

Bacteremia during Tonsillectomy

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Abstract:

Objectives: (1) To assess the incidence of bacteremia in patients with chronic tonsillitis who underwent tonsillectomy by dissection method. (2) To identify the aerobic organisms involved in bacteremia during tonsillectomy and their antibiotic sensitivity.

Materials And Methods: This descriptive study was conducted on patients who presented to the ENT OPD in YENEPOYA MEDICAL COLLEGE HOSPITAL over a period from October 2013 to October 2014. 42 patients who underwent elective tonsillectomy by dissection method, for chronic tonsillitis were selected. During tonsillectomy, within 2 minutes of removal of the first tonsil, blood samples were taken from the peripheral veins in accordance with the techniques of sterile blood collection. Samples were subcultured on suitable media under aerobic conditions for 24hrs, 72hrs and 5 days.

Results: Of the 42 samples collected, only 7 (16.67%) yielded positive blood cultures, while 35 samples (83.33%) showed no growth. The organisms isolated were Coagulase-negative Staphylococci (2), Pseudomonas (2), Acinetobacter (1), Diphtheroids (1) and a Gram +ve bacilli (1).

Conclusion: Bacteremia could originate from the tonsillar tissue bacteria following tonsillectomy. Antibiotic therapy is necessary, especially in patients with cardiovascular diseases. Amikacin may be a good empirical choice in the antibiotic regimen for prevention of bacteremia following tonsillectomy.

Keywords: amikacin, bacteremia, cardiovascular risk factors, chronic tonsillitis, tonsillectomy

I. Introduction

Tonsillectomy is one of the most frequently performed surgical procedures in otorhinolaryngology clinics worldwide. Adenoidectomy is most often simultaneously performed with tonsillectomy (adenotonsillectomy); but it may also be conducted as a separate individual procedure. Although tonsillectomy is usually performed on the paediatric population, a significant proportion of adults also undergo this procedure.

The human pharynx is a natural reservoir for several bacterial species, including Streptococcus pneumoniae, Haemophilus influenzae and Moraxella catarrhalis [1]. During tonsillectomy, the integrity of pharyngeal mucosa is broken and a fresh wound is formed in a field with a rich vascular supply and full of bacteria, some of which are pathogenic. Unlike many other operative procedures, in which the surgical wounds are closed primarily, tonsillectomy produces an open wound that heals by secondary intention. Hence, it might be expected that the bacterial migration into systemic circulation could readily occur in tonsillectomy [2].

The passage of viable indigenous bacteria across the mucosal barrier to local mesenteric lymph nodes and to other normally sterile body sites has been defined as bacterial translocation [3]. Dissemination of bacteria via the bloodstream, during a number of surgical and diagnostic procedures is called transitory bacteremia, which is particularly common during dental extractions in patients with periodontal disease, ranging from 10 to 100% in different studies [4]. The positive blood culture following tonsillectomy is also a well-recognized phenomenon, with reported incidences of 20 – 40% in children [5-10].

Transient bacteremia is the most common scenario following the introduction of microorganisms into the blood stream. Transient bacteremia is generally harmless in healthy subjects and resolves spontaneously without complication. But it may cause high mortality in the risk group with congenital / acquired heart diseases or orthopedic prosthesis despite antibiotic treatment. To counter this probability antibiotic prophylaxis is being frequently administered in risky patients [11-13].

Bacteremia observed during tonsillectomy may develop due to microorganisms in the central region of the tonsil, or contaminated oropharyngeal secretions, or due to local infections. It is known that tonsil surface cultures do not reflect central tonsil cultures. Therefore, it may be wrong to make a decision about prophylactic antibiotic choice solely based on surface culture results. Thus the identification of microorganisms observed during bacteremia is significant in choosing an antibiotic especially for risky patients [14,15].

The purpose of this descriptive study was to determine the incidence of bacteremia during tonsillectomy and to identify the organisms associated with it.

II. Materials And Methods

1. Source of Data.

The study cases were selected from those patients who presented to the ENT OPD in YENEPOYA MEDICAL COLLEGE HOSPITAL with chronic tonsillitis over a period from October 2013 to October 2014. The study was conducted after obtaining clearance from the ethical committee of the hospital. An informed consent was also taken from all the patients / by-standers.

Inclusion criteria: Patients who underwent elective tonsillectomy by dissection method for chronic recurrent tonsillitis.

Exclusion criteria: (1) Patients who underwent elective tonsillectomy, but diagnosed with conditions other than chronic tonsillitis, (2) Patients who had any other co-morbidities like cardiovascular diseases, (3) The presence of any focus of infection in the body, (4) History of any attacks of tonsillitis or upper respiratory tract infections 4 weeks prior to the operation, and (5) Use of antibiotics, for any reason, for at least 2 weeks before the operation.

2. Method of Collection.

All the patients underwent tonsillectomy by dissection method, under general anaesthesia. During tonsillectomy, within 2 minutes of removal of the first tonsil, blood samples (5ml in 50ml brain heart infusion bottle in adults and 1ml in 10ml brain heart infusion from children) were taken from the peripheral veins in accordance with techniques of sterile blood collection.

3. Bacteriological Analysis.

All of the samples were taken to the microbiology laboratory within half an hour. Samples were subcultured on 5% sheep agar and incubated at 35°C, 5% CO₂ and on Mac-Conkey agar under aerobic conditions for 24hrs, 72hrs and 5 days. Aerobic microorganisms were identified by standard laboratory methods.

III. Results.

The study included 42 patients (20 females and 22 males ranging in age from 4 to 30 years). Of the 42 samples collected, only 7 (16.67%) yielded positive blood cultures, while 35 samples (83.33%) showed no growth.

Table 1: Results of the blood cultures.

| | | |
|--------------------------------------|-----------|-------------|
| Blood culture samples showing growth | 7 | 16.67% |
| Blood culture samples found sterile | 35 | 83.33% |
| Total | 42 | 100% |

The organisms isolated were Coagulase-negative Staphylococci (2), Pseudomonas (2), Acinetobacter (1), Diphtheroids (1) and a Gram +^{ve} bacilli (1).

Table 2: Microorganisms isolated from the blood cultures.

| Isolates | Count | % |
|---|-------|-------|
| Coagulase - ^{ve} Staphylococci | 2 | 4.76% |
| Pseudomonas | 2 | 4.76% |
| Acinetobacter | 1 | 2.38% |
| Diphtheroids | 1 | 2.38% |
| Gram + ^{ve} bacilli | 1 | 2.38% |

The Coagulase-negative Staphylococci showed sensitivity to antibiotics like ampicillin, methicillin, amikacin, vancomycin, erythromycin, gentamycin, cefotaxime and linezolid while these strains showed resistance to clindamycin and cotrimoxazole. Pseudomonas strains isolated were found to be sensitive to amikacin, imipenem, piperacillin and most of the cephalosporins. Acinetobacter strain found in our study showed sensitivity to amikacin, gentamycin, aztreonam, imipenem, piperacillin and some of the cephalosporins; but showed resistance to ampicillin and chloramphenicol.

IV. Discussion

Tonsils are important structures of the immune system. Leukocytic infiltrations, swelling, necrosis, and surface ulceration in tonsils may occur in the acute bacterial infection of the tonsils. Thus, antibiotic therapy

may be sufficient in acute infections. Nevertheless, inappropriate treatment against the microorganisms, or entering low levels of antibiotics into the depth of tonsils, leads to continuation of the infection and recurrence of tonsillitis. Therefore, tonsillectomy is the choice of treatment in chronic and recurrent cases. Tonsillectomy is also a common surgical approach generally applied for Sleep-Disordered Breathing (SDB) and recurrent infections of tonsils, especially in children [16,17].

Bacteremia occurs frequently following tonsillectomy. Bacteremia in patients who underwent tonsillectomy due to chronic tonsillitis may lead to intense outcomes, especially in those who are faced with the risk of cardiovascular infection. Post-tonsillectomy bacteremia is a well-recognized aetiological factor in streptococcal endocarditis [11-13].

Of the 42 samples collected in our study only 7 samples (16.67%) yielded positive blood cultures. Of the 7 positive cultures, Coagulase-negative Staphylococci and Pseudomonas were grown from 2 cultures each (4.76% each); while Acinetobacter, Diphtheroids and a Gram positive bacilli were identified from 1 culture each (2.5% each).

Our findings were in agreement with the study done by **Mahmood Shishegar** and **Mohammad Javad Ashraf**, in which Coagulase-negative Staphylococci formed the major isolates, followed by Alpha-haemolytic Streptococci. In their study, even though Pseudomonas was isolated from both tonsillar surface and core, it was not seen in blood cultures [18]. In a study conducted by **Ahmed N AL-Juboori** and **Sura K AL-Alusi**, Pseudomonas was isolated from tonsillar surface as well as the post-tonsillectomy blood samples, but not from the tonsillar core [19]. In earlier studies done by **Koc et al**, bacteremia due to Acinetobacter has been demonstrated in patients who underwent nasal surgeries like septoplasty [20]; but post-tonsillectomy bacteremia by Acinetobacter has not been reported. But in our study Acinetobacter was isolated from 1 blood culture, which might represent a recent change in the microflora of tonsillar region, as was told by **Kasenomm et al**, **Yildirim et al** and **Kaygusuz et al** [21-23]. Diphtheroids isolated could be skin commensals, while the Gram +ve bacilli found, may be an environmental contaminant.

Unlike our study, most of the earlier studies demonstrated Haemophilus influenzae and Alpha- and Beta-haemolytic Streptococci to be the most common causes of post-tonsillectomy bacteremia. In the study conducted by **Olinat et al**, Streptococci (21.5%) and Staphylococci (9.8%) were the commonest organisms cultured [24]. In the study by **Francois et al**, Haemophilus influenza was the most common organism isolated after tonsillectomy, followed by Alpha-haemolytic Streptococci [5]. Haemophilus influenzae was isolated from 36.4% of the positive cultures and Streptococcus viridans from 9% in the study done by **Gaffney et al** [6], while **Soldado et al** isolated Haemophilus influenzae from 56% of the positive cultures and Streptococcus viridans from 36.5% [9]. In the series of **Rhoads et al** comprised of 68 patients, Streptococcus pyogenes was cultivated in the blood cultures of 4 patients [25].

The differences among the rates of bacteremia before and after tonsillectomy may be attributed to various factors, such as different blood culture gathering times, blood culture methods, amount of bleeding during the surgery, and history of recurrent Acute Otitis Media (rAOM) or recurrent Tonsillopharyngitis (rTF) in the patient [7,20,26].

It has been reported that transient bacteremia occurs within a one-hour time period [10]. There are different approaches regarding the timing of culture collection such as: immediately after removing the first or second tonsil [27], within the first 5 minutes after tonsillectomy [28], immediately after the completion of the operation [25], 2 minutes after the removal of the second tonsil [6,7], during tonsillectomy [5], and in the post-operative period [22]. In our study the blood culture was taken within 2 minutes following the removal of the first tonsil. **Yildirim et al** showed that timing of culture sampling was important for bacteremia detection. They investigated two groups of blood cultures taken within 2 minutes and 15 minutes after tonsillectomy and the difference between the two groups was statistically significant ($P < 0.05$) [21].

Koc et al concluded that bacteremia was more frequent after tonsillectomy with greater amount of bleeding during the surgery [20]. Also, **Esposito et al** showed that bacteremia was significantly more associated with adenotonsillectomy compared to adenoidectomy and was significantly more frequent in the patients with a history of rAOM or rTF [26].

Although there are many reports associated with post-tonsillectomy bacteremia, the pathophysiology of the bacteremia following tonsillectomy still remains controversial. **Kocaturk et al** suggested that transient bacteremia may originate from the pathogens inhabiting the tonsillar core tissue [29]. But some other studies have shown that the bacterial pathogens related to tonsillitis inhabited both the surface and the depth of the tonsil tissue. Moreover, a large number of studies have presented similarities between the types of isolated microorganisms from the surface and the depth of tonsil, but the degree of likeness has been very different in these studies. Thus the cultures taken from the surface of tonsil may not display the real existing pathogens; and hence, cultures from the depth of tonsil are also necessary for the identification of tonsil microbiology and selection of the appropriate treatment strategy [5,14,22]. Recent studies have also shown a change in the

microflora; therefore the microbiological study of the tonsil surface as well as the core is indicated in understanding the causative organisms of bacteremia during tonsillectomy [21,22,23].

Regarding the route of spread of infection, some authors like **Isaacson** and **Parke** have proposed a model of retrograde flow of bacteria through the exposed vessels. They believed that during tonsillectomy, the pharyngeal mucosa is torn and a fresh wound is generated in a field with a rich vascular supply, and full of bacteria, some of which are pathogenic; as a result of which, it can be presumed that the resection of such heavily colonized tissue may lead to bacteremia by the venous route within the pharyngeal mucous membranes [30]. But it has been reported that the incidence of bacteremia is relatively less during septoplasty and rhinoplasty, and it occurs only rarely during endoscopic sinus surgery although there is bacterial colonization in these operative sites as well [31-33]. Nevertheless bacteremia occurs in a significant percentage of tonsillectomies. Hence, it may be concluded that the occurrence of bacteremia is not related to the presence of bacterial colonization in the operative site. Authors like **Yildirim et al** presumed that bacteremia following tonsillectomy may be related to the manipulation of the operational site (i.e., traction and handling of the tonsil with the forceps, before or during the dissection; application of gauze tamponade; suture ligation for the treatment of haemorrhage during surgery; or, over-pressure to the tonsillar fossa during suction), rather than direct spread of bacteria into the exposed and traumatized vessels [21].

It has been reported that in healthy subjects, transient bacteremia usually lasts not more than 15 – 30 minutes and that the microorganisms associated are completely eliminated by the host defense mechanisms by this period. But transient bacteremia may lead to serious complications in the risky patient group while causing no problems in healthy patients. The effect of transient bacteremia due to tonsillectomy, especially on the development of endocarditis in patients with cardiovascular risks is very well known. Therefore, there is a consensus on the use of prophylactic antibiotics especially in the risky patient group. It has also been reported that prophylactic antibiotic treatment reduces bleeding and postoperative pain and increases recovery [21]. But in our study, none of the patients developed any infective complications. Therefore, it can be stated that the risk of metastatic infection is extremely low in healthy patients.

In brief, it can be said that bacteremia occurs infrequently in association with adenotonsillectomy, so it seems unnecessary to use prophylactic antibiotics routinely, to prevent bacteremia or its complications, unless the patient carries a high risk for a metastatic infection (e.g. having cardiac valvular disease). In such patients, amikacin may be a good empirical choice in the antibiotic regimen for the prevention of post-tonsillectomy bacteremia. However, there is obviously a need for larger controlled studies to confirm this presumption.

V. Conclusion

- In the present study, the growth of pathogenic bacteria in blood cultures suggests that bacteremia could occur following tonsillectomy.
- Antibiotic therapy is necessary, especially in patients suffering from chronic tonsillitis with cardiovascular diseases.
- Amikacin may be a good empirical choice of antibiotic in the regimen for the prevention of post-tonsillectomy bacteremia; but tonsillar surface and core cultures along with blood cultures must be taken for selecting specific antimicrobial therapy.
- Since none of the healthy patients in the study developed any infective complications, the use of prophylactic antibiotics in such patients remains controversial.
- In order to determine the antibiotic of choice in prophylaxis we think that studies adopting larger case series are warranted.

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