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Original Article

Microbiology and antimicrobial resistance in chronic resistant rhino sinusitis with or without polyp after functional endoscopic sinus surgery

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ABSTRACT

***Background*:** The purpose of this study was microbiology of chronic resistant rhino sinusitis with or without nasal polyp in patients undergoing functional endoscopic sinus surgery and antimicrobial resistance testing.

***Patients and Methods*:** In a cross-sectional study during December 2000 to June 2002, 94 CRS patients with or without nasal polyp were sampled through FESS for microbiology culture and In-vivo antimicrobial resistance was tested in both groups.

***Results*:** In CRS group with polyps (42 patients), the most common isolated organisms were Staph. coagulase-negative (26.2%), Staph. areous (23.8%), E-Coli (16.7%), Klebsiella (14.3%) and Enterobacter (7.1%). In CRS group without polyps (52 patients), the most common isolated organisms were Staph. coagulase-negative (25%), Staph. areous (11.5%), Klebsiella (9.6%), E-Coli (7.7%) and Strep. Non-group A (7.7%). Normal flora grew in 5 cultures (9.6%). In only one culture of CRS group without polyp, Pseudomonas was isolated. No resistance was reported from gram-positive bacteria against vancomycin and gram-negative rods were sensitive to ciprofloxacin, ceftriaxon and ceftizoxim.

***Conclusion*:** Despite of some previous studies, the most common micro- organisms in the cultures of CRS cases, regardless of having nasal polyps or not, were Staph. coagulase-negative, Staph. aureus and gram-negative rods, respectively. The incidence of GNRs in CRS group with nasal polyps is higher which may lead to special antibiotic therapy in them. Increasing In Vivo resistance of these bacteria to antibiotics is problematic and the routine old antimicrobial therapy may not be effective enough to control these pathogens and avoid surgical therapy. However, In Vivo evaluations are recommended to reveal a better interpretation.

Key words: Chronic Resistant Rhino Sinusitis-Polyp-Endoscopic Sinus Surgery

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The etiology of chronic rhinosinusitis (CRS) isn't well known while bacterial infection is believed to be a major factor in CRS development with or without nasal polyps. So, the antibacterial therapy remains the base of its treatment for many physicians, in spite of different interpretation of literatures for guidelines in antimicrobial selection.

The increasing bacterial resistance in acute rhinosinusitis has been well described [1], but its prevalence and importance in CRS is not well understood and requires more investigation. Hsu et al reported higher antimicrobial resistance in isolated staphylococcus coagulase negative (SCN), Pseudomonas, and other staphylococci in patients with CRS [2]. The prevalence of SCN, Staph aureus, and gram- negative rods have increased [2,3,4], since the reported incidence of SCN in CRS is 0- 60% of cultures, mainly considered as a contaminant and due to inappropriate antibiotic therapy [2,3,5]. Our data on resistance and prevalence is limited and a deeper understanding of them is critical for rhinologists to move from an empiric decision-making process to a more evidence–based or culture–directed therapy paradigm. Unfortunately, the rule of nasal polyps on the microbiology, colonization of pathogens and antimicrobial resistance patterns of CRS isn't accepted or studied yet.

The purpose of this study was microbiologic and In-Vivo antimicrobial resistance evaluation through functional endoscopic sinus surgery (FESS) in CRS patients with or without polyps.

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Subjects and Methods

A cross-sectional study was arranged on 94 CRS patients (42 cases with nasal polyps and 52 cases without any polyp) via FESS from December 2000 to June 2002. Only those patients older than 15 +- `years were included. All patients had failed maximal medical therapy, which typically included extended courses of oral antibiotics, topical and systemic Corticosteroid therapy, saline irrigation, and various oral decongestants with mucolytics. Topical and intravenous antibiotic-therapy was used in selected patient. Nasal preparation consisted of topical 0.25% phenylephrine before induction of general anesthesia.

We attempted to follow one consistent reproducible technique for brushing specimens via an endoscopic technique and sterilizing the nasal cavity in all cases of both groups undergone endoscopic sinus surgery.

If mucopurulent secretions were encountered during the surgical dissection, sterile cotton–tipped applicator was used at the orifice of infandibulom to obtain specimen.

The polyps were brushed for biopsy. All specimens were sent for aerobic, anaerobic and fungal cultures, the type of isolated organisms and In-vitro antibiotic sensitivity. Finally, resistance or sensitivity to ampicillin, cefazolin, cefalothin, ceftizoxim, ceftriaxon, co-trimoxasol, gentamycin, amikacin, vancomycin, penicillin-G and ciprofloxacin were tested.

The data statistically analyzed for each organism or group using unpaired two-tailed t-test.

Results

Totally 94 cultures and 86 isolations were obtained. The characteristics of 94 cases with CRS have listed in Table 1.

Table 1: The characteristics of 94 cases with chronic rhino sinusitis (CRS)

	CRS with nasal polyps				CRS without nasal polyps			
Sex / Age	Male	%	Female	%	Male	%	Female	%
15-19	0	0	2	4.76	5	9.61	2	3.85
20-24	5	11.91	3	7.14	1	1.92	3	5.77
25-29	3	7.14	2	4.76	2	3.85	2	3.85
30-34	3	7.14	1	2.38	5	9.61	4	7.7
35-39	3	7.14	1	2.38	4	7.7	1	1.92
40-44	2	4.76	2	4.76	1	1.92	3	5.77
45-49	2	4.76	2	4.76	3	5.77	1	1.92
50-54	3	7.14	0	0	3	5.77	2	3.85
55-59	2	4.76	1	2.38	-0	0	3	5.77
60-64	1	2.38	0	0	1	1.92	-0	0
>64	2	4.76	2	4.76	1	1.92	5	9.61
Total	26	61.9	16	38.09	26	50	26	50

After excluding normal flora (5 cultures in both groups) and no growth (5 cultures in CRS without polyps), 84 (89.3%) positive cultures were remained. The number of isolated organisms per culture ranged from 0 to 2, although the majority produced single isolation.

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Among 42 cases of CRS with polyp, 40 cultures revealed single positive isolation and only 2 cultures had normal flora. Isolated organisms in CRS with polyp have listed in Table 2.

Table 2: Microorganisms incidence in chronic rhino sinusitis with polyp

Gender / Isolation	Male	(%)	Female	(%)	Summation	(%)
Normal	1	2.38	1	2.38	2	4.76
E-Coli	4	9.52	3	7.14	7	16.67
SCN	8	19	3	7.14	11	26.2
S. Aureus	6	14.3	4	9.52	10	23.8
Klebsielleae	4	9.52	3	7.14	6	14.3
Enterobacter	1	2.38	2	4.76	3	7.14
Citrobacter	2	4.76	-	0	2	4.76
Total	26	61.9	16	38.09	42	100

S=staphylococci CN=coagulas-negative

The most common isolated organisms were Staph. coagulase-negative (26.2%), Staph. Aureus (23.8%), E-Coli (16.7%), Klebsiella (14.3%) and Enterobacter (7.1%).

In 52 cases of CRS without polyp, 44 positive cultures, 5 negative cultures and 3 cultures with normal flora was resulted. Isolated organisms in CRS without polyp have listed in Table 3

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Table 3: Microorganisms incidence in chronic rhino sinusitis without polyp

Gender / Isolation	Male	(%)	Female	(%)	Sum	(%)
SCN	6	11.54	7	13.46	13	25
S. Aureus	3	5.77	3	5.77	6	11.54
Strep. group A	-	0	2	3.85	2	3.85
Strep. Non-groupA	3	5.77	1	1.92	4	7.69
Pneumococcus	1	1.92	-	0	1	1.92
Klebsielleae	3	5.77	2	3.85	5	9.62
E-Coli	2	3.85	2	3.85	4	7.7
Citrobacter	1	1.92	-	0	1	1.92
Enterobacter	1	1.92	1	1.92	2	3.85
Pseudomonas	1	1.92	-	0	1	1.92
Mucor	-	0	2	3.85	2	3.85
Mixed	2	3.85	1	1.92	3	5.77
Normal Flora	*1*	*1.92*	*2*	*3.85*	3	*5.77*
No Growth	*2*	*3.85*	*3*	*5.77*	5	*9.62*
Total	*26*	*50*	*26*	*50*	*52*	*100*

S=staphylococci CN=coagulas-negative

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The most common isolated organisms were Staph. coagulase-negative (25%), Staph. aureus (11.5%), Klebsiella (9.6%), E-Coli (7.7%) and Strep. non-group A (7.7%). Resistance or sensitivity to antibiotics in both groups has listed in Tables 4 and 5.

Table 4: The antibiograms for Staph. coagulas-negative, Staph. aureus and E-Coli

Organism / Antibiotic	Staph. coagulas-negative			Staph. Aureus			E-Coli		
	S	R	I	S	R	I	S	R	I
Ciprofloxacin	8	1	-	7	2	-	7	-	-
Ceftizoxim	5	4	1	5	4	-	7	-	-
Ceftriaxon	4	2	2	7	2	-	6	-	-
Cefazolin	10	1	-	8	1	-	3	2	-
Cefalothin	5	1	-	3	2	-	-	-	-
Co-trimoxasol	-	-	-	-	-	-	5	2	-
Gentamycin	1	1	-	1	-	-	3	1	1
Amikacin	1	-	-	-	-	-	6	-	-
Vancomycin	11	-	-	10	-	-	-	-	-
Ampicillin	4	7	-	1	7	2	1	6	-
Penicillin-G	5	6	-	-	8	1	-	-	-

S= sensitive R= resistant I= intermediate

Discussion

The etiology of CRS is unclear or at least multifactorial[4]. Many researchers suggest change in pathogenic flora by nasal polyps however; others believe that the change in pathogens or antimicrobial resistances is typically due to inappropriate antibiotic therapy[1,2,4]. The role of bacterial infection in pathophysiology and management of CRS is the most controversial issue.

Staph. coagulase-negative (SCN)varies in CRS incidenceally, mainly considered as a contamination [2,3,5,6], but some authors have recently proposed that it is an important pathogen in CRS [7,8]. By using nasal endoscopic assistance for culture, Hsu et al [2], Nadel et al [3] and Bolger [9] found SCN in 42%, 35% and 17% of isolations, respectively. In the Nadel study, SCN prevalence was higher in specimens obtained in operating room where the risk of contamination may by greater [3].

The SCN (the most common isolated organism) was positive in 26.2% and 25% of first and second group, respectively. This study confirms the previously reported high prevalence of SCN as a pathogen in CRS. So, when SCN is isolated in the setting of mucopurulence and represents a single isolation on culture, its role as a pathogen should be considered [2,3,4]. We isolated Staph. aureus from 19% of cultures since; Hsu, Bolger and Nadel have reported it in 12%, 19% and 23% of cultures [2,3,9].

Bolger isolated GNR enteric bacteria in 34% of cultures [9]. In Nadel study, 27% of cultures revealed GNRs, especially in patients with a history of sinus surgery with nasal irrigations [3]. In both studies, P. aeruginosa was the most common GNR isolation [3,9]. Hsu et al found GNRs in 32% of isolations and 44% of total cultures [2]. Bhattacharyya and Kepnes looked for microbiology of CRS in symptomatic patients after FESS and found GNRs in 15% of isolations [10]. Recently, Kingdom et al have found GNR's in 20% of isolations [4].

Our overall data (38% of isolations and 34% of total cultures) reveal a slightly higher incidence of GNR's, but it is in general agreement with these studies.

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We found lower incidence of P. aeruginosa (1.1% of isolations) which seems not to be an important pathogen for CRS in Iran. Interestingly, we found a higher incidence of GNR's in CRS with nasal polyps that may lead to some special antibiotics therapy in them.

Bhattacharyya and Kepnes reported high rates of antibiotic resistance for SCN (cefazolin 63%, oxacillin 82%, and quinolone 38%) and P. aeruginosa (quinolone 32%). In addition, they found resistant to multiple antibiotics in 14% of all isolated organisms [10]. Kingdom et al found a surprisingly high rate of quinolone resistance for SCN and S.aureus (21% for each of them). They also found a high rate of quinolone (27% of patients) and aminoglycoside (36% of patients) resistance for P. aeruginosa [4]. We found lower rates of resistance among the more common isolations; only 11.1% of SCN and 22.2% of S. aureus were fluoroquinolone resistant.

In our study, gram-positive bacteria were sensitive to vancomycin and the sensitivity to ciprofloxacin, ceftriaxon and ceftizoxim between the GNR's was a rule.

Adjunctive medical therapy or concurrent antibiotic therapy had not controlled between two groups, our sample size was small and their impact cannot be easily measured, but these trends highlight the growing resistance issue facing the rhinologists treating CRS.

Conclusion

The most common microorganisms in our cultures were SCN, S. aureus and GNR's, respectively and SCN is an important pathogen. The incidence of S. aureus and GNRs is higher in CRS group with polyp, but the incidence of SCN between groups is nearly equal.

Pseudomonas was found only in one culture of CRS patients without polyps (1.1%).

The characteristics of most common isolations are in agreement with most recently published studies, but our data do not show a high level of antibiotic resistance for the most common isolations found in CRS. Culture –directed therapy can be the gold standard; however, antibiotic selection is often empiric. When antibiotic therapy is indicated in the management of CRS, these trends in the antimicrobial resistance should be considered to cover common causative organisms.

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