Kulak Burun Bogaz Ihtis Derg
2006;16(1):18-24

ORGINAL ARTICLE

Antibiotic sensitivities of *Streptococcus pneumoniae, Viridans streptococci* and group A hemolytic *Streptococci* isolated from the maxillary and ethmoid sinuses

Maksiller ve etmoid sinüslerden izole edilen *Streptokok pnömoni, Streptokok viridans* ve A grubu hemolitik *Streptokok*'ların antibiyotik dirençleri

Erol KELEŞ, M.D.,[1] Murat ARAL, M.D.,[2] H. Cengiz ALPAY, M.D.[1]

Objectives: To investigate antibiotic sensitivities of *Streptococcus pneumoniae*, *Viridans streptococci* and Group A hemolytic *Streptococci* isolated from the culture materials obtained from the sinuses of patients undergoing functional endoscopic sinus surgery due to chronic sinusitis.

Patients and Methods: We recruited 93 patients (63 males, 30 females; mean age 36±17.47; range 19 to 68 years) who were undergoing functional endoscopic sinus surgery due to chronic sinusitis into this study. Before the surgical intervention, in order to eliminate a possible contamination from skin and neighboring structures, nasal mucosa was cleansed with povidone-iodine solution. Nasal smear samples were obtained from all the patients before and after applying povidone-iodine solution. *Streptococcus pneumoniae*, *Viridans streptococci* and Group A hemolytic *Streptococci* that were isolated from the cultures were tested for antibiotic sensitivity.

Results: In the preoperative nasal smear cultures, total number of anaerobic bacteria isolated from 58 patients (62.3%) before applying povidone-iodine was 72, following the application of povidone-iodine a total of 16 microorganisms were identified from 12 (%12.9) patients. Microorganisms were isolated from 95.6% (89/93) of the samples obtained from maxillary sinuses and 91.3% (85/93) of the samples obtained from ethmoid sinuses. The most commonly identified microorganisms from both sinuses were coagulase (-) *staphylococcus* followed by Viridans *streptococci*, coagulase (+) *staphylococcus*, *Streptococcus pneumoniae* and Group A hemolytic *streptococci*. For the Viridans *streptococcal* strains that were isolated, 33.3% were resistant to tetracycline, 23.8% to chloramphenicol, and 19.04% to penicillin. A hemolytic *streptococci* strains were sensitive to penicilin, ofloxacine, ceftriaxone and cefepime in all groups; however they had 50% resistance to eritromycin and chloramphenicol and 100% resistance to tetracycline. The resistance pattern of the isolated *Streptococcus pneumoniae* strains were as follows: 25% to penicillin, 66.6% to trimethoprim/sulphometaxazole, 41.6% to eritromycin, 58.3% to tetracycline, 33.3% to chloramphenicol and 16.6% to rifampin. All of the isolated strains were sensitive to vancomycin.

Conclusion: We suggested that identification of the strains that are resistant to penicillin and other antibiotics is an important tool for choosing the empirical treatment to the *Streptococcus pneumoniae*, *Viridans streptococci* and group A hemolytic *streptococci* in clinical practice. *Viridans streptococci* which were frequently isolated from chronic sinusitis patients should be kept in mind.

Key Words: Chronic sinusitis; *Streptococcus pneumoniae*; *Viridans streptococcus*; Group A hemolytic *streptococci*; antibiotic sensitivity.

Amaç: Kronik sinüzit nedeniyle fonksiyonel endoskopik sinüs cerrahisi hastaların sinüslerinden alınan kültür materyallerinden izole edilen *Streptokok pnömoni*, *Streptokok viridans*, A grubu hemolitik *streptokok*'ların antibiyotik dirençleri araştırıldı.

Hastalar ve Yöntemler: Çalışmaya, kronik sinüzit nedeniyle fonksiyonel endoskopik sinüs cerrahisi uygulanan 93 hasta (63 erkek, 30 kadın; ort. yaş 36±17.47; dağılım 19-68) alındı. Cerrahi girişim öncesi nazal mukoza, deri ve komşu yapılar olası bir kontaminasyonu önlemek amacıyla povidone-iodine solüsyonuyla temizlendi. Tüm hastalardan povidone-iodine solüsyonu uygulamadan önce ve sonra burun sürüntü örnekleri alındı. Ameliyat sırasında da etmoid sinüsten ve maksiller sinüs ostiumundan kültür için materyal alındı. Kültürlerde izole edilen *Streptokok pnömoni*, *Streptokok viridans* ve A grubu hemolitik *streptokok*'lara antibiyotik duyarlılık testleri yapıldı.

Bulgular: Ameliyat öncesi burun sürüntü kültürlerinden povidone-iodine solüsyonu uygulamadan önce 58 hastadan (%62.3) 72 aerop bakteri üremesi olurken, povidone-iodine solüsyonu uygulandıktan sonra alınan kültürlerde 12 hastadan (%12.9) toplam 16 izolasyon oldu. Ameliyat sırasında maksiller sinüslerden alınan kültürlerde hastaların %95.6'sında (89/93), etmoid sinüsten alınan kültürlerde ise %91.3'ünde (85/93) mikroorganizma izole edildi. Her iki sinüste de en sık izole edilen mikroorganizma koagülaz negatif stafilokok, ikinci sıklıkta viridans *streptokok*'lar daha sonra sırasıyla koagülaz pozitif stafilokok, *Streptokok pnömoni* ve A grubu hemolitik *streptokok* idi. İzole edilen viridans *streptokok* suşunun %33.3'ü tetrasikline, %23.8'i kloramfenikole, %19.04'ü penisiline dirençli bulunurken, A grubu hemolitik *streptokok* suşunun tümü penisilin, ofloksasin, seftriakson, sefepime duyarlı, %50'si eritromisin ve kloramfenikole, tamamı tetrasikline dirençli bulundu. İzole edilen *Streptokok pnömoni* suşlarının %25'i pensiline, %66.6'sı trimetoprim/sülfametoksazole, %41.6'sı eritromisine, %58.3'ü tetrasikline, %33.3'ü kloramfenikole ve %16.6'sı rifampine dirençliydi. İzole edilen suşların tümü vankomisine duyarlıydı.

Sonuç: Kronik sinüzitli hastalardan sık olarak izole edilen *Streptokok pnömoni*, *viridans streptokok*'lar ve A grubu hemolitik *streptokok*'ların antimikrobiyal duyarlılıklarının araştırılmasının, klinikte uygulanacak ampirik tedavinin seçilmesinde ve kronik sinüzitli hastalarda viridans *streptokok*'ların tedavide göz önünde bulundurulması gerektiğini düşünüyoruz.

Anahtar Sözcükler: Kronik sinüzit; *Streptokok pnömoni; viridans streptokok*; A grubu Hemolitik *Streptococ*; antibiyotik duyarlılığı.

◆ *[1]Department of Otolaryngology, Medicine Faculty of Fırat University ([1]Fırat Üniversitesi Tıp Fakültesi Kulak Burun Boğaz Hastalıkları Anabilim Dalı), Elazığ; [2]Department of [2]Microbiology and Clinic Microbiology, Medicine Faculty of Kahramanmaraş Sütçü İmam University ([2]Kahramanmaraş Sütçü İmam Üniversitesi Mikrobiyoloji ve Klinik Mikrobiyoloji Anabilim Dalı), Kahramanmaraş, both in Turkey.*

◆ *Received - March 4, 2004 (Dergiye geliş tarihi - 4 Mart 2004). Request for revision - February 12, 2005 (Düzeltme isteği - 12 Şubat 2005). Accepted for publication - June 21, 2005 (Yayın için kabul tarihi - 21 Haziran 2005).*

◆ *Correspondence (İletişim adresi): Dr. Erol Keleş. Fırat Üniversitesi Fırat Tıp Merkezi, Kulak Burun Boğaz Hastalıkları Anabilim Dalı, 23119 Elazığ, Turkey. Tel: +90 424 - 233 35 55 Fax (Faks): +90 424 - 238 76 88 e-mail (e-posta): keleserol@yahoo.com*

Chronic sinusitis is the condition in which the symptoms of sinusitis last longer than 12 weeks. Paranasal sinuses were previously accepted as sterile cavities. However, in 1981 with the examination of maxillary sinus samples obtained by Brook,[1] aerobic bacteria were identified in 58% of the samples whereas anaerobics were present in all of them. Under the light of these findings the microbiology of the sinuses started to attract attention.

The microorganisms responsible from chronic sinusitis are different than that of acute sinusitis. Bacteroides, Veillonella, Rhinobacterium and together with other anaerobics Haemophilus influanzae, *Viridans streptococci* and different *streptococci* can be causative agents.[2,3] The most commonly encountered bacterial pathogens are hemolytic *streptococci*, Haemophilus influanzae and *Staphylococcus aereus*. Although it is rare, in cases with recurrences, fungus related infections should be kept in mind.

In several studies conducted until today, in the aspiration and/or biopsy materials of the patients with chronic sinusitis, *Viridans streptococci*, *Streptococcus pneumoniae* and different *streptococci* (hemolytic) were reported as the most commonly isolated strains.[4,5]

Except for their potential to induce endocarditis, *Viridans streptococci* are generally accepted as agents with low pathogenicity and for years they have been thought to be sensitive to regular penicillin. Recently, its increasing incidence in neutropenic patients, its potential to result in fatal complications and the evolution of resistant strains made this microorganism an important health issue.[6]

Group A hemolytic *streptococci* (GAHS) can be found in upper airways, skin and rectum in asymptomatic individuals. Depending on its biological characteristics and the defense state of the host, after entering the body, GAHS can localize on the mucosa, under the skin, in the joints in the form of localized and abscess type suppurations or can cause wound infections and sepsis.[7] Although GABHS are known to be bacteria with low potential to develop resistance, some antibiotics have become ineffective to these microorganisms as well.[8] *Streptococcus pneumoniae* is found as an opportunistic pathogen in 5-70% of nasopharynx mucosa. It results in infections once the integrity of the mucosal epithelium is lost and the resistance of the body is decreased. As it is dependent on external conditions, its isolation, live preservation and growth is difficult.[9] Penicillin has been used as the first choice in the treatment of pneumococcal infections for many years. During recent years, there has been an increase in resistant strains and the strains resistant to alternative antibiotics created problems. With the increase in the number of resistant strains *Streptococcus pneumoniae* related infections began to have an increased mortality.[10]

Today, the medical treatment of sinusitis is managed by antibiotics, agents that reduce mucosal edema and other supportive medications. As obtaining culture material from the sinuses necessitates an invasive intervention, chronic sinusitis patients are generally recommended to have an empirical antibiotic treatment. In the selection of such treatment options, the studies concentrating on the microbiology of the sinuses are providing guidance.

With the entry of the endoscopes into clinical practice, our knowledge regarding sinus infections has increased and endoscopes are providing us an opportunity to perform a more detailed examination of inside the nose. It is also possible to minimize the contamination in the sinuses.

In this study we aimed at investigating the antibiotic sensitivities of *Streptococcus pneumoniae*, *Viridans streptococci* and GAHS that were isolated from the maxillary and ethmoid sinuses of patients with chronic sinusitis.

MATERIALS AND METHODS

We recruited 93 patients (63 males, 30 females; mean age 36±17.47; range 19 to 68 years) who were undergoing functional endoscopic sinus surgery due to chronic sinusitis into this study. The study group consisted of chronic sinusitis patients whose disease lasted longer than 12 weeks, did not respond to medical treatment or patients who had recurrent sinusitis related complaints (more than 4 episodes a year). These patients had complete opacification of one or both maxillary sinuses and/or ethmoid sinuses or 5 mm or more thickening of the mucoperiosteum in computerized tomographic or conventional radiological examinations. The patients with acute infections or who received local or systemic antibiotics during the last one week were excluded from the study. All the patients were examined with Karl Storz endoscopy and endovision system.

Before the surgical intervention, in order to eliminate a possible contamination from skin and neighboring structures, nasal mucosa was cleansed with povidone-iodine solution. Nasal smear samples were obtained from all the patients before and after applying povidone-iodine solution. Samples were obtained from the patients during functional endoscopic sinus surgery (FESS) while they were under general anesthesia. Samples were obtained directly from the maxillary sinus ostium and when the ethmoid sinus was opened from the purulent and/or mucoid material within the sinus by a disposable aspirator set (Xomed Surgical Products, Jacksonville, Florida, USA) into a collecting tube. We paid attention not to touch nasal mucosa and surrounding structures during these procedures. Nasal smear samples and aspiration materials were transferred to coal containing amies transport media and thioglycolate media with separators by using sterile equipment. The samples that were transferred to the microbiology laboratory with coal containing amies transport medium within two hours were inoculated to 5% sheep blood agar, chocolate agar and eosine-methylene-blue agar for aerobic bacteria, and were left to incubation at 5% CO_2 concentration at 35 °C for 24-48 hours. For anaerobic cultures the samples were inoculated to anaerobic blood agar, Brucella blood agar enriched with vitamin K1, kanamycin and vancomycin added blood agar and to thioglycolate media with separators during surgery. The incubation was accomplished at 35 °C in Gas-Pak anaerobic jars for 48-72 hours. The samples obtained from the sinuses were additionally inoculated to Saboraud-Dextrose agar media and kept at room temperature for 20 days for fungal growth. The samples that were taken into thioglycolate media with separators during surgery were incubated at 35 °C in Gas-Pak anaerobic jars for 4-7 days for increasing the yield of the microorganisms. The anaerobic microorganisms that have not grown in the cultures were thought to have died during sampling or transport and four direct slides were prepared from the material sent to the laboratory for inoculation. These slides were than stained with Gram stain and examined. For the identification of anaerobics, OXOID An-ident discs were used (Oxoid limited, England).

Aerobic microorganisms were identified and isolated with standard microbiological methods. Vitek automated systems were also used in the identification of aerobic microorganisms (BioMerieux, Inc, Missouri, USA).

Antibiotic Sensitivity Assays (Antibiograms)

Streptococci pneumoniae, *Viridans streptococci* and GABHS strains that were identified were tested for their antibiotic sensitivities with disc diffusion (Kirby-Bauer) method. Disc diffusion assay was performed in accordance with NCCLS criteria; on Mueller-Hinton media containing 5% sheep blood a colony suspension adjusted to 0.5 McFarland with distilled water was inoculated. The discs were left to dry for 15-20 minutes and than dry discs (Oxoid) were placed to incubate for 16-18 hours at 37 °C. Following the incubation, zone diameters were evaluated according to the NCCLS criteria recommended for *Streptococci pneumoniae* and other *streptococci*. In Kirby-Bauer disc diffusion method oxacilline discs were preferred instead of penicillin according to NCCLS recommendations.

RESULTS

In the preoperative nasal smear cultures, total number of anaerobic bacteria isolated from 58 patients (62.3%) before applying povidone-iodine was 72, following the application of povidone-iodine a total of 16 microorganisms were identified from 12 (%12.9) patients. In the smear cultures obtained before applying povidone-iodine 35 patients had no growth, while in the cultures obtained after applying povidone-iodine 81 patients had no growth. In the cultures obtained during FESS from maxillary and ethmoid sinuses, 4 patients (4.3%) did not have any growth in the maxillary sinus and 8 patients (8.6%) did not have any growth in the ethmoid sinus.

In the bacterial cultures with positive results, 6 (6.45%) had co-presence of aerobic and anaerobic bacteria, 21 (22.5%) had more than one aerobic bacteria (two or three), 54 (58%) had only one aerobic bacteria, and 12 (12.9%) had only anaerobic bacteria. The bacterial growth in the cultures obtained during FESS and their distribution with respect to maxillary and ethmoid sinuses is demonstrated on Table I. None of the samples had fungal growth. The antibiotic sensitivities of the *Streptococcus pneumoniae*, *Viridans streptococci* and GAHS strains isolated from maxillary and ethmoid sinuses are shown on Table II.

TABLE I

THE MICROORGANISMS THAT HAVE BEEN ISOLATED FROM INTRAOPERATIVE MAXILLARY AND ETHMOID SINUS CULTURES

Microorganisms	Microorganisms growing in maxillary sinuses		Microorganisms growing in ethmoid sinuses	
	n=89	%	n=85	%
Aerobic				
Coagulase (-) *staphylococcus*	18	20.0	12	33.3
Viridans streptococcus	12	13.3	9	25.0
Coagulase (+) *staphylococcus*	9	10.0	4	11.1
Streptococcus pneumoniae	9	10.0	3	8.3
Klebsiella pneumoniae	4	4.4	2	5.5
Group A hemolytic *Streptococcus*	2	2.2	2	5.5
Enterecoccus gallinorum	3	3.3	–	–
Haemophilus parainfluenza	3	3.3	1	2.7
Haemophilus influenza	3	3.3	2	5.5
Klebsiella oxytoca	3	3.3	1	2.7
Streptococcus bovis (Group D nonenterococci)	3	3.3	–	–
Pseudomonas aeroginosa	3	3.3	–	–
Anaerobic				
Bacteroides fragilis	9	10	–	–
Fusobacterium spp.	3	3.3	–	–
Gram positive coccus	6	6.6	–	–
Total	90	100	36	100

DISCUSSION

Any kind of inflammatory process that is present in the nasal cavity and the nasopharynx can affect the sinuses as well. For this reason, the information regarding the normal nasal and paranasal flora is of importance in evaluating the microbiology of acute and chronic sinusitis. In the aim of identifying the microbiology of acute and chronic sinusitis, maxillary sinuses have always been a priority target because of easy access. As maxillary sinuses are easily accessible, the problem of contamination is not commonly experienced while obtaining a culture. However, obtaining culture from the ethmoid sinuses without contamination is difficult even in operation room conditions. In order to minimize the risk of contamination, we cleansed the nasal passage with povidone-iodine solution before the operation. We obtained nasal smear cultures before and after applying povidone-iodine solution. Coagulase (-) *staphylococci* that is found in 40-100% of the normal flora of the nasal passage, was present in 50% of the cultures obtained before applying povidone-iodine solution. Coagulase (+) *staphylococci* is found in 25-40% of nasal flora.[5,11] In our study, Coagulase (+) *staphylococci* was present in 37.5% of the cultures obtained before applying povidone-iodine solution. In the nasal smear cultures obtained from chronic sinusitis patients before applying povidone-iodine solution, the rate of microorganism identification was 62.3%, following the application of povidone-iodine solution this was reduced to 12.9% and there was no growth of diphyteroids which are found in 90-100% of the normal flora in our study, these all show us that contamination was prevented to a great extent.

The studies investigating the microorganisms causing chronic sinusitis produced diverse results. Many researchers reported most commonly identified microorganisms isolated from mucosal biopsies and/or aspiration material obtained from maxillary and ethmoid sinus as Coagulase (-) *staphylococci* (CNS), *Staphylococcus aereus*, *Streptococcus pneumo-*

TABLE II

ANTIBIOTIC SENSITIVITIES OF *STREPTOCOCCUS PNEUMONIAE*, *VIRIDANS STREPTOCOCCUS*, GAHS STRAINS ISOLATED FROM MAXILLARY AND ETHMOID SINUSES

Antibiotic	*Streptococcus pneumoniae*						*Viridans streptococcus*						GABHS					
	Sensitive		Less sensitive		Resistant		Sensitive		Less sensitive		Resistant		Sensitive		Less sensitive		Resistant	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Oxacilline	9	75	–	–	3	25	5	23.8	12	57.1	4	19.04	4	100	–	–	–	–
Ofloxacine	12	100	–	–	–	–	21	100	–	–	–	–	4	100	–	–	–	–
Trimetoprim/ sulphametoxazole	3	25	1	8.3	8	66.6	–	–	–	–	–	–	–	–	–	–	–	–
Eritromycin	5	41.6	2	16.6	5	41.6	13	61.9	4	19.04	4	19.04	–	–	2	50	2	50
Tetracycline	4	33.3	1	8.3	7	58.3	12	57.1	2	9.05	7	33.3	–	–	–	–	4	100
Chloramphenicol	8	66.6	–	–	4	33.3	16	76.2	–	–	5	23.8	1	25	1	25	2	50
Cephtriaxone	11	91.6	–	–	1	8.3	18	85.4	1	4.7	2	9.05	4	100	–	–	–	–
Cefepime	11	91.6	1	8.3	–	–	20	95.3	1	4.7	–	–	4	100	–	–	–	–
Rifampin	9	75	1	8.3	2	16.6	–	–	–	–	–	–	–	–	–	–	–	–
Vancomycin	12	100	–	–	–	–	21	100	–	–	–	–	4	100	–	–	–	–

nia, *Viridans streptococci* and diphyteroid bacilli.[4,5] In our study most commonly identified microorganism was CNS (32.2%) followed by *Viridans streptococci* (22.5%), Coagulase (+) *staphylococci*, *Streptococcus pneumonia*, *Klebsiella pneumoniae* and GAHS.

The frequency of anaerobic microorganisms in chronic sinusitis changes between 0-100%.[5,11] These different results might be related to the differences in obtaining cultures, age of the patient, duration of the disease, the utilization of antibiotics before the operation, the sinus from which the culture has been obtained, the method of transport for the culture, and the delays experienced between the time the culture has been obtained and the time it has been inoculated to a culture environment. However, the fact that the techniques utilized in the sampling differ from each other, can only partially explain the problem of finding different percentages for microorganisms in different studies.[12] Brook[13] reported the percentage of anaerobic bacteria as 88%, while Almadori et al.[4] reported it as 36% and Doyle and Woodham[5] did not report any anaerobic bacteria at all. The most commonly isolated anaerobic bacteria in order of appearance were gram positive cocci and *Bacteroides strains*. In our study we identified the percentage of anaerobic bacteria as 20% for maxillary sinus. We could not isolate anaerobic bacteria from ethmoid sinuses. The anaerobic bacteria that were isolated were: *Bacteroides fragilis* 13.3%, gram *fusobacterium spp.* 3.3%, gram positive cocci 6.6%.

In recent studies, it was reported that there was relation between fungies and chronic sinusitis.[14,15] In our study, fungies were detected in none of the samples. This situation might be related to changes in nasal flora because of cleaning the nasal mucosa, skin and surrounding structures with povidon iodin solution before surgical interventions, in order to prevent the possible contamination.

In the pathogenesis of chronic sinusitis, the term pathogen for the microorganisms like CNS, *Viridans streptococci* and anaerobic strains is still controversial. However, Brook[13] and Karma[16] accepted these agents as pathogens in the pathogenesis of chronic sinusitis.

Guiot et al.[17] conducted a study with the aim of identifying the frequency of penicillin resistant *Viridans streptococci* in healthy children and children with hematological diseases; in 50 healthy children they identified a 40% carrier rate for penicillin resistant *Viridans streptococci*, whereas this was 63% for children with hematological diseases and 10% for adults. Potgieter et al.[18] investigated the antibiotic

sensitivity of 211 *Viridans streptococci* isolated from blood cultures with MIC test; 38% of the isolates were resistant to penicillin whereas 41% were resistant to tetracycline. All the strains that were examined were sensitive to cephalosporins and vancomycin. Doern et al.[19] examined a total of 352 *Viridans streptococci* that were isolated from blood cultures at 43 medical centers during a time period of two years, of these 13.4% had high degree and 42.9% had partial resistance to penicillin which added to a total of 56.3%.

In our study we isolated 21 *Viridans streptococci*, of these 33.35% were resistant to tetracyclines, 23.8% to chloramphenicol and 19.04% to penicillin, while all the isolated strains were sensitive to vancomycin. In the effort to prevent the failures experienced in the treatment of *Viridans streptococci* related infections, we have to identify carrier status, conduct epidemiological studies to this end and to demonstrate multiple antibiotic resistance in a clear manner.

Today, penicillins are still used as the most effective medication against GAHS. In patients with penicillin allergy, the first choice is eritromycin. In cases who are not responding to treatment, antimicrobial agents like ampicillin- sulbactam or amoxicillin-clavulonic acid and cephalosporins can be used. Resistance to beta lactamase antibiotics is an important health problem. In our study, the four GAHS strains that were all sensitive to penicillin, oflaxocin, ceftriaxone, cefepime and vancomycin were 50% resistant to eritromycin and chloramphenicol and 100% resistant to tetracycline. For public health and treatment purposes, the isolation of GAHS, investigating their antibiotic resistance patterns, identification of carriers and reducing their numbers is very important. In the treatment of GAHS penicillin continues to be the first choice. However, it should be kept in mind that resistance states can occur and these should certainly be reported to the clinicians. Although this resistance is not at a level that would create any concern for the moment, it should be closely monitored and treatment guidelines should be developed accordingly. We believe that antibiotics should not be administered before having culture-antibiogram results and correct antibiotics should be chosen.

In the treatment of pneumococcal infections, the antibiotic that should be given as a first choice is penicillin. The studies that have been conducted report that there is an increasing resistance to penicillin throughout the years. Resistance has especially increased during the last 20 years. Starting from 1980 onwards, the resistance rates have reached 40% in Spain, 58% in Hungary, 48% in France, 15.5% in USA and 14.4% in South Africa, and different rates are being reported for various geographical locations.[20,21] With the evolution of penicillin resistant pneumococci, the problem of resistance to other antibiotics has become an issue as well.[20,21] Perez-Trallero et al.,[21] reported eritromycin resistance as 7.9% in *Streptococcus pneumoniae* strains. Geslin et al.[22] reported that *Streptococcus pneumoniae* strains have 20% resistance to tetracycline, 9% to chloramphenicol and 26% to eritromycin. In our study the resistance pattern of the isolated *Streptococcus pneumoniae* strains were as follows: 25% to penicillin, 66.6% to trimetoprim/sulphometaxazole, 41.6% to eritromycin, 58.3% to tetracycline, 33.3% to chloramphenicol and 16.6% to rifampin. The success in the treatment of *Streptococcus pneumoniae* infections depends on the isolation of the causative agent. Today we have limited choices in the treatment of infections caused by penicillin resistant pneumococci. To this end, we need the development of new antibiotics that can reach high concentrations in the tissue while not bringing about resistance while being used in the treatment of penicillin resistant pneumococci that might occur. Additionally, the identification of the strains that are resistant to penicillin and other antibiotics is an important tool in our aim to strengthen the empirical treatment used in clinical practice.

Nowadays, the treatment of chronic sinusitis is in the type of empirical treatment directed at most commonly found bacteria. However, the fact that we have resistant strains and that there are differences in the microbiological spectrum responsible from the etiology, necessitates the identification of causative agent and performing antibiotic sensitivity tests when possible.

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