

## EVALUATION OF ENDOSCOPICALLY GUIDED PRE-TREATMENT AEROBIC MICROBIOLOGY OF THE MIDDLE MEATUS IN CHRONIC SINUSITIS

### KRONİK SİNÜZİTLİ HASTALARDA TEDAVİ ÖNCESİ ENDOSKOPIK GİRİŞİM İLE ALINAN ORTA MEATUS AEROB KÜLTÜRLERİNİN DEĞERLENDİRİLMESİ

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**Anahtar Sözcükler:** Aerop mikroorganizmalar, orta meatus, kronik sinüzit, *in vitro* antibiyotik duyarlılığı, disk difüzyon yöntemi

## SUMMARY

Although it is known that culture-directed therapy along with surgery increases treatment success; the antimicrobial therapy is usually selected on empirical basis, mostly because of the lack of time and equipment for a proper endoscopy. Therefore, most of the centers follow up the treatment protocols directed against the known sinus pathogens. The purpose of this study was to characterize the bacteriology of outpatient chronic maxillary sinusitis, and argue about the effectiveness of known antimicrobial agents against these microorganisms. A prospective study was carried out on 44 consecutive patients referred to an outpatient clinic at The Kocaeli University Hospital, Department of Oto-Rhino-Laryngology, between May 1999 and January 2000. Swabs of 44 chronically inflamed maxillary sinuses were processed for aerobic bacteria as well as yeast and yeast-like organisms during endoscopy. Antibiograms were carried using Kirby-Bauer disk diffusion technique. Of the 44 total cultures, there were 38 (86.3%) positive cultures yielding 49 isolates. Thirty-two cultures had two or fewer isolates; two cultures had three isolates. The most frequently isolated organisms were coagulase-negative staphylococcus (21 of 49, 42.8%), *Streptococcus* spp. (12 of 49, 24.4%), *Staphylococcus aureus* (8 of 49, 16.3%), *Pseudomonas aeruginosa* (5 of 49, 10.2%) and *Candida albicans* (3 of 49, 6.1%). According to antimicrobial susceptibility testing, therapy in protocol with amoxicillin-clavulanic acid was shifted to another antibiotic in 24 of the 44 cases (54.5%). Most of the therapy protocols on chronic sinusitis are based on the studies in which *Streptococcus pneumoniae* and *Haemophilus influenzae* are known as the most important pathogens. But as *Staphylococcus* spp. accounted for more than 50% of cases in this study, beta-lactam antimicrobials such as amoxicillin-clavulanate which shows the best activity against pneumococci, *Haemophilus influenzae* and *Moraxella catarrhalis* would not be an appropriate agent and should not be selected as the first drug. In a conclusion, antimicrobial treatment should be based on serial culture and sensitivity results and coordinated with surgical drainage.

## ÖZET

Kronik rinosinüzit (KS)'in tanı ve tedavisinde, endoskopik kültüre dayalı tedavinin başarı şansının daha fazla olduğu bilinmekle beraber; pekçok merkez, gerek zaman yokluğundan gerekse uygun aygıtların olmaması nedeni ile ampirik tedaviyi tercih etmektedir. Ampirik antibiyotiğin seçildiği protokoller tüm dünyada en sık izole edilen patojenlere göre düzenlenmiş tedavi protokolleridir. Bu çalışmada, KS tanısı almış olan hastalarda, endoskopik orta meatus kültürü ile

olası etken patojenleri saptamayı ve bu patojenlerin protokol gereği kullanılan amoksisilin-klavunat aside duyarlılığının araştırılması amaçlanmıştır. Çalışmaya Mayıs 1999-Mart 2000 tarihleri arasında Kocaeli Üniversitesi KBB Polikliniği'ne KS kliniği ile başvuran ve bu tanısı radyolojik olarak desteklenen 44 hasta alındı. Örnekler, vestibüler kontaminasyon olasılığını azaltmak için, rijit nazal endoskop ile nazal ala retrakte edilerek, steril eküsyon yardımı ile orta meatusta bulunan patolojik sekresyondan alındı. Sürüntü örnekleri Stuart taşıma besiyeri içerisinde en kısa sürede laboratuvara gönderildi. Tüm kültürler aerop bakteri ve mantar besiyelerine ekildi. Antibiyogramlar Kirby-Bauer disk difüzyon tekniği ile yapıldı. Toplam 44 kültürün 38'inde (%86) üreme oldu ve 49 köken saptandı. En sık izole edilen mikro-organizmalar koagülaz- negatif stafilokoklar (21/49, %42.8), *Streptococcus türleri* (12/49, %24.4), *Staphylococcus aureus* (8/49, %16.3), *Pseudomonas aeruginosa* (5/49, %10) ve *Candida albicans* (3/49, %6) idi. Yapılan antibiyogram sonuçlarına göre tedavi protokolünde öngörülen antibiyotiğe direnç saptanan 24 olguda (%54.5) tedavi değiştirildi. Altı aylık kontrollerde tüm olgularda klinik yanıtın devam ettiği görüldü. *Streptococcus pneumoniae* ve *Haemophilus influenzae*'nin en sık etken olarak kabul edildiği tedavi protollerinin başarılı olma olasılığının yüksek olmadığı anlaşılmıştır. En sık üreyen bakterinin stafilokoklar olması nedeni ile birincil ilaç seçiminde antistafilokoksik etkinliğin gözönünde tutulması gerekmektedir. Ayrıca KS'in akut ataklarının ampirik tedavisinde de yaygın olarak kullanılan amoksisilin-klavulonik aside karşı yüksek direnç bulunmuştur. Sonuç olarak, antimikrobiyal tedavinin mümkünse endoskopik örnek alınımının sonuçlarına göre başlanması, bu mümkün değil ise, her bölgenin kendi patojen listesini ve direnç durumunu çıkararak özel bir protokol hazırlaması gerektiği düşünülmüştür.

## INTRODUCTION

Sinusitis is an extremely common disease process. Approximately 0.5-5% of upper respiratory infections are complicated by acute sinusitis (1). Studies have shown that the most common organisms responsible for the development of acute sinusitis are *Streptococcus pneumoniae*, *Haemophilus influenzae*, *Moraxella catarrhalis*, *Staphylococcus aureus* and viridans streptococci (2). With chronic sinusitis (CS), however, a broader spectrum of possible pathogens, which may be resistant to first-line antibiotic therapy, makes identification of the causative organisms crucial for successful treatment. A large number of studies over several decades have sought to determine the bacterial organisms present in CS. Nonetheless, several issues remain unsettled. The maxillary sinuses have usually been considered as the primary focus of the disease and, therefore, the majority of microbiological studies on chronic sinusitis have concentrated on the maxillary sinusitis (3). Studies dealing with bacterial findings of CS, which have attempted to define the correct pathogens, have been frequently published, but have reported a diversity of results. Obtaining the appropriate causative agent was difficult because of unresolved questions of whether the bacterial findings are influenced by the method of specimen collection, transportation, and cultivation. Although the successful treatment of maxillary sinusitis necessitates a thorough knowledge of the prevailing bacteriology, many patients with CS are treated empirically with beta-lactams or with combination of antibiotics on protocols.

The goal of this study is to determine the prevalence of bacterial species from endoscopically guided sinus cultures, to evaluate the efficacy of antimicrobial agents in the clinical protocol and to correlate the therapy with the bacteria recovered from the infected sinuses.

## MATERIALS AND METHODS

**Patient selection:** This prospective study was performed at the Laboratories of the Clinical Bacteriology and Infectious Diseases Department, University Hospital of Kocaeli. The patients, with the diagnosis of chronic sinusitis, undergone endoscopy at the outpatient clinics of the Department of Otolaryngology between May 1999 and January 2000. Patients presenting with recurrent (more than four acute episodes per year) or persistent (more than 12 weeks) sinus complaints, including nasal discharge, nasal obstruction, cough, headache, facial fullness, change in taste or smell, and frequent throat clearing and/or wheezing were evaluated for chronic sinusitis. Fluid retention or opacification in the maxillary sinus was verified in every patient by otolaryngological examination, conventional radiographs and computed tomographic (CT) scans. Patients with the above complaints and with mucoperiosteal thickening of more than 5 mm or complete opacification in one or both maxillary sinuses on CT scans or conventional radiographs were diagnosed as chronic sinusitis and underwent endoscopic surgery. Patients with an acute sinusitis attack at the time of the study were excluded. Only patients who had not received any antibiotic treatment at least one month before the collection of specimens were included in the study. Fortyfour adult patients whose ages ranged between 16 to 52 years (median 34 years) was found to be appropriate for the study.

**Collection of specimen:** Specimens were obtained by endoscopic sinus surgery under local anaesthesia. The swabs were placed immediately into Stuart's transport medium. All the samples were transported to the microbiology laboratory usually within one hour of specimen collection.

**Microbiological analysis:** All of the specimens were immediately inoculated onto 5% defibrinated sheep blood agar, chocolate agar with 300 mg/l bacitracin, and eosin-methylene blue agar. The plates were incubated at 37° C aerobically (eosin-methylene blue) under 5 % carbon dioxide (5 % sheep's blood and chocolate agars) and examined at 24 to 48 hours. The organisms were isolated and identified using conventional methods.

## RESULTS

This study included 44 adult patients for whom the clinical diagnoses of chronic sinusitis was confirmed. The average age of the patients was 34 years (range 16-52 years). Eighteen of them were females and 26 were males. Of the 44 total cultures, there were 38 (86.3%) positive cultures yielding 49 isolates. The sinus specimens yielded no bacterial growth in six cases (12.2%). Coagulase-negative staphylococci were the most common pathogen, being present in 21 of 49 pathogens (Tables 1 and 2). According to antimicrobial susceptibility testing, therapy in protocol with amoxicillin-clavulanic acid was shifted to another antibiotic in 24 of the 44 cases (54.5 %). Antimicrobial resistance rates of all isolates given in Table 3.

**Table 1.** Bacteriology of the maxillary sinus in the study group

Types of isolates	No. of isolates
Pure aerobic and facultative growth	31
Mixed aerobic and facultative growth	18
Cultures with two isolates	6
Cultures with three isolates	2
No bacterial growth	6
Positive rate of culture	86.3%

**Table 2.** Bacterial isolates in 38 patients with chronic maxillary sinusitis (n: 49)

Species	No. of isolates	%
Gram-positive		
Coagulase-negative staphylococci	21	42.8
<i>Streptococcus</i> spp.	12	24.4
Alpha-hemolytic	5	
<i>Streptococcus pneumoniae</i>	4	
Beta-hemolytic	3	
<i>Staphylococcus aureus</i>	8	16.3
Gram-negative		
<i>Pseudomonas aeruginosa</i>	5	10.2
<i>Candida albicans</i>	3	6.1

**Table 3.** Susceptibility rates (%) of the isolates in the study group

	CNS*	<i>Streptococcus</i> spp.	<i>S. aureus</i>	<i>P. aeruginosa</i>
PenicillinG	47.6	100	12.5	NU**
Amox-clav***	47.6	83.3	50	NU
Erythromycin	33.3	50	37.5	NU
Co-trimoxazole	85.7	83.3	75	60
Cefaclor	85.7	58.3	50	60
Seftriaxone	95.2	91.6	75	80
Ofloxacin	100	100	87.5	87.5

\*: Coagulase-negative staphylococci \*\*: Not used

\*\*\*: Amoxicillin-clavulonic acid

## DISCUSSION

Medical therapy for acute and chronic sinusitis has been traditionally guided by empiric data for antibiotic selection. Although this approach is usually effective in most of cases, the variable diversity of microorganisms and growing problems on antibiotic resistance of many organisms has made successful treatment far more difficult. Because judicious selection of antimicrobial agents is becoming more important, culture-directed therapy may lead to more successful treatment of sinusitis. The results from studies on the microbiological aetiology of chronic sinusitis show a greater variation than those on acute infections. With chronic sinusitis, anaerobic bacteria and *S. aureus* are thought to predominate (4), but many studies are contradictory to these results, where no or few anaerobes were identified and alpha-hemolytic streptococci predominated over the other bacteria (5, 6). Identification of more than one bacterial species is found more often in contrast to acute sinusitis (5). The evidences are contradictory about the bacteriology of chronic sinusitis. The increasing incidence of beta-lactamase producing organisms in sinusitis has been well documented (3-5) and these organisms account for many treatment failures. Brook (4) demonstrated that with chronic sinusitis anaerobic bacteria and *S. aureus* were shown to be predominant whereas Doyle and Woodham (5) found no anaerobes and a higher frequency of *S. aureus* and Enterobacteriaceae in adult chronic ethmoidal sinusitis. In the study of Karma et al. (7) in which adult maxillary sinusitis biopsy and secretion specimens were examined, *Streptococcus viridans* and *Haemophilus influenzae* were found as the most frequent pathogens. Erkan et al. (8) found anaerobic bacteria in 88% of cases, and staphylococci as the most frequent aerobic organism in a study from the Kayseri Region of Turkey. Only Orobello et al. (9) demonstrated the predominance of coagulase-negative staphylococci in chronic sinusitis. In fact, given this high variability of

microorganisms with high prevalence of beta-lactamase-producing ones, many physicians are beginning to question the adequacy of many first-line antibiotic therapies for sinusitis. Another phenomenon that has recently made treatment of sinusitis even more difficult is the emergence of penicillin-resistant *S. pneumoniae* (10). During evaluation of the microbiology of CS in the present study, the table given in reference of Şener et al. (11) were followed (Table 3). In our study, treatment with amoxicillin-clavunatic acid 24 of 44 (54.5 %) cases were shifted to another antibiotic according to results of susceptibility tests. Clearly if these resistant organisms can be identified before treatment is initiated, success rate will be higher. Traditionally it has been difficult to obtain reliable sinus cultures since nasal and nasopharyngeal cultures are poor predictors of sinus pathogens (8, 9). Middle meatal puncture has been considered valuable in obtaining accurate cultures. In the present study, coagulase-negative staphylococci were the predominant organisms. These organisms are known as nonclassical pathogens which belong to the normal respiratory flora as alpha-hemolytic streptococci, *Neisseria*, and *Corynebacteria*. The role of these microorganisms in the pathogenesis of CS is not yet clear although they are accepted as causative agent by many authors as Brook (3, 4) and Karma et al. (7). It is also known that staphylococci have the potential to cause chronic infections, especially when found together with infection parameters. The authors of this paper suggest that if empiric antimicrobial therapy

is to be used for chronic sinusitis, it should be primarily be effective against staphylococci. The total number of anaerobic bacteria was only four amongst the 53 bacterial isolates. Although they have been accepted as classical pathogens by many authors, their significance is still a controversy. Muntz and Lusk (12) isolated anaerobes in equal numbers from patients and controls, and although Wald (1) did not recover anaerobes in high numbers in 40 children with chronic sinusitis, they were accepted as potential pathogens by some other authors, such as Brook (4) who had isolated 97 anaerobes from 40 children with chronic sinusitis. The low isolation rate of anaerobic bacteria in this study might be due to some technical factors related to transport or processing of the specimens. Also the fastidious nature of these organisms makes their isolation difficult. The results suggest that microorganisms other than classical pathogens may contribute to the pathogenesis of CS and as empiric medical therapy for sinusitis becomes more and more uncertain, culture-directed therapy, especially in cases of multiple therapy failures, or complicated sinusitis, is a valuable therapeutic tool.

This study demonstrates that middle meatal aspiration cultures can be confidently used to guide antibiotic selection and monitor treatment in chronic sinusitis. The widespread use of nasal endoscopes coupled with the ease in obtaining a middle meatal aspiration culture, may increase the effectiveness of antibiotic therapy as we enter an era of increasing multiple antibiotic resistance.

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