p < 0.05$ ). The results of this study suggest that a transient bacteraemia occurs frequently in association with tonsillectomy, but the timing of culture sampling for its detection is important.

**Key words:** Tonsillectomy; Bacteria; Bacteraemia

### Introduction

Tonsillectomy is one of the most frequently performed surgical procedures in otorhinolaryngology clinics worldwide. Although it is usually performed on the paediatric population, a significant proportion of adults also undergoes the procedure. Unlike many other operative procedures which are closed primarily, tonsillectomy produces an open wound that heals by secondary intention. As the wound surfaces remain open in this operation, it might be expected that bacterial migration into the systemic circulation could readily occur.

The risk of bacteraemia changes from one operation to the other. For example, it has been reported that bacteraemia is virtually nil during tympanostomy tube placement and occurs only in frequently during adenoidectomy, septoplasty, rhinoplasty and endoscopic sinus surgery.<sup>1–6</sup> Bacteraemia may lead to dramatic results in patients who have cardiovascular risk factors. Hence, antibiotic prophylaxis before tonsillectomy is offered by some authors.<sup>7,8</sup> In the literature, there are many reports related to blood cultures taken directly after tonsillectomy,<sup>7–11</sup> but, to our knowledge, there is little information about the course of bacteraemia.

The purpose of this study was to determine the incidence of bacteraemia during tonsillectomy, identify the organisms leading to bacteraemia, investigate the effect of the timing of the culture sampling on the

incidence of bacteraemia associated with tonsillectomy, and investigate the course of bacteraemia.

### Materials and methods

Sixty-four consecutive patients with a history of recurrent episodes of acute tonsillitis or obstructive symptoms due to tonsillar hypertrophy that was confirmed by examination, who had been admitted for elective tonsillectomy, were included in the study. The indication for tonsillectomy was recurrent acute tonsillitis for at least two years with five or more acute attacks per year. Patients were randomly classified into two groups: Group 1 included 33 and group 2 included 31 patients. In group 1, besides tonsillar surface and deep tissue cultures, pre-operative (after intubation), early post-operative (within two minutes after tonsillectomy) and post-operative (60 minutes after tonsillectomy) blood cultures were obtained. In group 2, pre-operative (after intubation) and post-operative (15 minutes and 60 minutes after tonsillectomy) blood cultures as well as tonsillar surface and deep tissue cultures were taken. The ages of patients ranged from three to 35 years with a mean age of  $10.6 \pm 7.8$  years. Twenty-eight were males and 36 were females. The patients did not have any cardiovascular risk factors nor had they received any antibiotic therapy for at least 20 days before the operation. The study was approved by the Medical Ethics Committee, Faculty of

Medicine, Sutcu Imam University, and informed consent was obtained from all of the children's parents or guardians. All patients underwent tonsillectomy, under general anaesthesia within the operating theatre at Sutcu Imam University Hospital between July 2001 and November 2002. They were all discharged from the hospital on the morning of the first post-operative day without any problem.

Six ml of blood for patients under 10 years of age and 16–18 ml of blood for those over 10 years of age were taken from a peripheral vein under aseptic conditions. Half of the sample was inoculated into an aerobic blood culture bottle (BACTEC™ 40 ml or 25 ml, Lytic/10) and the other half into an anaerobic blood culture bottle (BACTEC™ 40 ml, Lytic/10, Anaerobic /F blood bottle). The tonsillar surface cultures were taken transorally under direct vision using a sterile cotton-tipped applicator for aerobic and anaerobic microorganisms. Each swab was placed in transport medium. Then tonsillectomy was performed using dissection and snare technique. The removed tonsil was placed in a sterile container, rinsed out in sterile conditions with physiological saline and held by forceps. Its one side was cauterized with a heated scalpel and an incision was made through the cauterized area with a sterile scalpel, cutting the tonsil in half. The core was swabbed with a sterile cotton-tipped applicator and placed into aerobic and anaerobic transport media. All of the samples were taken to the microbiology laboratory within half an hour. For aerobic culture, the samples obtained by swabbing were inoculated onto five per cent sheep blood agar, chocolate agar and MacConkey's agar and incubated for 24–48 hours at 35°C. For anaerobic culture, the samples were inoculated onto chocolate agar, MacConkey's agar and five per cent anaerobic sheep blood agar containing kanamycin and vancomycin, and incubated for 48–72 hours at 35°C in a GasPak® anaerobic system. In addition, samples obtained by swabbing for anaerobes were inoculated into enriched thioglycolate broth, and incubated for four to seven days at 35°C in a GasPak® anaerobic jar (AnaeroGen™, Oxoid Ltd., Basingstoke, Hampshire, UK).

The venous blood samples collected in blood culture bottles were incubated within the BACTEC 9050 automatic blood culture system (Becton, Dickinson and Company, Sparks MD 21152, USA). Routine bacteriological inoculations were performed from the bottles in which bacterial growth took place.

Aerobic microorganisms were identified by standard laboratory methods.<sup>12</sup> Anaerobic microorganisms were identified by using OXOID An-ident discs (Oxoid Ltd., Basingstoke, UK).

## Results

Sixty-four patients were included in the study. The organisms isolated from the tonsillar surface did not always correspond with the organisms isolated from the deep tissue specimens. The organisms isolated from the tonsillar surface swabs and tissue specimens are presented in Table I. *Staphylococcus aureus* was the most commonly grown organism in the core of the tonsillar tissue and/or surface culture (18 patients), followed by Group A  $\beta$ -haemolytic streptococci (GABHS) (14 patients), *Haemophilus influenzae* (11 patients) and *Streptococcus pneumoniae* (10 patients). Six anaerobic bacteria were isolated from the cultures of the core of the tonsillar tissue but only one from those of the tonsillar surface.

All the pre-operative blood culture specimens were negative. In group 1, bacterial growth was observed in nine out of 33 blood cultures (27.3 per cent) prepared immediately after tonsillectomy (within two minutes after tonsillectomy). In group 2, bacterial growth was observed in only two out of 31 blood cultures (6.5 per cent) taken 15 minutes after tonsillectomy. This difference between the two groups was statistically significant ( $\chi^2 = 4.868$ ,  $SD = 1$ ,  $p = 0.027$ ). The organisms isolated from blood cultures in both groups are presented in Table II. In both groups, all of the post-operative blood cultures that were taken 60 minutes after tonsillectomy were negative. The patients with bacteraemia ages ranged from three to 24 years, their temperatures from 36.0°C to 37.5°C and the mean pulse rate from 88 to 120/min. These patients

TABLE I  
ORGANISMS ISOLATED FROM TONSIL SWABS AND DEEP TISSUE SPECIMENS OBTAINED DURING TONSILLECTOMY (64 TONSILS)

Organisms	Surface only (n)	Surface and core (n)	Core only (n)
GABHS	1	8	5
<i>Strep pneumoniae</i>	4	1	5
<i>H influenzae</i>		1	10
<i>Staph aureus</i>	3	4	11
<i>Escherichia coli</i>		2	1
<i>Enterobacter</i> spp.		1	1
Unclassified streptococci	1		1
Group C $\beta$ haemolytic streptococci			1
Group F $\beta$ haemolytic streptococci			1
Normal flora	25	29	12
Anaerobes	1		5
<i>Fusobacterium</i> spp.			1
<i>Bacteroides melanigenicus</i>			1
Gram negative coccobacilli			1
Gram positive cocci	1		2
No growth	1		2

TABLE II  
DATA ABOUT THE CASES WITH POSITIVE BLOOD CULTURES

Patient	Blood cultures	Tonsillar surface	Tonsillar core	Age	Sex
1*	<i>E coli</i>	NF <sup>†</sup> + <i>E. coli</i>	<i>E. coli</i>	5	F
2*	<i>Staph aureus</i>	NF	<i>Staph aureus</i> + CNS**	24	F
3	<i>H influenzae</i>	NF + <i>Strep pneumoniae</i>	<i>H influenzae</i>	3	F
4	<i>H influenzae</i>	NF	<i>H influenzae</i>	9	M
5	Unclassified streptococci	Unclassified streptococci	CNS	10	M
6	GABHS	NF	GABHS	7	F
7	<i>Strep viridans</i>	NF	<i>Strep viridans</i>	8	F
8	<i>Staph aureus</i>	NF + GABHS	<i>Staph aureus</i> + CNS	4	F
9	<i>Strep pneumoniae</i>	NF	<i>Strep pneumoniae</i>	16	F
10	<i>Staph aureus</i>	GABHS	NF	5	M
11	GABHS	GABHS	GABHS	13	M

\*Group 2

NF<sup>†</sup> = Normal flora; CNS\*\* = Coagulase-negative staphylococci

did not have any clinical signs and/or symptoms of a serious infection such as sepsis and were discharged from the hospital on the first post-operative day without problems.

## Discussion

The organisms isolated from the tonsillar surface did not always correspond with the organisms isolated from the deep tissue specimens. While the surface cultures commonly showed entirely normal flora, the tonsil core cultures contained pathogenic microorganisms. Despite being common in core cultures, *H influenzae* was rarely present on surface cultures. In our study, the tonsillar bacteriology results for *H influenzae* with surface swabs reflected one out of 11 (9.1 per cent) of the colonization of the bacteria of concern in the tonsil as a whole, including the core tissue and/or tonsillar surface. This was named as the estimated probability of tonsillar bacteriology via surface swabs and the estimated probabilities for *H Influenzae*, *Staph aureus*, *Strep pneumoniae* and GABHS were one out of 11 (9.1 per cent), seven out of 18 (38.9 per cent), five out of 10 (50 per cent) and nine out of 14 (64.3 per cent), respectively. Our study, like many others, has demonstrated the presence of pathogenic bacteria in tonsillar tissue. Hence it should be kept in mind that if medical therapy is planned according to the pathogens isolated from culture of the tonsil surface and the antibiogram results, it may be insufficient because of the difference between the tonsil surface and tissue interior culture. The mucous membranes covering the oropharyngeal tract are constantly exposed to a variety of pathogenic microorganisms. The mucous layer covering the epithelium and the epithelium itself act as an important barrier protecting the underlying tissues. During tonsillectomy, the oropharyngeal mucosa is torn with the resultant fresh wound in a field full of bacteria and rich in vascular supply. Any surgical procedure in such a heavily colonized site and tissue such as tonsils may lead to bacteraemia by the venous route within the tissues and oropharyngeal mucous membranes.

In our study, the incidence of bacteraemia associated with tonsillectomy gradually decreased from 27.3 per cent to null in time following tonsillectomy. The overall incidence of bacteraemia

in our study was 11 out of 64 cases (17.2 per cent), which was slightly lower than those reported in other studies on post-tonsillectomy bacteraemia.<sup>7-9</sup> On the other hand, the rate of bacteraemia was 27.3 per cent in group 1 in which the blood cultures were taken within two minutes following tonsillectomy (early post-operative), and this result was consistent with the ones reported in other studies related to post-tonsillectomy bacteraemia.<sup>7-9</sup> It has been reported that the incidence of bacteraemia is close to zero during septoplasty and rhinoplasty, and it also occurs rarely during endoscopic sinus surgery, although there is bacterial colonization in these operative sites as well.<sup>4-6</sup> Nevertheless, as shown in our study, bacteraemia occurs in a significant percentage of tonsillectomies. Although there are many reports associated with post-tonsillectomy bacteraemia, the pathophysiology of the bacteraemia during tonsillectomy still remains controversial. Some authors have proposed a model for retrograde flow of bacteria through the exposed vessels,<sup>13</sup> while others have suggested the traction of tonsil before dissection as the route of entry of microorganisms into the circulation.<sup>9</sup> From the results of our study on adenoidectomy<sup>3</sup> and other studies<sup>4-6</sup> associated with nasal surgery, it may be concluded that the occurrence of bacteraemia is not related to the presence of bacterial colonization in the operative site. Bacteraemia may be related to the traction and handling by forceps of the tonsil before dissection rather than direct spread of bacteria into the exposed and traumatized vessels. Isaacson and Parke reported two cases of meningitis after adenoidectomy.<sup>13</sup> They suggested that the occurrence of meningitis was due to retrograde flow of bacteria secondary to retropharyngeal lidocaine and epinephrine injection. We did not perform any injection to the tonsillar bed before or during tonsillectomy. By presuming that the bacteraemia may be related to some procedural factors that vary with the operation we suggest that bacteraemia during tonsillectomy is a result of the manipulation of the operational site (i.e., the traction and handling by forceps of tonsil before or during dissection, application of gauze tamponade or suture ligation for treatment of haemorrhage during the operation, or overpressure to the tonsillar fossa with suction).

*Staph aureus*, considered as an important pathogen in nosocomial infections, is a frequent cause of bacteraemia in post-operative patients and carries a high mortality. Also, GABHS has been reported to result in endocarditis, arteritis, and osteomyelitis, all of which may lead to mortality in a significant number of patients who have cardio-vascular defects, despite antibiotic treatment.<sup>14</sup> In the present study, we found *Staph aureus* in three cases and GABHS in two cases in the post-operative blood cultures. These patients did not have any clinical signs and symptoms of a serious infection.

- **This is prospective randomized trial to assess the presence of bacteraemia in the immediate period following tonsillectomy**
- **The blood culture findings did not always correlate with the bacteriology of the tonsillar surface**
- **Tonsillectomy was associated with a transient bacteraemia in some cases and detection rates depended upon the time of sampling**
- **The bacteraemia was not associated with any enhanced post-operative morbidity and antibiotics are not, therefore, indicated to prevent this phenomenon in the routine case**

Transient bacteraemia is the most common scenario following the introduction of microorganisms into the bloodstream. The quantity of the bacteria during a transient bacteraemia resulting from dental treatment has been estimated as 1–10 per ml of blood, with a falling rate bringing the initial level to 10–50 per cent after 10 min.<sup>15</sup> According to the reports in the literature, these values are rather low, since  $10^3$ – $10^9$  bacteria per ml of blood is required to produce experimental infective endocarditis in an animal model.<sup>16</sup> It has been reported that, in healthy subjects, transient bacteraemia usually lasts no more than 15–30 minutes, and that the microorganisms associated with this transient bacteraemia are completely eliminated by the host defence mechanisms within this period.<sup>17</sup> In the present study, the absence of bacterial growth in all post-operative blood cultures obtained 60 minutes after tonsillectomy including the cases with documented bacteraemia from early post-operative blood cultures supports the previously mentioned results found by other investigators. Transient bacteraemia is generally harmless in healthy subjects and resolves spontaneously without complication. However, it may lead to dramatic results in patients carrying a high risk of cardiovascular infection. Also, any weakness or failure of the host defence mechanisms due to leukaemia, acquired immune deficiency syndrome or immunosuppressive treatments may increase the risk of bacteraemia causing systemic illness. Bacteraemia has not led to any clinical

consequences in our patients. Although prophylactic antibiotic therapy is offered by some authors before tonsillectomy, it does not seem to be indicated in otherwise healthy subjects in this surgery. In our clinic, we do not use antibiotics for prophylactic purposes unless the patient has risk factor. On the other hand, there may be some benefits of antibiotic use post-operatively on wound healing, fever and pain in patients undergoing tonsillectomy, but this topic is beyond the scope of this investigation.

## Conclusion

In this study, it was demonstrated that there was a close relationship between culture sampling time and the incidence of bacteraemia in association with tonsillectomy and that the incidence gradually decreased in time following tonsillectomy. Absence of bacterial growth in all post-operative blood cultures obtained 60 minutes after tonsillectomy including the cases with documented bacteraemia from early post-operative blood cultures suggests that this bacteraemia is transient. In conclusion, transient bacteraemia occurs frequently during tonsillectomy, but the timing of the culture sampling for the detection of this bacteraemia is of great importance. It seems unnecessary to use prophylactic antibiotics routinely to prevent bacteraemia or its complications unless the patient carries a high risk for a metastatic infection.

## Acknowledgements

This study was supported by Kahramanmaraş Sutcu Imam University Research Fund (No. 2002/6/8).

## References

- 1 Lohr JA, Sloop FB, Sydnor A Jr, Donowitz LG. Bacteremia associated with tympanostomy tube insertion. *J Infect Dis* 1989;**159**:594–5
- 2 Brown OE, Manning SC, Phillips DL. Lack of bacteremia in children undergoing myringotomy and tympanostomy tube placement. *Pediatr Infect Dis J* 1995;**14**:1101–2
- 3 Okur E, Aral M, Yildirim I, Kiliç MA, Ciragil P. Bacteremia during adenoidectomy. *Int J Pediatr Otorhinolaryngol* 2002;**66**:149–53
- 4 Silk KL, Ali MB, Cohen BJ, Summersgill JT, Raff MJ. Absence of bacteremia during nasal septoplasty. *Arch Otolaryngol Head Neck Surg* 1991;**117**:54–5
- 5 Slavin SA, Rees TD, Guy CL, Goldwyn RM. An investigation of bacteremia during rhinoplasty. *Plast Reconstr Surg* 1983;**71**:196–8
- 6 Rontal M, Bernstein JM, Rontal E, Anon J. Bacteriologic findings from the nose, ethmoid, and bloodstream during endoscopic surgery for chronic rhinosinusitis: implications for antibiotic therapy. *Am J Rhinol* 1999;**13**:91–6
- 7 Kaygusuz I, Gok U, Yalcin S, Keles E, Kizirgil A, Demirbag E. Bacteremia during tonsillectomy. *Int J Pediatr Otorhinolaryngol* 2001;**58**:69–73
- 8 Francois M, Bingen EH, Lambert-Zechovsky NY, Mariana-Kurkdjian P, Nottet JB, Narcy P. Bacteremia during tonsillectomy. *Arch Otolaryngol Head Neck Surg* 1992;**118**:1229–31
- 9 Anand VT, Phillips JJ, Allen D, Joynson DH, Fielder HM. A study of postoperative fever following paediatric tonsillectomy. *Clin Otolaryngol* 1999;**24**:360–4
- 10 Soldado L, Esteban F, Delgado-Rodriguez M, Solanellas J, Florez C, Martin E. Bacteraemia during tonsillectomy: a study of the factors involved and clinical implications. *Clin Otolaryngol* 1998;**23**:63–6

- 11 Van Eyck M. Bacteremia after tonsillectomy and adenectomy. *Acta Otolaryngol* 1976;**81**:242–3
- 12 Koneman EW, Allen SD, Janda WM, Schreckenberger PC, Winn WC. *Diagnostic Microbiology*. 4th edn. Philadelphia: JB Lippincott Company, 1992
- 13 Isaacson G, Parke WW. Meningitis after adenoidectomy: an anatomic explanation. *Ann Otol Rhinol Laryngol* 1996;**105**:684–8
- 14 Wong VK, Wright HT. Group A beta hemolytic streptococci as a cause of bacteremia in children. *Am J Dis Child* 1988;**142**:831–3
- 15 Mouton C, Robert JC. Infections loco-régionales et métastase des infections bucco-dentaires. In: Mouton C, Robert J-C, eds. *Pathologies buccales d'origine bactérienne*, Masson, Paris, 1994; 161–73. Cited in: Gendron R, Grenier D, Maheu-Robert LF. The oral cavity as a reservoir of bacterial pathogens for focal infections. *Microbes Infect* 2000;**2**:897–906
- 16 Wright AJ, Wilsin WR. Experimental animal endocarditis. *Mayo Clin Proc* 1982;**57**:10–4
- 17 Coulter WA, Coffey A, Saunders IDF, Emmerson AM. Bacteremia in children following dental extraction. *J Dent Res* 1990;**69**:1691–5

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I. Yildirim, M.D. takes responsibility for the integrity of the content of the paper.  
Competing interests: None declared

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