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Chronic Tonsillitis: A Comparative Study of the Causative Organism Cultured Through Throat Swab vs. Core Culture and Biopsy of the Tonsillectomy Specimen

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Abstract: ***Background: The current study was undertaken with the objective to compare the growth pattern of organisms and antibiotic sensitivity of the cultures on the surface and core of the tonsil and to do histo-pathological examination of the tonsillectomy specimen and compare. Materials and methods: This prospective study was carried out in the Department of Otorhinolaryngology, Shadan Institute of Medical Sciences, Hyderabad over a period of 11/2 years from October 2012 to March 2014. 30 patients of all age groups and both the sexes admitted for tonsillectomy for various indications were selected for the study. Results and conclusion: This study proves that there are differences between the results of the surface and core tonsillar bacteriology. Rational therapy against tonsillar core pathogens include antibiotics directed against Staphylococcus Aureus, Streptococcus Pneumoniae,Pseudomonas aeruginosa like gentamycin, amikacin and ciprofloxacin. Our study has shown the imperative of continuous surveillance and antimicrobial susceptibility generally and in particular of tonsillar material for early detection of emerging resistance trends and adjustment and usage of appropriate therapeutic interventions.***

Keywords: Tonsil, surface, core, culture, specimen

1. Introduction

Tonsils are important components of the immune system and their infections are very frequent. Tonsils are immunologically more active in the first years of life[1]. During aging, whereas lymphoid tissue regresses, sub epithelial tissue changes into fibrotic tissue and crypts alter into cavities filled with keratin. In case of infection, bacteria that inhabit the crypts spread into the tonsil and leave their toxins and other products in it, eventually leading to polymorphponuclear leukocyte infiltration, swelling, necrosis and surface ulceration in tonsils. Consequently, after acute infection, bacteria may inoculate into the core[2]. These infections are highly frequent especially in childhood. Although antibiotic therapy may be sufficient in the treatment of acute tonsillitis, tonsillectomy remains the treatment of choice in the management of recurrent and chronic tonsillitis. In recurrent tonsillitis; the goal of the treatment is to eradicate the bacteria that cause infection. Inappropriate antibiotic therapy against the pathogen in deep tissue or inadequate antibiotic levels in the tonsillar tissue leads to the continuation of the infection and the re inoculation of the surface[3]. The results of antibiotic susceptibility tests for microorganisms isolated from tonsillar surface swab cultures are determinative, both in the selection of antibiotics and in prophylaxis. On the other hand, some studies have reported that bacteria causing tonsillitis inhabit not only the tonsillar surface but also the tonsillar deep tissue. Consequently, the antibiotic treatment may sometimes be unsuccessful, although it is chosen according to the results of the cultures taken from the tonsillar surfaces. Because the tonsillar surface is contaminated with oropharyngeal secretions, it generally shows normal flora of the oropharynx. Oropharyngeal flora contains aerobic and anaerobic bacteria, including *alpha-hemolytic* and *nonhemolytic streptococci*, *coagulase negative staphylococci*, *neisseriae*, *corynebacteria*, *actinomyces*, *leptotrichiae and fusobacterium* species. Bacterial agents such as *Group A Beta hemolytic streptococci*, *staphylococcus aureus*, *hemophilus influenza*, *streptococcus pneumonia*, *corynebacterium diptheriae* and *neisseria gonorrhea* are the main causes of tonsillitis[4].Today medical therapy is the first step in the mana.gement of recurrent tonsillitis and surgical treatment is reserved for inevitably carried out in cases in which medical treatment fails.

2. Objectives

1) To obtain throat swab culture and sensitivity in patients presenting with recurrent/chronic tonsillitis.
2) To obtain core culture and sensitivity of the tonsillectomy specimen.
3) To compare the growth pattern of organisms and antibiotic sensitivity of the cultures.
4) To do histo-pathological examination of the tonsillectomy specimen and compare.

3. Methodology

The present study was carried out in the Department of Otorhinolaryngology, Shadan Institute of Medical Sciences, Hyderabad over a period of 11/2 years from October 2012

to March 2014. 30 patients of all age groups and both the sexes admitted for tonsillectomy for various indications were selected for the study. It is a prospective study.

Inclusion criteria: All patients admitted to the hospital wards in SIMS for tonsillectomy for Recurrent/chronic tonsillitis or Tonsils with obstructive symptoms.

Exclusion criteria: HIV/Immuno compromised, Patients on antibiotics within the past 3 weeks, Patients undergoing tonsillectomy for reasons other than recurrent/chronic tonsillitis or for tonsils with obstructive symptoms.

Method of collection of data: A proforma was filled for each patient documenting age, sex, address and clinical information, including chief complaints and duration of symptoms. Following this a detailed Otorhinolaryngological and general physical examination was done. Investigations including Hb%, bleeding time, clotting time, HIV and urine routine examination were done for all patients prior to surgery.

Method of collection of culture specimens: Tonsillar surface swab was taken for all cases of chronic tonsillitis posted for Tonsillectomy before commencement of antibiotic therapy. Swab was collected by rotating a sterile cotton swab over the surface of the tonsils without touching other parts of the oropharynx. It was placed in sterile test tube and transported to microbiology lab. All patients underwent tonsillectomy by dissection and snare method. Excised tonsils were placed in normal saline. The tissue was taken from the core using aseptic precautions. The tonsils were cut with a sterile blade and with another sterile blade only the core was extracted in a wedge shaped manner, innoculated and cultured in aerobic media for a period of 7 – 48 hours. The tonsils were then subjected to histo-pathological examination.

The entire data was anlaysed and stastical tests were applied as and when appropriate.

4. Obseravations & Results:

In this study of total 30 patients, 14(46.6%) patients were male and 16(53.3%) patients were female. Male to female ratio is 1:1.14(Table:1).The minimum age is 6 years and maximum is 29years. The mean age being13.3years.

Table 1: Male: Female Ratio

Male	*Female*
1	1.14

The most common complaint seen in 90% of patients was difficulty in swallowing, 86.6% had sore throat, 66.6% had fever, 56.6% had history of snoring, 46.6% had mouth breathing, 13.3% had cough and 10% complained of ear pain(Fig:1).

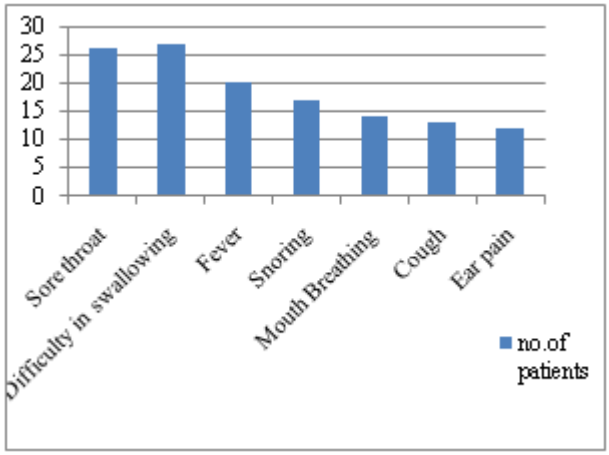

Figure 1: Frequency of complaints

Highest number of patients that is 16 out of 30 (53.3%) had grade 3 hypertrophy, followed by 30% of patients with grade 2 ,13.3% with grade 4 and only 3.3% had grade 1 tonsillar hypertrophy(Table:2).

Table 2: Tonsillar Hypertrophy

Hypertrophy	*No. Of patients*
Grade 1	1
Grade 2	9
Grade 3	16
Grade 4	4

On comparing the culture results of throat swab and tonsillar core regarding the type of isolated organism, core culture revealed pathogenic organisms in 66.6%(20) of studied cases while throat swab detected pathogenic organisms in 36.6% (11) of cases.

Throat swab revealed growth of normal flora in 63.3% (19 cases) verses 33.3% (10cases)in tonsil core. Both tonsil surface and core yielded normal flora in 26.6% (8) cases.

Out of the 22 cases yielding pathogens, 36.3% (8cases) had same pathogen in both throat swab and tonsil core .50%(11 cases)had normal flora on the surface with pathogen present in the core.9%(2 cases)had pathogen present in the surface and normal flora in the core and 4.5%(1 case) had different pathogens in the surface and core(Table:3).

Table 3: Distribution of Organisms Isolated From the Tonsillar Surface and Core Tissue Cultures

Tonsillar surface	*Tonsillar core*	*Number of patients*	%
Normal flora	Normal flora	8	26.6%
Normal flora	Pathogen present	11	36.6%
Pathogen present	Pathogen present (same)	8	26.6%
Pathogen present	Pathogen present (differ)	1	3.33%
Pathogen present	Normal flora	2	6.66%

Sensitivity=12.10%Specificity=33.3%Positivepredictivevalue=80%

Of the 22 cases yielding pathogen, Staphylococcus Aureus was found in 27.2%(6 cases), Streptococcus pneumonia in 18.1%(4cases), Klebsiella pneumonia in 13.6% (3cases), GABHS in 13.6% (3 cases), Pseudomonas aeruginosa in 9%(2 cases), E.Coli in 9%(2 cases), Candida in 9%(2 cases) and Haemophilus influenza in 4.5%(1 case).

Table 4: Organisms Isolated from Throat Swab and Tonsil Core

Organism	*Tonsil Swab only*	*Tonsil Swab and Core*	*Tonsil Core only*	*No. of cases*	*% of cases*
Straphyococcus Aureus	1	3	2	6	27.2%
Streptococcus pneumoniae	1	1	2	4	18.1%
Pseudomonas aeruginosa	0	1	1	2	9%
Klebsiella pneumoniae	0	1	2	3	13.6%
Group A beta haemolytic streptococci	0	1	2	3	13.6%
E.coli	0	1	1	2	9%
Haemophilus influenza	1	0	0	1	4.5%
Candida albicans	0	0	2	2	9%

The bacteria isolated according to prevalence in decreasing order of frequency were Staphylococcus Aureus, followed by Streptococcus pneumonia, Klebsiella pneumonia, GABHS, Pseudomonas aeruginosa, Escherichia coli, and Haemophilus influenza. All the organisms were isolated in more numbers from the tonsillar core when compared to surface(Fig:2).

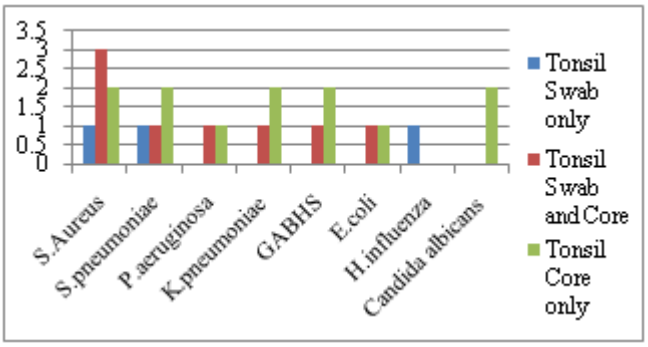

Figure 2:

Most of the staphylococcus aureus isolates are sensitive to gentamycin and amikacin and resistant to cefuroxime and roxythromycin. Most Streptococcus pneumonia are sensitive to ampiclox, amikacin and cefuroxime and resistant to cefadroxil. Most GABHS are sensitive to ampiclox and sparfloxacin and resistant to roxythromycin and cefotaxim(Fig:3),(Table:7).

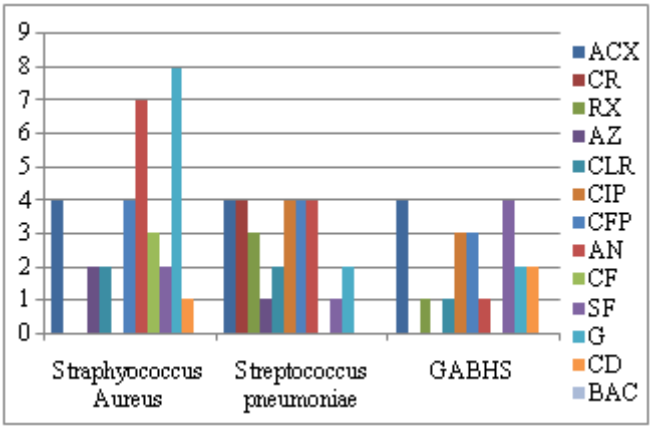

Figure 3: Drug Sensitivity of Gram Positive Bacteria

Most of the Pseudomonas aeruginosa isolates are sensitive to ciprofloxacin and cefperazone and resistant to cefadroxil. Most of the Klebsiella pneumonia are sensitive to ciprofloxacin, sparfloxacin, lomefloxacin and netilmycin and resistant to cefotaxim and sulbactum .Most of the E.Coli are sensitive to sparfloxacin and netilmycin and resistant to cefoperazone, cefotaxim and lomefloxacin. Haemophilus influenza is sensitive to ciprofloxacin and sparfloxacin and resistant to cefoperazone(Fig:4),(Table:7).

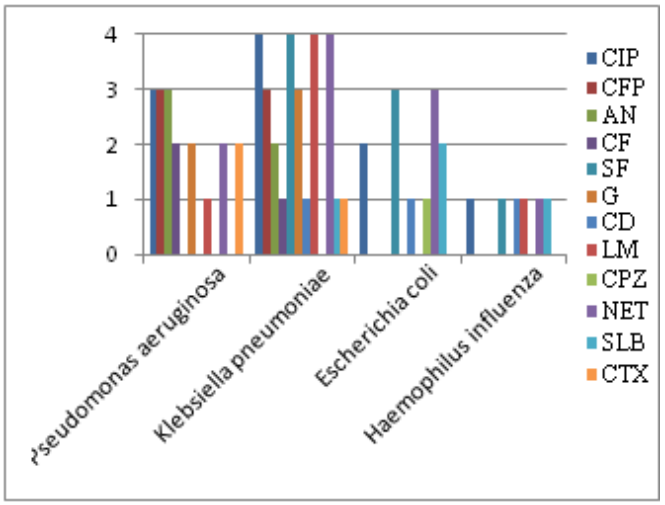

Figure 4: Drug Sensitivity Of Gramnegetive Bacteria

On histopathological examination 50% of the cases were chronic follicular type, 13.3% were chronic parenchymatous type and 6.6% were chronic fibrotic type(Table:6).

Table 6: Results of Histopathological Examination of the Tonsils

Pathological type	*No.of cases*
Follicular	15
Parenchymatous	13
Fibrotic	2

Table 7: Antibiotic Sensitivity Results of Pathogenic Isolates in the Current Study

	Straphyococcus Aureus			*Streptococcs pneumoniae*			*GABHS*			*Pseudomons aeruginosa*			*Klebsiella pneumoniae*			*Escherichia coli*			*Haemophils influenza*		
	S	**I**	**R**	**S**	**I**	**R**	**S**	**I**	**R**	**S**	**I**	**R**	**S**	**I**	**R**	**S**	**I**	**R**	**S**	**I**	**R**
Ampiclox	4	-	5	4	-	1	4	-	-												
Cefuroxime	-	1	8	4	1	-															
Roxiythromycin	-	1	8	3	2	-	1	1	2												
Azithromycon	2	1	6	1	2	2	-	3	1												
Clarithromycin	2	-	7	2	1	2	1	2	1												
Ciprofloxacin	-	2	7	4	1	-	3	1	-	3	-	-	4	-	-	2	-	1	1	-	-
Cefoperazone	4	3	2	4	1	-	3	1	-	3	-	-	3	1	-	-	-	3	-	-	1
Amikacin	7	1	1	4	1	-	1	3	-	3	-	-	2	2	-	-	1	2	-	1	-
Cefotaxim	3	3	3	-	3	2	-	2	2	2	1	-	1	-	3	-	-	3	-	1	-
Sparfloxacin	2	6	1	1	3	1	4	-	-	-	3	-	4	-	-	3	-	-	1	-	-
Gentamycin	8	1	-	2	2	1	2	1	1	2	1	-	3	1	-	-	2	1	-	1	-
Cefdadroxil	1	4	4	-	2	3	2	2	-	-	-	3	1	2	1	1	-	2	1	-	-
Lomefloxacin										1	-	2	4	-	-	-	-	3	1	-	-
Ceptazidime										-	2	1				1	2	-	-	1	-
Netilmycin										2	-	1	4	1	1	3	-	-	1	-	-
Sulbactum													1	1	3	2	1	-	1	-	-
Cceftriaxone										2	-	1	1	2	2	-	3	-	-	1	-
Bacitacin								2	2												

5. Discussion

The pathogenesis of infectious/inflammatory disease in the tonsils most likely has its basis in their anatomic location and their inherent function as organ of immunity, processing infectious material, and other antigens and then becoming, paradoxically, a focus of infection/ inflammation. No single theory of pathogenesis has yet been accepted, however viral infection with secondary bacterial invasion may be one mechanism of the initiation of chronic disease, but the effects of the environment, host factors, the widespread use of antibiotics, ecological considerations, and diet all may play a role.

Tonsillitis can be classified into[5]: Acute tonsillitis, Recurrent tonsillitis, Chronic tonsillitis: chronic follicular, chronic parenchymatous and chronic fibrotic tonsillitis. Several pieces of direct and indirect evidence indicate that the palatine tonsils are continuously engaged in local immune responses to microorganisms. If the tonsillar lymphocytes became overwhelmed with this persistent stimulation they may be unable to respond to other antigens; the immunological response, particularly in recurrent tonsillitis, may then be impaired.

Once this immunological impairment occurs, the tonsil is no longer able to function adequately in local protection nor can it appropriately reinforce the immune system of the upper respiratory tract.As a norm, all cases that presented with acute/recurrent/chronic tonsillitis, a throat swab is the first line of management. Normal bacterial flora present in the oral cavity and oropharynx may be cultured in most cases and antibiotic therapy was instituted based on the results obtained from the cultures grown by the throat swab.

Several studies have disapproved this theory. Studies done by different authors have stated that pathogens found in the tonsillar surface vary from those found in the tonsillar core and antibiotic therapy should be targeted towards the pathogens that are found in the core in cases of recurrent/chronic tonsillitis[6,7,8].

In this study the male to female ratio was 1:1.4 in comparison to Abhay Kumar et al[9] where it was 1.6;1. Bista.M et al[10] showed 1.7:1, Mustafa Gul et al[11] showed a ratio of 1.18:1. In Salman Mutiullah Shaikh et al[12] the ratio was 1:1.7 , Babaiwa U. F et al[13] showed a ratio of 1.14 :1,Abdelaziz.M.E et al[14] showed 1:1.07 and Agarwal.A et al[15] had 1.3:1. The mean age in our study is 13.3yr in comparison Abhay Kumar et al[9] revealed a mean age of 10-15 yr. In contrast Mustafa Gul et al[11] had the mean age of $12.5^{\pm}6.4$yr . Salman Mutiullah Shaikh et al[12] showed a mean age of $13.04^{\pm}6.47$yr, BabaiwaU.F et al[13] showed a mean age of 6 yr, Abdelaziz.M.E et al[14] had 2-9yr and Agarwal.A et al[15] had 11-20yr.

Table 8: Comparing the age and sex distribution

S.No	*Study*	*Male: Female ratio*	*Age mean/range*
1	Abhay Kumar et al[9]	1.6:1	10-15 yr
2	Mustafa Gul et al[11]	1.18:1	$12.5^{\pm}6.4$ yr
3	Salman Mutiullah S. et al[12]	1:1.7	$13.04^{\pm}6.47$ yr
4	BabaiwaU.F et al[13]	1.4:1	6 yr
5	Abdelaziz.M.E et al[14]	1:1.07	2-9 yr
6	Agarwal.A et al[15]	1.3:1	11-20 yr
7	Present study	1:1.4	13.3 yr

In our study discrepancy between the organisms obtained from surface and core cultures simultaneously was seen in maximum number of cases. Abhay Kumar et al[9], Mustafa Gul et al[11], Salman Mutiullah Shaikh et al[12], BabaiwaU.F et al[13] , bdelaziz.M.E et al[14] and Agarwal.A et al[15] showed similar results.

The most common organism isolated in our study from both surface and core is Staphylococcus Aureus(27.2%) followed by Streptococcus Pneumoniae(18.1%). In Abhay Kumar et al[9] it was Staphylococcus Aureus followed by GABHS.Bista M et al[10] showed Streptpcoccus viridians and Streptococcus

Pneumoniae . In Mustafa Gul et al[11] most common organism was GABHS followed by Staphylococcus Aureus . In Salman Mutiullah Shaikh et al[12]the most common organism was Streptococcus Pneumoniae (86.56%) followed by Staphylococcus Aureus(47.76%).In Babaiwa U.F et al[13] the most common organism isolated was Staphylococcus Aureus (69%) followed by Streptococcus Pneumoniae (14%).In Abdelaziz.M.E et al[14] the most common organism was Staphylococcus Aureus (77.7%) followed by GABHS (18.5%) and in Agarwal.A et al[15] Streptococcus viridians and Branhamellacatarrhalis (71.13%)

In this study among the 73.3% pathogens a significant 54.54% were found only in tonsil core .Abhay Kumar et al[9]showed an overall variance in surface culture as to the presence or absence of core pathogens in 58% of cases. Mustafa Gul et al[11] found the difference to be 59.4%. Salman Mutiullah Shaikh et al[12]showed that among the 80.59% pathogens a significant 46.29% were found only in the tonsil core. In contrary the BabaiwaU.F et al[13] showed identical organism in both surface and core in maximum number of patients. Abdelaziz.M.E et al[14] showed variation in 62.5% cases and similarity in 37.5% and Agarwal.A et al[15] showed variation in surface and core organisms in 63.63% and similarity in 36.3%.

Table 8: Comparing the organisms cultured

S.No	*Study*	*Most common organism*	*% variation between surface and core*	*% identical between surface and core*
1	Abhay Kumar et al[9]	Staphylococcus Aureus	58%	12%
2	Mustafa Gul et al[11]	GABHS	59.4%	10.6%
3	SalmanMutiullahS etal[12]	Streptococcus Pneumoniae	57.5%	12.5%
4	BabaiwaU.F et al[13]	Staphylococcus Aureus	33.3%	66.6%
5	Abdelaziz.M.E et al[14]	Staphylococcus Aureus	62.5%	37.5%
6	Agarwal.A et al[15]	Streptococcus viridians	-	-
7	Present study	Staphylococcus Aureus	63.6%	36.4%

The susceptibility of the gram positive microorganisms isolated in this study showed that Staphylococcus Aureus is most susceptible to gentamycin and amikacin. Streptococcus Pneumoniae is susceptible to ampiclox and amikacin and GABHS is susceptible to ampiclox and sparfloxacin. BabaiwaU.F et al[13] showed that Staphylococcus Aureus is most susceptible to gentamycin and ciprofloxacin, Streptococcus species susceptible to ciprofloxacin and Cotrimoxazole. Abdelaziz.M.E et al[14] showed that Staphylococcus Aureus is most susceptible to Oxacillin and Cefpodoxime, GABHS is susceptible to Amoxycillin, Agarwal.A et al[15] showed that Staphylococcus Aureus is most susceptible to ciprofloxacin and GABHS is susceptible to Netilmycin.

Amongst the gram negative organisms cultured in our study Pseudomonas aeruginosa are sensitive to ciprofloxacin and cefperazone. Klebsiella pneumonia is more susceptible to ciprofloxacin and gentamycin. Haemophilus influenza for ciprofloxacin and sparfloxacin and E.Coli are mostly susceptible to sparfloxacinand netilmycin. This is in correlation with BabaiwaU.F et al[13] in which Pseudomonas aeruginosa showed highest susceptibility to ciprofloxacin and gentamycin. In Abdelaziz. M.E et al[14] gram negative organisms showed highest susceptibility to Cotrimoxazole, Amoxycillin, Cefpodoxime. In Agarwal.A et al[15] E.Coli are mostly susceptible to gentamycin, netilmycin and Pseudomonas aeruginosa are sensitive to ciprofloxacin and netilmycin.

This study showed that gentamycin, amikacin and ampiclox should be the treatment of choice for gram positive organisms, ciprofloxacin and sparfloxacin for the gram negative organisms (Table:9).

Table 9: Comparing antibiotic sensitivity of gram positive & gram negative organisms

S. No	*Study*	*Sensitivity of gram positive organisms*	*Sensitivity of gram negative organisms*
1	BabaiwaU.F et al[13]	Ciprofloxacin, Cotrimoxazole Gentamycin	Ciprofloxacin, Gentamycin
2	Abdelaziz.M.E et al[14]	Oxacillin, Amoxycillin, Cefpodoxime	Cotrimoxazole, Amoxycillin, Cefpodoxime
3	Agarwal.A et al[15]	Ciprofloxacin, Netilmycin	Ciprofloxacin, Gentamycin, Netilmycin
4	Present study	Amikacin, Gentamycin,	Ciprofloxacin, Sparfloxacin

On subjecting the tonsils for histopathological examination 50% of cases were of chronic follicular type,13.3% were of chronic parenchymatous type and 6.6% were of chronic fibrotic type. This study reveals throat swab sensitivity-12.10%, specificity-33.3 %, and positive predictive value-80% in diagnosis of chronic tonsillitis. Salman Mutiullah Shaikh et al[49] showed sensitivity 47.91 %, specificity 68.12 %, and positive predictive value 79.31%. Abdelaziz.M.E et al[14] al[49] showed sensitivity 38.9%, specificity 33.3%, and positive predictive value 63.6%.

The current study shows non-reliability of the throat swab in diagnosis of recurrent tonsillitis. This important agreement also revealed in other studies(Table:10).

Table10: Comparing the sensitivity, specificity and positive predictive values of tonsil surface swab.

S. No	*Study*	*Sensitivity*	*Specificity*	*Positive predictive value*
1	SalmanMutiullahS.etal[12]	47.91%	68.12%	79.31%
2	Abdelaziz.M.E et al[14]	38.9%	33.3%	63.6%
3	Present study	12.10%	33.3%	80%

6. Conclusion & Summary

In view of our study and other studies investigating tonsillar bacteriology, it is obvious that there are differences between the results of the surface culture and core culture. Thus if medical therapy is given only on the basis of tonsil surface

swab results, and if the therapy fails in some cases, then the antibiotic therapy should be revised. The results of this study indicate that rational therapy against tonsillar core pathogens include antibiotics directed against Staphylococcus Aureus, Streptococcus Pneumoniae, Pseudomonas aeruginosa like gentamycin, amikacin and ciprofloxacin.

As a result it can be said that tonsillar swab is not a very good predictor of tonsil core organisms. Our study has shown the imperative of continuous surveillance and antimicrobial susceptibility generally and in particular of tonsillar material for early detection of emerging resistance trends and adjustment and usage of appropriate therapeutic interventions.

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