

Reducing the Recidivism Rate in Pediatric Cholesteatoma

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ABSTRACT

Objective: Prospective analysis to study the recidivism rate in 30 pediatric patients with cholesteatoma who underwent canal wall down mastoidectomy.

Methods: Thirty patients with cholesteatoma belonging to pediatric (under the age of 12 years) age group were included in the study. The study period was the duration of 1 year (August 2013 to September 2014). These patients underwent canal wall down mastoidectomies and were followed up postoperatively for 6 months. The rate of recidivism and measures to lower recidivism were analyzed.

Results: Three out of thirty patients had discharging cavity on postoperative follow-up. In 2 of these patients' cavity became dry with medical management. One patient showed epithelial pearl which was surgically removed. Rest all the patients had dry mastoid cavities at the time the study was completed. Thus, the recidivism rate in our study was 3.33%.

Conclusion: Considering the aggressiveness of pediatric cholesteatoma preoperative high resolution computed tomography is must as it gives a fair idea of the disease extent and helps in diagnosing complications due to cholesteatoma. Canal wall down (CWD) mastoidectomy with wide meatoplasty is the surgery of choice for pediatric patients with cholesteatoma to ensure complete disease

Keywords: Canal wall down mastoidectomy, Cholesteatoma, High resolution computed tomography, Pediatric cholesteatoma..

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INTRODUCTION

Cholesteatoma is an abnormal growth of keratinizing squamous epithelium in the temporal bone.¹⁻³ It is benign but locally invasive and capable of causing the destruction of middle ear cleft structures due to its osteolytic effects.⁴ Cholesteatoma in children is more aggressive than in adults because of cellular mastoid, rapid tissue growth and a greater degree of upper respiratory tract infection ascending via eustachian tube.

Surgery is the mainstay of the treatment with the aim of complete eradication of disease to make ear dry, to restore serviceable hearing and to prevent recurrence. CWD and the intact canal wall mastoidectomy are the two main techniques described for cholesteatoma surgery. Studies have shown a high recidivism rate of 36 percent with intact canal wall (ICW) technique. However, rate of residual cholesteatoma after canal wall down mastoidectomy ranges from 6 to 72 % with an average of 16.6%.⁵

MATERIALS AND METHODS

This is a prospective study and was conducted in the Department of Otorhinolaryngology, Head and Neck Surgery at our tertiary care center during the period of one year, i.e., from September 2013 to August 2014 with an aim to study the rates of recidivism (residual and recurrence) in patients of cholesteatoma in paediatric age group who underwent surgery in the form of CWD mastoidectomy and to study the factors ensuring low recidivism rate. We included 30 consecutive pediatric patients who presented with postero-superior retraction pocket or attic retraction with or without cholesteatoma flakes, Marginal perforation and patients presenting with complications due to cholesteatoma. Patients with a safe type of otitis media, patients with cholesteatoma with age >12 years and patients not giving consent for the surgery were excluded from the study. All patients after a detailed history and thorough ear, nose, throat examination underwent microscopic ear examination, and high resolution computed tomography scan (HRCT) of the temporal bone and a pure tone audiogram (PTA). These children underwent surgery in the form of canal wall down mastoidectomy with or without obliteration. The ossicular chain reconstruction to restore hearing was done either in the same sitting or later depending upon the status of the middle ear mucosa and the Eustachian tube function.

Based on intraoperative findings, we evaluated the following:

- Number of sub-sites involved by the cholesteatoma, i.e., mastoid cavity, antrum, attic, anterior epitympanum, mesotympanum, sinus tympani, facial recess, Eustachian tube, etc.,—status of the ossicular chain in terms of erosion or absence of the ossicles—status of the facial canal—Presence of any tegmen tympani erosion—presence of labyrinthine fistula—Cellularity of the mastoid cortex—presence of dehiscence of sinus plate.

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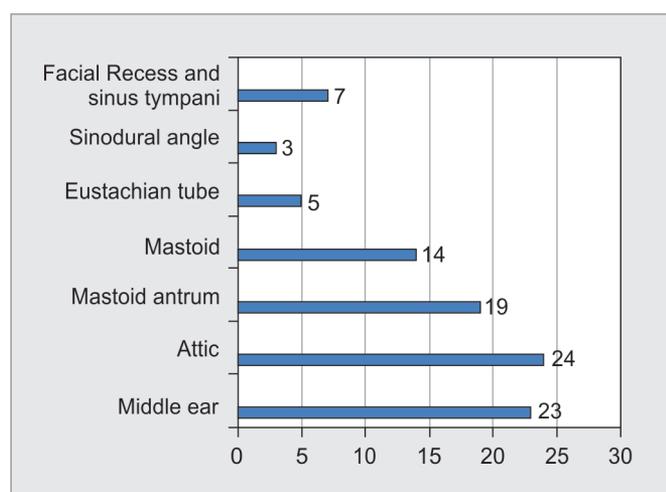
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Intraoperative findings were compared to HRCT findings. Follow-up examinations were carried out at 1 week post-op, and then weekly for a month and then at three months, six months and one-year post-surgery to access the status of the mastoid cavity and to look for any residual or recurrent disease.

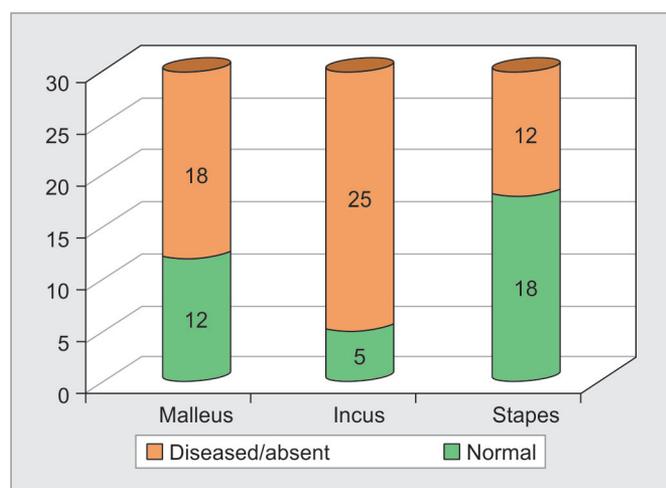
RESULTS

Intraoperative findings suggested (Graph 1) that disease was extensive in most of the cases with middle ear involved in up to 76.66% cases and attic involved up to 80% cases. Disease extended to involve antrum in 63.33% cases with mastoid involvement in 46.66% cases. Disease extended to involve Eustachian tube area in 16.66% cases. Sino dural angle was diseased in 10% cases only. The region of the facial recess and sinus tympani was involved in as many as 23.33% cases.

The most commonly necrosed ossicle (Graph 2) was incus in as many as 25 cases. Second most commonly diseased ossicle was malleus which was either necrosed or absent in 18 cases. Stapes involvement was relatively less common.



Graph 1: Extent of disease (Intraoperative finding)



Graph 2: Status of ossicles (intra-op finding)

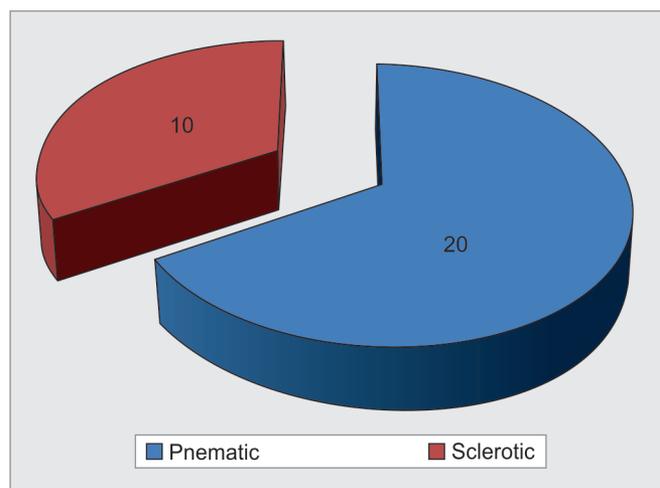
Nearly 66.67% (20) of our cases had well-pneumatized mastoid (Graph 3) on intraoperative examination while only 33.34% (10) cases had sclerotic mastoid.

Our study showed an excellent correlation between HRCT and intra-op findings (Table 1). A preoperative CT scan may be helpful in relation to diagnosis and decision making for surgery in cases of cholesteatoma and ossicular erosion. The CT scan Graphs 4 and 5 can accurately predict the extent of disease and is helpful for detection of lateral canal fistula, erosions of the dural plate, and ossicular erosions

In our study, (Table 2 and Graph 6) only two patients had discharging ear on follow up which were managed conservatively with topical medications. One patient showed epithelial pearl in the posterosuperior region which was surgically removed. This was the only case in our study with residual disease. Thus the rate of recidivism in our study was only 3.34%.

DISCUSSION

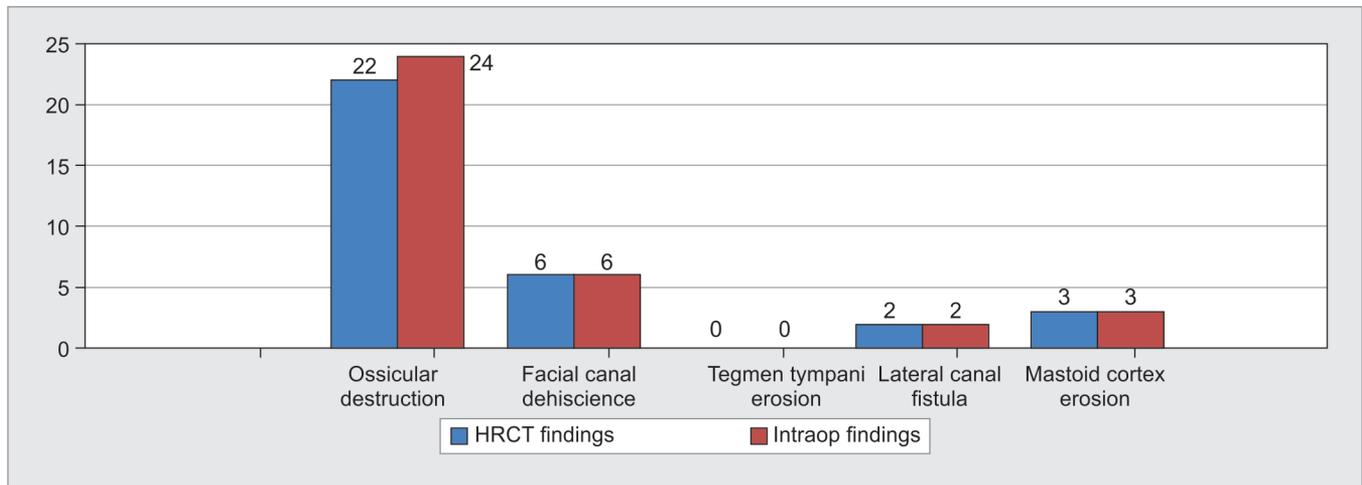
Cholesteatoma despite being a benign disease is associated with significant morbidity due to its ability to destroy and grow at the expense of underlying bone. Cholesteatoma is known to behave more aggressively in the pediatric population due to various factors.⁵ This necessitates early and complete surgical removal of cholesteatoma to render the ear safe and dry as well as ensuring lower recidivism rates. Our study showed that 66.67% of cases had pneumatic mastoid on intraoperative examination while only 33.34% cases had sclerotic mastoid. This is in accordance with various studies which showed that mastoid tends to be more cellular or pneumatic in the pediatric group as compared to adults.⁵⁻⁷ A well-pneumatized mastoid provides an easier pathway of spread for cholesteatoma thus making disease both extensive and aggressive in children. Besides this, the shorter, wider and more horizontal eustachian tube in



Graph 3: Pneumatization of mastoid (intraoperative finding)

Table 1: Correlation between HRCT and surgical findings

Findings	HRCT findings	Percentage (%)	Intra-op findin	Percentage (%)
Ossicular destruction	22	73.33	24	80
Facial canal dehiscence	6	20	6	20
Tegmen tympani erosion	0	0	0	0
Lateral canal fistula	2	6.67	2	6.67
Mastoid cortex erosion	3	10	3	10
Sinus plate dehiscence	0	0	0	0



HRCT Ossicular Destruction

Sensitivity: 86.4%
Specificity: 62.5%

HRCT LSCC Fistula

Sensitivity: 100%
Specificity: 100%

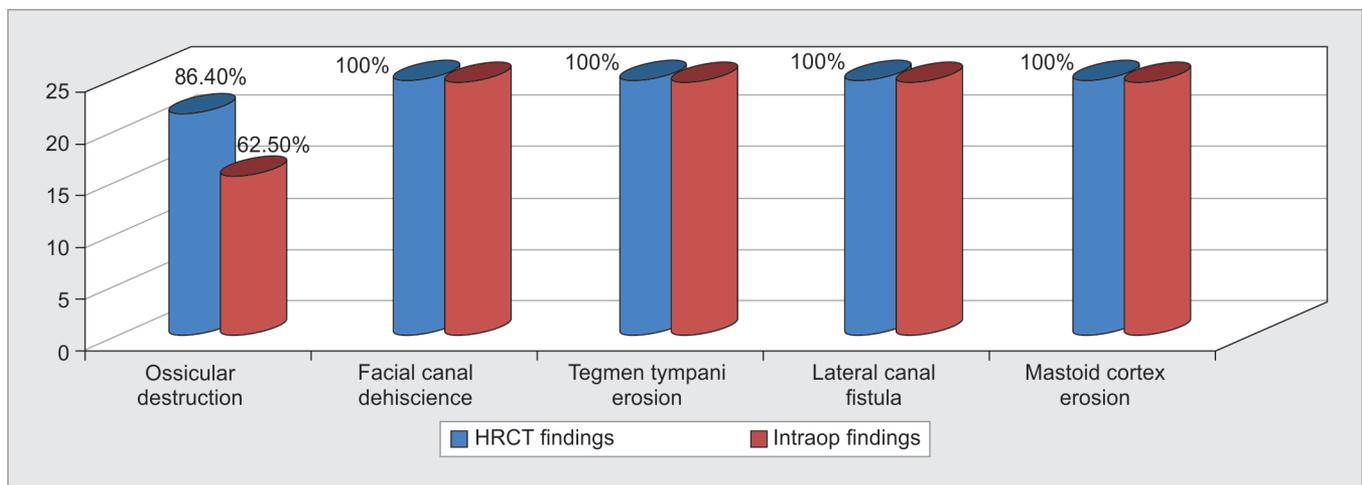
HRCT Facial Canal Dehiscence

Sensitivity: 100%
Specificity: 100%

HRCT Tegmen Tympani Erosion

Sensitivity: 100%
Specificity: 100%

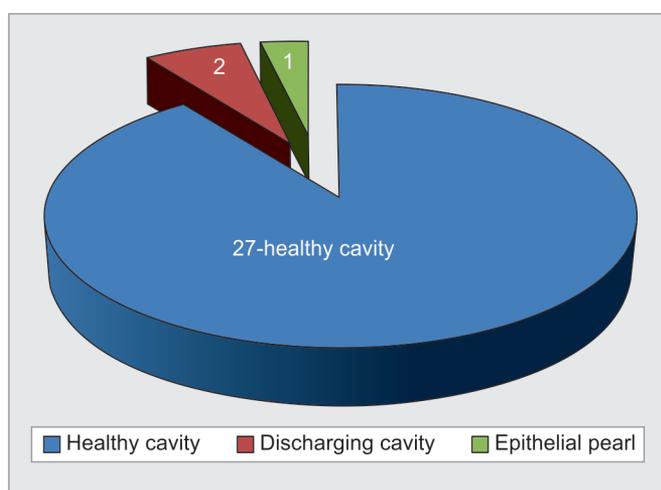
Graph 4: Correlation between Hrct and surgical findings



Graph 5: Correlation between hrct and surgical findings

Table 2: Status of mastoid cavity on follow-up

Status of cavity	At 3 months	At 6 months
Healthy cavity	27	29
Discharging cavity	2	0
Epithelial pearl	1	1



Graph 6: Mastoid cavity on follow-up

children makes the middle ear mucosa more prone to superimposed infection and inflammation via ascending upper respiratory tract infection.

Cholesteatoma is known to cause disruption of ossicular assembly due to its bone destroying property thus compromising the hearing of affected individual. Hearing loss in children interferes with social and scholastic development of the pediatric population. Therefore it is important to diagnose this condition in children early and ensure complete surgical removal of the disease. The most commonly affected ossicle in our study was incus in 83.34% cases while the second most commonly diseased ossicle was malleus which was either necrosed or absent in 60% cases. Stapes supra-structure was involved by the disease process in 40% cases. Various studies have highlighted this ossicular disruption due to cholesteatoma with the long process of incus being most commonly involved.⁶⁻¹⁰ This happens due to associated chronic inflammation of the marrow spaces through which the blood vessels traverse. In the long process of the incus, this leads to subsequent destruction.¹¹ Involved ossicles are known to harbor the cholesteatoma thus it is imperative to remove the necrosed ossicles intra-operatively. Restoring or repairing the hearing mechanism is secondary aim during cholesteatoma surgery with the primary aim of rendering the ear safe and dry by removing all the possible disease from the ear.

Preoperative imaging in the form of HRCT temporal bone gives a fair idea about the anatomy and any associated alteration in the normal anatomy of the middle ear and mastoid. This provides a guide to the operating surgeon regarding the location of the dura, sigmoid plate and any variation in the anatomy of the facial canal. It also shows the extent of the cholesteatoma and help in picking up asymptomatic complications such as lateral canal fistula or facial canal dehiscence which can pose intraoperative difficulties

to the surgeon. Imaging of temporal bone along with brain are must in cases presenting with intracranial complications. Our study revealed that HRCT has sensitivity of 86.4% and specificity of 62.5% for ossicular destruction while for facial canal dehiscence, LSCC fistula, tegmen tympani erosion revealed the sensitivity and specificity of 100%. Thus there was an excellent correlation between HRCT and intraoperative findings. Preoperative CT scan is highly helpful in predicting the extent of disease, detection of lateral canal fistula, erosions of the dural plate, and ossicular erosion.¹²⁻¹⁵ By knowing the disease extent preoperatively one can ensure complete surgical removal of the disease thus lowering the rate of recidivism.

Two most common surgical techniques for treating cholesteatoma are ICW and CWD mastoidectomy (CWD). The goal of treatment in cholesteatoma is total eradication of the disease to obtain a safe and dry ear. Since the success of any given approach is measured in terms of the rate of recidivism, we strongly recommend CWD technique for pediatric cholesteatoma cases owing to the aggressive and extensive nature of the disease in children especially in a developing country like India. Lowering the facial ridge up-to the level of lateral semicircular canal allows complete visualization of various precarious areas such as facial recess, sinus tympani, anterior epitympanum, etc. which can harbor hidden cholesteatoma. Studies have shown a high recidivism rate of 36 percent with ICW technique.¹⁶⁻¹⁹ However, the rate of residual cholesteatoma after canal wall down mastoidectomy ranges from 6 to 72% with an average of 16.6%.⁵ In our study, only two patients at follow up had discharging ear. Thorough clinical, as well as otoscopic examination, ruled out the presence of any residual or recurrent cholesteatoma. One patient had an epithelial pearl in posterosuperior region on otoscopic examination. The patient was re-explored and epithelial pearl was surgically removed. This was the only case in our study with residual disease. In our study, all cases had good postoperative results in terms of complete disease removal and dry mastoid cavities with a recidivism rate of 3.34%.

The lower recidivism rate and high success rate of surgery in our study were ensured via various following precautions that were taken intra-operatively:

- Complete eradication of disease by single stage canal wall down mastoidectomy with an attempt to reconstruct hearing in same procedure rather than going for second look surgery.
- Adequate lowering of the facial ridge (up to the level of the lateral semicircular canal) thus ensuring adequate postoperative drainage of the cavity as well as easier examination and cleaning.

- Proper saucerization of the mastoid cavity removing all the ridges and bony spicules.
- Adequate exposure and removal of disease from following key areas:
 - Facial recess
 - Sinus tympani
 - Anterior epitympanum
 - Supra-tubal recess
 - Sino Dural angle
 - Mastoid tip
- Adequately wide meatoplasty

CONCLUSION

Pediatric cholesteatoma is extensive and aggressive. Early diagnosis and complete disease removal are important to reduce associated morbidity and mortality.

HRCT temporal bone is must in cases of pediatric cholesteatoma to know the extent of the disease and to diagnose the occult as well as manifest complications of the cholesteatoma.

CWD mastoidectomy with wide meatoplasty is the surgery of choice for treating pediatric cholesteatomas especially in developing country like India. It is important to ensure complete disease removal from hidden areas like facial recess, sinus tympani, etc., to lower the rate of recidivism.

Restoration of hearing without compromising the disease clearance is of paramount importance and should be attempted at the time of primary surgery.

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