

Original Article

Status of ossicular chain in cholesteatoma

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Abstract

Objectives: To assess the ossicular changes in cholesteatoma both in children and in adults.

Methods: This was a cross sectional comparative study which was carried out in the departments of Otolaryngology and Head-Neck Surgery of Bangabandhu Sheikh Mujib Medical University and Shaheed Suhrawardy Medical College Hospital during the period of January 2014 to December 2014. A total number of 55 patients having cholesteatoma were included in this study. Patients were divided into two groups according to their age. Age belonged to 18 years and more than 18 years were considered as group I (n=29) and group II (n=26) respectively. All patients were undergone Tympanomastoidectomy and all intraoperative findings were recorded. The two groups were compared with regard to extension of disease and status of ossicular chain.

Results: In this study majority of patients were within 11-18 years in children group and within 19-30 years in adults group. Most of the children were male and female predominant in adult group. Extension of disease was significantly higher in children group. Ossicular erosion was also more frequent in children group.

Conclusion: Extension of cholesteatoma and ossicular erosion was significantly higher in children group.

Key words: Ossicular chain, cholesteatoma, middle ear;

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Introduction

Cholesteatoma are characterized by migration of keratinized hyperproliferative squamous epithelium positioned in a fibrous stroma into middle ear and mastoid cavity¹. The hallmark of cholesteatoma is its retention of keratinous debris. Histologically, the squamous epithelial lining or 'matrix' of a cholesteatoma is similar to that of skin. The matrix is usually surrounded by a layer of inflamed, vascular, subepithelial connective tissue. A cholesteatoma can be filled with keratin and be quite dry or be associated with bacterial infection leading to profuse malodorous otorrhoea.

The cholesteatoma has a detrimental effect on hearing with negative impact on quality of life of patients as it disrupts the continuity of ossicular chain due its greater bone erosion power. Bone erosion mechanism in cholesteatoma is not completely understood. Some author suggested that bone erosion would be due to the pressure placed by cholesteatomas on the ossicular surface^{2,3}. Other noticed that eroded ossicles were surrounded by an inflammatory reaction and they suggested that the inflammation was the cause of ossicular resorption.^{4,5} It has been proved that the granulation tissue adjacent to the ossicles is able to produce a variety of enzymes and mediators that accelerate ossicular resorption.

In children cholesteatoma is more aggressive which is demonstrated by the greater size of cholesteatoma and by the higher rate of ossicular chain damage compared to adults leading to greater hearing impairment in children.⁶

The aim of management of cholesteatoma includes eradication of disease and restoration of hearing. So, proper assessment of ossicular chain should be done before intervention that will help the surgeon to choose the proper reconstructive procedure.

Since a considerable number of children with cholesteatoma attend the otolaryngology services of our hospitals, it was felt necessary to study in detail about the pattern of ossicular erosion in cholesteatoma in paediatric age group in order to provide serviceable hearing required for the development of child.

Objectives

1. To observe the ossicular changes in cholesteatoma in children.
2. To find out the ossicular changes in cholesteatoma in adult.
3. To compare the ossicular changes in cholesteatoma in children and in adults.

Methods

Study design: This was a cross sectional comparative study.

Place of Study: This study was carried out in the departments of Otolaryngology and Head-Neck Surgery of Bangabandhu Sheikh Mujib Medical University, and Shaheed Suhrawardy Medical College Hospital.

Duration of study: January 2014 to December 2014.

Study population: This study was carried out on patients having cholesteatoma, who was admitted for undergoing surgery in the Department Otolaryngology and Head-Neck Surgery in tertiary academic hospital (BSMMU, ShSMCH) Dhaka during the study period.

Sample size: 55 (29 were child and 26 were adult)

Sampling method: Purposive, non-random sampling.

Inclusion criteria:

1. Patients having acquired cholesteatoma.
2. Patients, who will undergo surgery for cholesteatoma.

Exclusion criteria:

1. Patient having congenital cholesteatoma.
2. Patient who had previously undergone mastoid surgery.
3. Patient who had history of trauma to ear causing hearing loss.
4. Patient not giving consent for study.

Methods:

The study population was divided into two groups according to age at the day of surgery:

Group-1: Children (Patient between 0-18 years of age)

Group-2: Adult (Patient >18 years of age)

The clinical diagnosis of cholesteatoma was established by a detailed clinical examination including otoscopic and microscopic examination and all findings were recorded.

All patients were undergone Tympanomastoidectomy by well experienced senior surgeons and all intraoperative findings were recorded.

Depending upon intraoperative involvement of the attic, antrum, mastoid cavity, mesotympanum, Eustachian tube, labyrinth, the extension of cholesteatoma was classified as stage I (One site); stage II (Two sites); stage III (Three sites); stage IV (Four sites); and stage V (Five or more sites)⁷.

In order to quantify the degree of ossicular erosion the following scale were prepared adding up the score according to the items 0 - if the ossicular chain is intact; 1- for discontinuity of the chain; 1- for each eroded

ossicle; 2-absence of each ossicle; 3- eroded footplate. This score was cumulative and in order to obtain the score of the patient every alteration found was added up, having as a result a scale with values between 0 and 10⁸.

Data collection technique: Relevant data was collected in a predesigned data collection sheet for each of the patient with cholesteatoma. Diagnosis was made by history, clinical, otoscopic, microscopic examination and radiological investigation.

Data analysis: All collected data were checked and verified thoroughly to reduce inconsistency. Categorical variables were presented in the form of frequency and percentage and quantitative data was presented in the form of mean and standard deviation. Chi square test and fisher's exact test were used to analyze the categorical variables. Student t-test was used for continuous variables. P values <0.05 was considered as statistically significant.

Observation and Results:

Table I
Distribution of the study patients by age (n=55)

Age (in year)	Group I(n=29)		Group II(n=26)	
	n	b	n	%
≤10	13	44.8	-	-
11 – 18	16	55.2	-	-
19 – 30	-	-	14	53.8
31 – 40	-	-	9	34.6
>40	-	-	3	11.5
Mean±SD	12.0	±3.3	30.8	±9.9
Range (min, max)	(7	, 16)	(19	, 53)

Most of patient belonged to age 11 – 30 years.

Table II
Distribution of the study patients by sex (n=55)

Sex	Group I(n=29)		Group II(n=26)		P value
	n	%	n	%	
Male	18	62.1	12	46.2	0.236
Female	11	37.9	14	53.8	

Male was predominant in children and female was predominant in adult group.

Table III
Incidence of sites involved by cholesteatoma (n=55)

Cholesteatoma	Group I (n=29)		Group II (n=26)		P value
	n	%	n	%	
Attic	27	93.1	24	92.3	0.651
Mastoid aditus	25	86.2	19	73.1	0.244
Mesotympanum	21	72.4	14	53.8	0.087
Mastoid cavity	22	75.9	13	50.0	0.047
Sinus tympani	11	37.9	3	11.5	0.024
Eustachian tube	0	0	0	0	-
Labyrinth	0	0	0	0	-

Attic, aditus and mesotympanum were more involved by cholesteatoma in both groups.

Table IV
Distribution of the study patients according to extension of disease (n=55)

Extension of disease (Stage)	Group I(n=29)		Group II(n=26)		P value
	n	%	n	%	
Stage I: One site	2	6.9	4	15.4	0.005 ^s
Stage II: Two sites	4	13.8	6	23.1	
Stage III: Three sites	2	6.9	10	38.5	
Stage IV: Four sites	14	48.3	4	15.4	
Stage V: Five sites or more	7	24.1	2	7.7	

Extension of cholesteatoma was more in children.

Table V
Distribution of the study patients according to ossicular chain status (n=55)

Ossicular chain status score	Group I (n=29)		Group II (n=26)		P value
	n	%	n	%	
0	0	0	1	3.8	0.0002
1	0	0	13	50.0	
2	3	10.3	2	7.7	
3	7	24.1	5	19.2	
4	8	27.6	1	3.8	
5	5	17.2	2	7.7	
6	5	17.2	0	0	
7	1	3.4	2	7.7	
Mean±SD	4.2±1.36		2.3 ± 1.91		
Range (min,max)	(2,7)		(0,7)		

Ossicular erosion was more in paediatric cholesteatoma.

Discussion

This cross sectional study was carried out with an aim to compare the ossicular changes in cholesteatoma both in children and in adults. The study findings were discussed and compared with previously published relevant studies.

In this present study it was observed that more than half (55.2%) of patients belonged to age 11-18 years in group I and 53.8% patients belonged to age 19-30 years in group II which is consistent with another study.⁸

Cholesteatoma was more common in males (52%) than in females 48.0%.⁹ In this current study male were 62.1% of group I and 46.2% of group II. Female were 37.9% of group I and 53.8% of group II. The difference was not statistically significant ($p > 0.05$) between two groups.

In this current study it was observed that attic, mastoid aditus, mesotympanum were involved by both groups without significant difference but involvement of mastoid cavity and sinus tympani was significantly more in group I. In another study it was found that involvement of attic, mesotympanum, aditus and mastoid cavity in group-I and group-II were 86.66% vs 87.98%, 73.33% vs 65.25%, 66.33% vs 84.41% and 36.66% vs 83.44% respectively, which was more or less similar to this study.¹⁰

In this current study it was observed that Stage IV and Stage V were significantly ($p < 0.05$) higher in group I and Stage II and Stage III were significantly ($p < 0.05$) higher in group II. Another study mentioned that concerning the intraoperative extension disease, 33.33% children and 51.94% adults presented a cholesteatoma extension I—II staged; 67% patients of group I and 49% patients of group II were classified as stage III or more with a statistically significant difference, which are comparable with the

current study.¹⁰ Most of the study shows that paediatric cholesteatoma is more aggressive and grows rapidly.¹¹ Some author suggested that the connective tissue layer within the mastoid of younger children accelerates epithelial growth.¹² Our study confirm a significant increase of the proliferative rate of cholesteatoma matrix in children than in adults, suggesting an explanation for the aggressive hyperproliferative behaviour observed in this disease which support the results found by another study where a significant higher proliferative activity of cholesteatoma keratinocytes was found in children as compared to adults.¹³

The degree of compromise of ossicular chain showed an average of 4.20 ± 1.36 in group I and of 2.30 ± 1.91 in group II. The mean ossicular erosion was significantly ($p = 0.0002$) higher in group I. The mean ossicular erosion found by another study was 4.26 ± 2.37 in paediatric patients and 4.45 ± 2.73 in adult group without any statistically significant difference ($P = 0.753$).⁸ So, significantly higher ossicular erosion was found in paediatric cholesteatoma in our study. Today it is believed that ossicular erosion are caused by active processes of bone resorption. Bone resorption mechanism in chronic otitis media is not completely understood. Some author suggested that bone resorption would be due to the pressure placed by cholesteatomas on the ossicular surface^{3,12}. So, greater extension of paediatric cholesteatoma may cause greater erosion. Some author noticed that eroded ossicles were invariably surrounded by an inflammatory reaction suggested that the inflammation was the cause of ossicular resorption^{4,5}. It has been proved that the granulation tissue adjacent to the ossicles is able to produce a variety of enzymes and mediators that accelerate ossicular resorption.

Conclusion

This study was undertaken to assess the ossicular changes in cholesteatoma both in children and in adults. In this study it was found that extension of disease and ossicular erosion was significantly more in children group. So, management of paediatric cholesteatoma should be started as early as possible and children with cholesteatoma should be referred early to otolaryngologist from primary health care setting.

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