



Research Article

Tonsillitis Index, recommendation for tonsillectomy in recurrent/chronic tonsillitis

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ABSTRACT

A prospective study was conducted on 57 patients. The aim of this study is to find out the concept of Tonsillitis Index as a clinical decision-making as a guide and indicator to recommend tonsillectomy in patients with recurrent/chronic tonsillitis.

Data were collected, including the disease history data, based on the evaluation of the severity of the recurrent tonsillitis and length of morbidity period. Microbiology reports of tonsillar surface swabs, tonsil core specimens and blood culture reports were collected. (Tonsillitis Index) to investigate whether there is a relationship between the disease history of recurrent /chronic tonsillitis and the macroscopic signs of sclerotic process in tonsils were evaluated. The statistical analysis of the study showed good correlation between tonsillitis Index score >25 and sclerotic tonsils. Being sensitive in 92.31%, specificity in 77.4% and positive likely hood ration of 4.00 and positive predictive value of 77.42%. The findings suggest that when the tonsils have deteriorated functionally and when the Tonsillitis Index score >35, the tonsils have deteriorated immunologically and the chance for resolution of recurrent / chronic infection is less likely to occur. Hence tonsillectomy is an appropriate surgical option.

KEYWORDS: Tonsillitis Index, Tonsil Surface, Tonsil Core Culture, Recurrent / Chronic Tonsillitis, Tonsillectomy

INTRODUCTION:

Chronic/recurrent tonsillitis and tonsillar hypertrophy are common tonsillar diseases. Tonsillectomy one of the most frequently surgery worldwide performed to prevent recurrent throat infections as well as tonsillar hypertrophy, which are considered the most important indicators [1]. There are many previous studies on tonsillectomy for children in all its aspects [2], corresponding to fewer studies in been shown to be effective in the management of recurrent/chronic tonsillitis, nevertheless, the indications of tonsillectomy for recurrent acute adults [3]. Tonsillectomy in adult has tonsillitis are controversial, unsettled

and there is no consensus as to which patents would benefit from such surgery [4,5]. Often, sore throats due to acute tonsillitis is self-limited with a short duration, while a few patients experience recurrent exhausted attacks, accompanied by impairment of normal functioning tonsil [6]. Therefore, tonsillectomy is an effective option for the prevention of recurrent tonsillitis, remains a common indication for otolaryngology surgery. Clinically indication of tonsillectomy generally depends primarily on the frequency of tonsillitis episodes (at least three episodes per year), despite adequate medical therapy, may be considered as candidates for tonsillectomy and is

definitely recommended for patients with more than four or five episodes per year considered as appropriate indicators for tonsillectomy [7-11]. Yet there is no worldwide agreement about a specific number of bouts of acute tonsillitis that warrants tonsillectomy, most clinicians agree that some range of the number of infections over a period of time would be an indication for surgical intervention, nevertheless there is no consensus for these arbitrarily used criteria, need for more accurate indicator. Based on this observation we investigate the concept of “Tonsillitis Index”. It is defined as the number of episodes of acute tonsillitis per year multiplied by the number of years during which the episodes of acute tonsillitis occurred. Our goal in suggesting this concept is an attempt to establish a correct, reasonable and logic indicators for new indications for tonsillectomy in recurrent/chronic tonsillitis. Several studies of direct and indirect evidence indicate that the 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. Recurrent/chronic tonsillitis is mainly associated with bacterial and/or viral infection of the tonsillar crypts or parenchyma results in obstruction of tonsillar crypts due to tissue fibrosis, accompanied by distension of the crypts' bottom and retention of its content [12,13]. Extensive tissue fibrosis seemed to be a critical point in the recurrent tonsillitis pathogenesis

and the defensive function of tonsils becomes impaired, as sclerotic type tonsils remarkably have lower count of neutrophils in its tissue, which increased the risk for bacteremia during tonsillectomy [14]. Transient bacteremia during tonsillectomy in some cases (reported by various author) which may be associated with any enhanced postoperative morbidity. Although there are many reports associated with post- tonsillectomy bacteremia, the pathophysiology of the bacteremia following tonsillectomy still remains controversial. Transient bacteremia may originate from the pathogens inhabiting the tonsillar core tissue [15].

AIM OF STUDY

This study aims to identify tonsillar micro-organisms found both on the surface and in the core tissues of tonsil of patients suffering from recurrent/chronic tonsillitis and to determine a clinical decision-making process "the tonsillitis index" for tonsillectomy by exploring the association between the macroscopic oropharyngeal sign of tonsillar sclerosis and the disease history and occurrence of bacteremia during tonsillectomy. This study goals to determine the correct indications for tonsillectomy.

METHOD AND MATERIAL

This prospective study involves 57 patients. Irrespective of sex, cases admitted to Otorhinolaryngology department - Surgical Specialty Center, Faculty of Medicine, University of Benghazi. All patients were admitted for tonsillectomy, suffering from recurrent tonsillitis and adeno-tonsillar hypertrophy, from 1st January to 31st December 2018. All patients had symptoms of recurrent acute tonsillitis at least 03 episodes per year, for at least three successive years and none had received antimicrobial therapy for at

least one week before surgery. Specimens were collected at the time of the elective tonsillectomy as:

1-Tonsillar surface swab; after induction of general anaesthesia and intubation a tonsillar surface swab was obtained by rotating a sterile cotton wool swab over the surface of the tonsil.

2-Tonsillar core swab specimen; after tonsillectomy was performed by dissection technique. Immediately after excision, the tonsil was dipped in povidine iodine solution for 30 sec. Then it was rinsed in sterile saline solution and sectioned into two pieces under strict aseptic condition, core specimen taken from cut surface and dispatched to microbiology laboratory. Isolated microorganisms were identified by using conventional method and API identification panel (Bromereux).

3-Blood samples for blood culture; preoperatively, 5cc venous blood sample preoperatively and early postoperative within 5 minutes after excision of the second tonsil, was collected from all the patients, inoculated into BACTEC, plus+ aerobic/F (for adult) and Ped. plus/F (for children). (Becton Dickinson microbiology system USA) BACTEC 9050 blood culture systems, to determine the presence or absence of bacteremia. Collection of clinical profile data (number of tonsillitis episodes per year, the length of morbidity period in years, oropharyngeal examination to identify the characteristic signs of sclerotic process as increased tightness of tonsillar and peritonsillar tissue together with the fixation of palatine tonsil in the tonsillar fossa). Microbiology report of tonsil surface and core swab cultures and blood culture were also collected. Tonsillitis Index were calculated by multiplying the number of tonsillitis episodes per year by the morbidity period in years.

Statistical analysis of result performed using SPSS- version 8. The baseline demographic and clinical correlates were tabulated and expressed as numbers and percentages.

The bacteriology of the tonsillar surface and core was also found out to be expressed as frequencies. Relationship between the organism identified on the surface and that from the core was tested for sensitivity, specificity and likelihood ratio calculated using chi square test, kappa agreement test.

A logistic regression analysis done for the post-tonsillectomy bacteremia associated with 'sclerotic-type' tonsils ($p=0.0015$), and the presence of sclerotic signs in tonsil using the sensitivity, specificity, positive (PPV) and negative predictive value (NPV) analyzed. Based on the disease history data and the presence of sclerotic signs, the receiver-operating curve (ROC) and the area under the curve (AUC) were constructed for prediction of sclerotic type tonsils using Chi-square, and Pearson's rank correlation tests

RESULTS

Fifty-seven patients with age ranging from 4 years to 37 years, median age 16 years, mean age $16.8 + 8.37$ S.D. were included in the study. Seventeen (30%) out of them were males and 40 patients (70%) were females.

All patients were operated by cold and dissection method.

Twenty-five patients (44%) underwent tonsillectomy alone while the other 32 patients (56%) had simultaneous procedure of adenoidectomy and tonsillectomy.

Bacteriological analysis:

Over all total number of positive isolates obtained from both surface and core cultures were 72% (82 specimens). Core culture revealed pathogens on 42 patients (73.68%), while surface culture detected pathogen in 40 patients (70.18%) (Table 1).

Table 1: Organism isolation from culture of surface and core

Surface			Core		
No growth	Normal flora	Pathogen	No growth	Normal flora	Pathogen
1 (1.75%)	16 (28%)	40 (70.18%)	1 (1%)	14 (25%)	42 (73.68%)

Comparison of culture:

Significant levels of differential microbiota are present in the core and surface tonsillar tissues culture. The tonsillar surface culture compared with tonsillar core culture, a large percentage of the patients had no correlation between organisms cultured simultaneously from the two sites. On comparing the culture results between surface and tonsil core cultures, a pathogenic bacteria were isolated in 54 patients (95%), but non-pathogenic bacteria recovered in only 3 patients (5%), 14 patients (25%) showed pathogen in tonsil core culture with normal flora (NF) in corresponding surface swab culture, and 12 patients (21%) had pathogenic organism in surface swab culture with normal flora in tonsillar core swab culture, while 3 patients (5%) had normal flora in both surface and core swab culture. The micro-organisms isolated from the surface and the core culture match in 11 patients "8+3" (19 %), with 34 patients "14+20+12" (60 %) having different micro flora. There is discrepancy of pathogen in 46 patients: 14+20+12" (81%). Different pathogens grown in 20 patients (35%), over all discrepancy of organisms found in 46 patients (81%) (Table 2).

Statistical Analysis:

The results of culture of tonsil surface and core swabs were further analyzed for statistical significance. The

likelihood ratio for similar and general organism pathogen calculated using sensitivity and specificity.

Table 2: Comparison of culture reports

Surface	Core	Number (%)
Normal flora	Pathogen	14 (25)
Pathogen	Pathogen (same)	8 (14)
Pathogen	Pathogen (different)	20 (35)
Pathogen	Normal flora	12 (21)
Normal flora	Normal flora	3 (5)

For similar pathogens the sensitivity and specificity were 19% and 80% respectively, likelihood ratio being 0.95 and for general pathogen the sensitivity and specificity were 66.67% and 20% specificity respectively, with a likelihood ratio of 0.83. From this test results it is evident that the tonsil surface swab is not a reliable diagnostic test for representing the growth of the same bacterial microflora as the tonsil core.

Distribution of organism:

Among the distribution of organisms isolated from surface and core specimens staphylococcus aureus (SA) the most common isolate, found in 32 patients (56.41%), 15 patients in core of tonsil and 17 patients in surface culture. According to prevalence in decreasing orders of frequency, 30 patients (52.62%) were B. hemolytic streptococcus (B.H.S), S. pyrogens (SP) in 24 patients (42.10%), 9 patients in surface and 15 patients in core culture, followed by Alfa hemolytic streptococci (A.H.S) in 14 patients (24.46%), 9 patients in surface and 5 patients in core H. Influenza (HI) was cultured in 4 patients (7%) in core culture only (Table 3).

The result of blood culture:

No growth in preoperative blood sample but in postoperative blood culture 6 samples (10.52%) yielded

positive blood cultures, while 51 samples (89.48%) showed no growth. *S. Aureus* in 4 patients and *S. Pyrogens* in 2 patients were cultivated. Pathogens isolated in blood culture were same as one in tonsil core culture (Table 4).

Table 3: Distribution of Organism isolated from tonsillar surface and core culture

	Surface	Core	Total (%)
SA	17	15	32 (56.4)
B.H.S	13	17	30 (52.6)
S.P	9	15	24 (42)
S.Pneumonia	1	2	3(5.26)
A.H.S	9	5	14 (24.5)
HI	0	4	4 (7)
S.Fecalis	3	2	5(8.77)
S.Aglectia	1	0	(1.75)
S. Variance	3	8	11(19.3)
Fungus	1	1	2(3.5)

Table 4: Post tonsillectomy bacteremia

Specimen Culture			
No.	Surface	Core	Post op Blood culture
1	NF	SA	SA
2	SA	SA	SA
3	SP	SA	SA
4	NF	SP	SP
5	SA	SA	SA
6	SA	SA	SP

The bacteremia were observed in 6 patients of sclerotic type tonsillitis (Table 5).

On examination of oropharynx Sclerotic process in tonsil observed in 26 patients out of 57 patients. The mean tonsillitis index for whole group of

recurrently inflamed tonsil was 30 (range 6 – 60) (Table 6).

Table 5: Predictor for the development of post-tonsillectomy bacteremia (Chi-square test)

Predictor	Blood culture	Blood culture	Total
	Positive	Negative	
Sclerotic	6	20	26
Inflammat.	0	31	31
Total	6	51	57

Sensitivity 100%, Specificity 60.78%, Positive Likelihood Ratio 2.55, Positive Predictive Value 23.08%

Table 6: Correlation between Tonsillitis Index and sclerotic tonsils

Tonsillitis Index	Sclerotic Tonsil	
	Present	Absent
< 15	0	16
6 - 25	2	8
16 - 35	8	6
36-45	12	1
46-60	4	0
Total	26	31

The observed agreement is 6/57 (89% of the observation) un-weighted kappa = 0.161.

Depending upon the disease history data (Tonsillitis index values), and the presence or absence of tonsillar sclerosis (oropharyngeal sign).

The receiver-operating curve (ROC) with the area under the curve (AUC) was plotted by computing the sensitivity and specificity of increasing order of clinical findings in predicting for sclerotic type tonsils to ascertain the cut-off value of Tonsillitis Index, (Two variables Tonsillitis Index and Oropharyngeal sign).

It revealed that a Tonsillitis Index score of 35 is an optimal cut-off value for prediction of sclerotic type tonsils (AUC = 0.776). It revealed sensitivity

92.31%, specificity 77.4%, positive likelihood ratio 4.00 and positive predictive value 77.42%. (Table 7).

Table 7: Cross tabulation for likelihood ratio at cut off point >25 of tonsillitis index (chi square test)

Tonsillitis Index	Sclerotic Tonsil	
	Present	Absent
> 25	24	7
< 25	2	24

Chi square test: Sensitivity 92.31%, Specificity 77.42%. Positive Likelihood Ratio 4.09, Positive

Predictive Value 77.42%

Optimal cut-off score of Tonsillitis Index – Score of 35 is an optimal cut off value for prediction of sclerotic type tonsillitis, (AUC=0.776), has sensitivity (61%), specificity (96%), positive predictive value of (94%) with likelihood ratio (LR+) (19%).

The Tonsillitis Index score >35, had a sensitivity of 61%, specificity of 96%, positive predictive value of 94% with likelihood ratio (LR+) 19%.

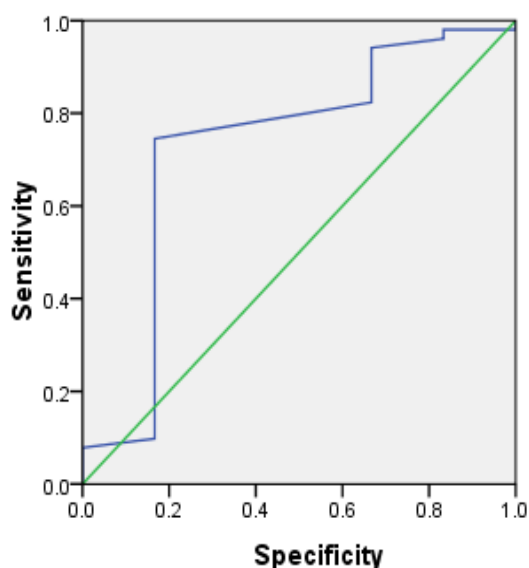
All differences were considered statistically significant for P-values less than 0.05 (Logistic regression-statistic) (Table 8).

Table 8: Likelihood ratio for sclerotic sign at various cut off point of tonsillitis index

Index of tonsillitis	Oropharyngeal Sclerosis		Sensitivity (TPR)	Specificity	specificity (FPR)	Likelihood ratio
	Present	Absent				
<15	0	16	0	0.48	0.52	0
16-25	2	8	1	0.51	0.49	2.07
26-35	8	6	0.92	0.77	0.23	4.09
36-45	12	1	0.61	0.96	0.04	19.04
46-60	4	0	0.15	1	0.0	0

The ROC curve shows the trade-off between sensitivity (or TPR) and specificity (1 –FPR)

ROC Curve



DISCUSSION

The diagnosis of chronic/recurrent tonsillitis is mainly by history and clinical examination. However, Superficial tonsil swabs as main investigation routinely used in many countries to confirm diagnosis, are often utilize as a guide in the selection of this therapy in tonsillitis. It is also well accepted that effective treatment of chronic tonsillitis depends on knowledge of the infecting organism. However, studies indicate a marked discrepancy in the surface and core pathogen flora. Some published reports have suggested that in chronic / recurrent tonsillitis, most of bacteria are embedded in the core of the tonsil rather than the surface of the tonsils. Normally tonsillectomy is decided considering

primarily by H/O on frequently of tonsillitis episodes, definitely recommended for patients with more than four or five episodes per year [1,2].7,8, but adult often have fever or less severe episodes of tonsillitis, but have other indices of chronic disease, such as poor general health, time loss from school or work, decreased life quality due to systemic effects or comorbid diseases, group A β -hemolytic streptococcus carriage state, and increased serum concentrations of antibodies, which have also been considered as appropriate indicators for tonsillectomy. Continuous inflammation in the tonsillar tissue leads to specific morphological changes like fibrosis of stroma and blood vessels (sclerosis changes) or an altered immune status of the tonsils result in functional breakdown of recurrently inflamed tonsils and may lead to bacteremia during tonsillectomy. Some studies reported by various author that tonsillectomy with transient bacteremia in some cases may not be associated with any enhanced post operative morbidity. Therefore, this study also aimed to find out relationship of sclerosis process in tonsils and development of bacteremia post tonsillectomy (by analyzing data for organism isolated on tonsil core swab and blood culture). We observed that no growth of microorganism in pre operative blood sample but post operatively the bacteremia developed in 6 patients of sclerotic type of tonsillitis. Pathogen isolated in blood culture same as one in tonsil core culture. possibly bacteremia could originate from the deep tonsillar tissue (core) bacteria following tonsillectomy. The result of blood culture and tonsil core culture further analyzed for the likelihood ratios to consider the sclerotic types of tonsillitis as a predictor for

tonsillectomy. the sensitivity and specificity were 83.3% and 0.58% respectively, likelihood ratio being 0.83, fair agreement between finding of bacteremia and sclerotic tonsil- the observed agreement is 89%, un weighted Kappa=0.161 Analysis of data in this study correlates well with presence of tonsillar Sclerosis and occurrence of bacteremia during tonsillectomy are in accordance with current knowledge of pathogenesis of recurrent tonsillitis (Parenchymal fibrosis- Tonsillar sclerosis). These morphological macroscopic changes of sclerosis in tonsil on oropharyngeal examination that could be used as the indicators for tonsillectomy with recurrent tonsillitis. Considering the sclerotic sign, the only indicator for tonsillectomy, may lead to an over estimation of the need for surgery as sclerotic sign is very frequent found in healthy person and has low specificity and PPV for recurrent tonsillitis diagnosis, therefore, we try to investigate to make conclusion that the Tonsillitis Index could be used as tool to take decision for tonsillectomy for recurrent tonsillitis. Therefore, the Tonsillitis Index values were compared with the presence or absence of most characteristic sclerotic signs. Statistical analysis for correlation between Tonsillitis Index and sclerotic tonsils, the ROC curve plotted by computing the sensitivity and specificity of increasing order of clinical findings in predicting sclerotic type tonsils to ascertain the cut-off value of Tonsillitis Index, it revealed sensitivity 92.31%, specificity 77.4%, positive likelihood ratio 4.00 and positive predictive value 77.42%. Optimal cut off point of Tonsillitis Index was found to be 35 which had balanced sensitivity, specificity and predictive values indicates that a minimum of 35

tonsillitis episodes could be sufficient for development of sclerotic type tonsils, The Tonsillitis Index score >35, the tonsils have deteriorated immunologically and chance for resolution of recurrent / chronic infection is less likely to occur, may lead to bacteremia during tonsillectomy had a sensitivity of 61%, specificity of 96%, positive predictive value of 94% with likelihood ratio (LR+) 19%). suggesting that high frequency of tonsillitis episodes and longer disease history (morbidly Period) correlates well with presence of tonsillar Sclerosis and occurrence of bacteremia during tonsillectomy are in accordance with current knowledge of recurrent tonsillitis Pathogenesis. The Tonsillitis Index can be considered as an indicator for tonsillectomy; therefore, the recommendation of tonsillectomy should be based on detail disease history, taking both the frequency of tonsillitis episodes per year and the length of morbidly period into account and presence of sclerotic sign could build up the decision

CONCLUSION

The results from this study confirm that the swab cultures taken from the tonsillar surface may not always represent the actual bacteriology of the interior tonsil, and thus, tonsillar deep tissue cultures may be helpful in clarifying tonsillar microbiology and guiding the treatment of patients with chronic tonsillitis. It should be kept in mind that if medical therapy is planned according to the tonsil surface culture it may be insufficient because of the difference between the tonsil surface and tissue interior culture. Staphylococcus aureus was the commonest isolated organism in the surface and core of the tonsil. The growth of same pathogen bacteria in blood and core swab culture, suggest

that bacteremia could originate from tonsil core bacteria Occurrence of post tonsillectomy bacteremia is closely associated with presence of sclerotic sign on oropharyngeal examination The sclerotic type tonsils have lost their defensive function, therefore sign of sclerotic process in tonsils on examination of oropharynx can be used as an indicator to select with recurrent tonsillitis for tonsillectomy. Therefore, the high Tonsillitis Index values could serve as an indicator for tonsillectomy. The correlation between the longer morbidly period and the presence of pathogens in tonsil core culture suggests that persistent infection may have a role.

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