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Mastoidectomy: retrospective analysis of 137 cases in a tertiary care hospital

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ABSTRACT

Background: Mastoidectomy is a common otologic surgery and at times can be a lifesaving procedure. The aim of the study is to analyze surgical indications, operative parameters and per-operative findings encountered.
Methods: This is a retrospective study done in patients who had undergone mastoid surgeries between 1st Jan 2016 to 31st Dec 2016 in the Department of Otorhinolaryngology, Govt. Medical College hospital, Trivandrum.
Results: Of the 137 patients the peak age incidence was 16 – 30 years. Cholesteatoma was present in 32% of which 91% had canal wall down mastoidectomy. 64% patients, mostly chronic otitis media- mucosal and inactive squamosal, underwent canal wall up procedure. In 62% cases the ossicular chain was eroded, which was mainly incus (87%). Abnormalities encountered within the mastoid during surgery were mainly dehiscent facial canal (17.5%), low lying dura (16.8%) and contracted antrum (15.3%). A positive association could be noted between contracted antrum and the position of sinus and dural plates, and was statistically significant. Co-existence of facial canal dehiscence with lateral canal fistula and dural plate dehiscence were also noted. The tympanoplasty procedures commonly employed in canal wall up procedures was Type I and 2, and in canal wall down procedure was Type 3.
Conclusions: Adequate skill development of the ear surgeons in the tertiary centre should be ensured, to individualize the procedure appropriate for each patient and optimize the outcome of surgery. Early referral to the nearby otological centre should be promoted not only to prevent complications but also for better post-surgical functional outcome.

Keywords: Chronic otitis media, Mastoidectomy, Anatomical abnormalities, Tympanoplasty

INTRODUCTION

Mastoidectomy ranks among the commonest surgical procedures performed in the otological realm and is aimed at therapeutic excenteration of mastoid air cells.[1] Chronic otitis media is the commonest indication for performing this surgery, where continued inflammation of the middle ear cleft leading to osteitis and irreversible mucosal changes, or presence of cholesteatoma causing bone erosion, necessitate surgical disease clearance. It is also indicated in other inflammatory diseases or tumors of the middle ear and mastoid. Two basic surgical approaches have been evolved for mastoid clearance, namely the canal wall up and the canal wall down procedures.[2] The canal wall up procedure include cortical mastoidectomy, combined approach tympanoplasty, and mastoidectomy with canal wall reconstruction. Canal wall down procedures include modified radical mastoidectomy and radical mastoidectomy. Need for added procedures like tympanoplasty is decided by the findings encountered during surgery, when the mastoid surgeon must individualize the procedure appropriate for each patient to optimize the outcome of surgery.

The aim of the study is to conduct a chart review of patients undergoing mastoidectomy, over a period of one

year, in a tertiary care referral hospital, so as to study and analyze surgical indications, operative parameters and per-operative findings encountered.

METHODS

This is a retrospective study done in 137 patients who had undergone mastoid surgeries between 1st January 2016 to 31st December 2016 in the Department of Otorhinolaryngology, Government Medical College hospital, Trivandrum.

Inclusion criteria

Inclusion criteria were all patients who had undergone mastoidectomy for management of acute or chronic otitis media with or without complications; patients who had undergone mastoidectomy for treatment of tumours of middle ear and mastoid

Exclusion criteria

Exclusion criteria were patients undergoing mastoidectomy as an approach for other surgeries like cochlear implantation, vestibular neurectomy, labrynthectomy and translabrynthine CP angle tumour excision.

The methodology employed was chart review and extraction of details of patients as per performa. Data retrieved included the demographic details, clinical characteristics, surgical indications, type of surgery performed, per-operative findings, immediate post-operative complications and the histopathology reports. A database of the study population was thus set up to collate and analyze the findings using computer software SPSS 11.0.

RESULTS

A total of 149 patients underwent mastoidectomy in our centre during the study period, of which 12 were excluded applying the exclusion criteria. Therefore 137 patients (67 males and 70 females) who met our selection criteria were included for retrospective analysis. Majority of the patients (55%) belonged to the lower socioeconomic strata. The ages ranged between 3 to 67 years, with maximum number between 16- 30 yrs (mean age 28 yrs). Frequency and distribution of age and gender is given in Table 1.

Symptomatology

Commonest presenting symptom observed was otorrhea; reported by 123 patients, of which 35% foul smelt and 16% were blood stained. Detailed distribution of symptoms among the study population has been depicted in Table 2.

Ear examination findings

Most common finding on clinical evaluation of the ear was central perforation with active discharge. Other findings recorded are shown in Figure 1.

Table 1: Frequency and distribution of age and gender.

Age in years	Males	Females	Total
<16	10	8	18
16-30	26	30	56
31-45	22	23	45
46-60	8	7	15
>60	1	2	3
Total	67	70	137

Table 2: Symptomatology.

Symptom	No. of patients	Percentage
Otorrhea	123	89.8
Hearing loss	102	74.5
Earache	27	19.7
Tinnitus	19	13.9
Vertigo/giddiness	14	10.2

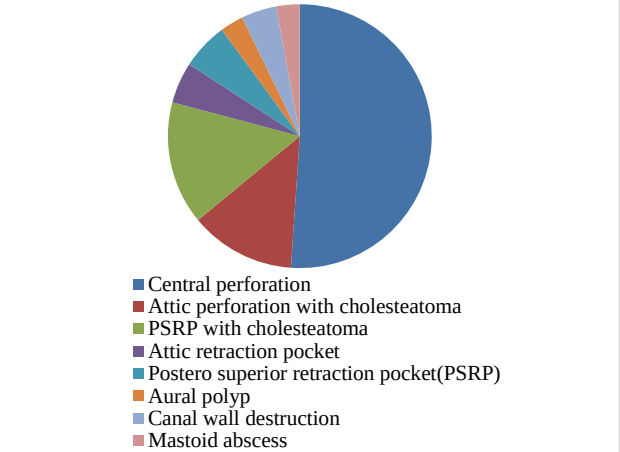

Figure 1: Ear examination findings.

Diagnosis

COM was the commonest indication (94%) for mastoidectomy; majority of these patients had mucosal disease. Other inflammatory middle ear diseases included acute otitis media (AOM) and tuberculous otitis media. Mastoidectomy was done in those patients with AOM who had developed complications and failed to respond to medical treatment. Congenital cholesteatoma was encountered in a 7-year-old child. Neoplasms observed in the study included embryonal rhabdomyosarcoma, extramedullary plasmacytoma and glomus tumor. Detailed split up of cases with type of surgery employed are shown in Table 3.

Table 3: Diagnosis and type of surgery employed.

Diagnosis	No of patients (n=137)	Canal wall up	Canal wall down
COM- active mucosal	71	69	2
COM- active squamosal	43	4	39
COM- inactive squamosal	15	13	2
Congenital cholesteatoma	1	0	1
AOM	2	2	0
Tuberculous OM	2	0	2
Tumors	3	0	3
Total	137	88	49

Table 4: Anaesthesia and surgical approach.

Type of mastoidectomy	GA	LA	Postaural	Endaural
Canal-wall up (n=88)	37	51	77	11
Canal-wall down (n=49)	17	32	45	4
Total	54	83	122	15

Table 5: Intraoperative pathology noted.

Operative findings	Epi tympanum	Epi + Meso tympanum	Epi + Meso + Hypo tympanum	Antrum	Antrum + Aircells
Granulation	94	21	0	91	34
Cholesteatoma	44	12	2	41	25
Pus	0	0	0	24	5
Glue	0	0	0	13	0
Mass	3	3	3	3	3

Surgical parameters

Majority of cases were operated under LA; preferred surgical approach was post aural. 64% of the patients underwent canal wall up procedures while 36% needed canal wall down surgeries (Tables 3 and 4).

Canal wall up procedures included 73 cortical mastoidectomy and 15 cortical mastoidectomy and atticotomy with attic reconstruction. Majority of patients with COM mucosal disease, and AOM were treated with cortical mastoidectomy. For attic reconstruction, tragal or conchal cartilage was used and it was opted for patients with inactive squamosal disease or in patients with limited cholesteatoma after thorough disease clearance. Bone chips alone or combined with paté were used for canal wall reconstruction to completely isolate the mastoid cavity from the middle ear.

49 patients needed canal wall down procedures which included 44 modified radical mastoidectomy (MRM) and 5 radical mastoidectomy. Majority of patients with cholesteatoma needed modified radical mastoidectomy (MRM). Of the 4 patients who underwent revision surgery (all MRM) for recurrent cholesteatoma, stenosis of previous meatoplasty was noted in 3 of them and high facial ridge in all four. Radical mastoidectomy was done in all 3 patients with tumors and in 2 cases of tuberculous otitis media. Inside-out technique was employed in 17 patients who underwent canal wall down procedures in the presence of small sclerotic mastoids and contracted antrum.

Pathology

Most common intraoperative pathology identified was presence of granulation tissue seen in 116 patients; of these, 49 patients had granulations alone while 35 patients had both granulations and cholesteatoma. Granulations were noted most commonly in the epitympanum followed by antrum, mesotympanum and mastoid aircells. Granulations were purplish and bleeding in all cases except in 1 case of tuberculous otitis media, where it was pale.

Cholesteatoma was observed in 44 patients in this study. It was associated with granulations in 36 cases (81.8%). Cholesteatoma was found to involve both middle ear and mastoid in 41 patients while it was confined to the middle ear (epitympanum) alone in 3 patients. Involvement of antrum was noted in all patients with mastoid cholesteatoma; of these 62.5% had extensive disease involving antrum and other mastoid air cells (mainly tip cells, peri-facial cells, peri-sinus cells and sino-dural angle) while in 37.5% cholesteatoma was limited to the antrum alone. Middle ear cholesteatoma was observed to involve epitympanum in all cases; confined to epitympanum in 7%, there was added involvement of

mesotympanum in 27.9%, while hypotympanum was also involved in 4.7%.

Pus was seen filling the antrum in 24 cases which extended to other air cells in 5 cases. 13 patients had thick glue on opening the antrum, but none had extension to other mastoid aircells.

All 3 patients with tumors had extensive involvement of middle ear and mastoid. These masses were friable in rhabdomyosarcoma and plasmacytoma while it was firm and profusely bleeding in glomus tumor. Pathology found intraoperatively are summarized in Table 5.

Ossicular status

Figure 2 shows status of the ossicles identified during surgery. The ossicular chain was eroded in 62%. Of these patients with an interrupted ossicular chain (eroded or absent), majority had eroded or absent incus (87%); malleus was eroded or absent in 54% and stapes superstructure eroded or absent with intact footplate in 41%.

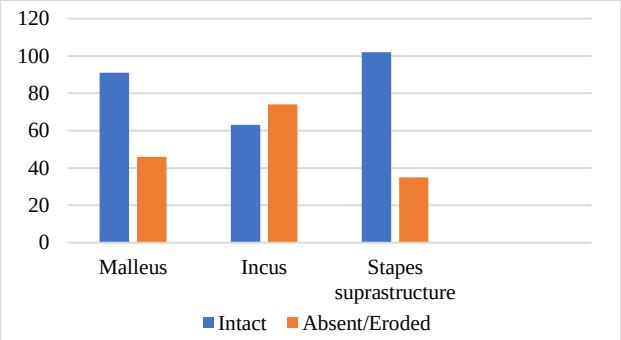

Figure 2: Ossicular status.

Intraoperative findings

Abnormalities noted in mastoid landmarks during surgery are described in Table 6.

23 patients had low lying dura and 19 patients had anteriorly placed sigmoid sinuses. The mastoid antrum was small and contracted in 21 patients. A positive association could be noted between contracted antrum and the position of sinus and dural plates and was statistically significant (Table 7 and 8).

Facial canal dehiscence was observed in 24 patients; it was seen in the tympanic segment in 87.5% cases and in the vertical segment in 12.5%. Commonest site in the tympanic segment was at the second genu above the lateral semicircular canal, as seen in 18 cases. Dehiscence of entire middle ear segment was seen in 2 patients and dehiscence of geniculate ganglion in 1 patient. Fistula on lateral semicircular canal was observed in 16 patients and was seen on the dome in all. Middle cranial fossa dura was noted exposed at the mastoid tegmen in 14 patients and at tegmen tympani in 1 patient; while in 1 patient medial wall of mastoid cavity was seen eroded exposing posterior fossa dura. Co-existence of facial canal dehiscence with lateral canal fistula and dural plate erosion was noted, and the association was statistically significant (Table 9 and 10).

Table 6: Intraoperative findings within mastoid.

Abnormal Mastoid landmark	No. of patients	Percentage (%)
Contracted antrum	21	15.3
Low lying dura	23	16.8
Anterior sigmoid sinus	19	13.9
Dehiscent facial canal	24	17.5
Lateral canal fistula	16	11.7
Dural plate erosion	14	10.2
Sinus plate erosion	4	2.9

Table 7: Association between contracted antrum and low-lying dura.

Contracted antrum	Low lying dura		Total
	Present	Absent	
Present	17	4	21
Absent	6	110	116
Total	23	114	137

Chi square test, p<0.0001.

Table 8: Association between contracted antrum and anterior sigmoid sinus.

Contracted antrum	Anterior sigmoid sinus		Total
	Present	Absent	
Present	12	9	21
Absent	7	109	116
Total	19	118	137

Chi square test. P value <0.0001.

Table 9: Association between dehiscent facial canal and lateral canal fistula.

Dehiscent facial canal	Lateral canal fistula		Total
	Present	Absent	
Present	10	14	24
Absent	6	107	113
Total	16	121	137

Chi square test, p<0.0001.

Table 10: Association between dehiscent facial canal and dural plate erosion.

Dehiscent facial canal	Dural plate erosion		Total
	Present	Absent	
Present	6	18	24
Absent	8	105	113
Total	14	123	137

Chi square test, p value =0.0237

Table 11: Type of tympanoplasty.

Tympanoplasty	No. of patients	Percentage (%)
Type 1	52	38
Type 2	36	26
Type 3	44	32
Nil	5	4
Total	137	100

Reconstruction

The tympanoplasty procedure commonly employed in canal wall up procedures was type I and to a lesser extent type 2. In canal wall down procedures, mainly type 3 tympanoplasty was done. Reconstruction was not possible in 5 patients due to extensive disease. Most common ossiculoplasty material used was autograft incus. Other materials employed were cartilage (conchal and tragal), autograft malleus and teflon (PORP and TORP) (Table 11).

Immediate complications

During the immediate post-operative period the most common complications found were vertigo and vomiting. Vertigo was reported by 9 patients immediately after surgery of which 4 had associated vomiting. Vertigo was transient in 7 patients and subsided within 24 hours. There was persistence of vertigo in 2 patients with associated nystagmus which lasted for 5 days, but subsided with conservative management without any sequelae. Vomiting was observed in 6 patients which was reported along with vertigo in 4. It subsided with drug treatment and did not last for more than 1 day in any patient.

Facial paralysis was noted in 3 patients; 2 had transient paresis possibly due to the effect of local anesthetic on exposed nerve and one had facial nerve transection which required re exploration and grafting.

DISCUSSION

Despite advances in public health and medical care, chronic otitis media (COM) is still prevalent around the world.[3] South-East Asia and the Western Pacific regions have the highest prevalence, morbidity and mortality from otitis media. Prevalence surveys show that the global burden of illness from CSOM involves 65–330 million individuals with draining ears, 60% of whom suffer from significant hearing impairment.[4] In India, it is the single major cause of reversible conductive deafness. The hearing impairment produced by otitis media affects intellectual performance in children and is likely to inhibit language and cognitive development. Though the frequency of life-threatening complications from COM has been dramatically reduced with the introduction of antibiotics, in the developing world, they still remain the most common cause of death from COM.[4] The surgical treatment is the main stay of therapy and is aimed at eradication of disease, prevention of complication, maintenance and restoration of hearing, and giving the patient a non-discharging ear.[5]

COM usually affects the young population in their economically productive years which is in turn affecting their social and economic condition also. In our study, though all age groups were involved (range 3-67 yrs), the majority of patients were in the age group 16-30 yrs, and mostly from lower socioeconomic strata. This is similar to previously published studies.[5-7]

The commonest indication for surgery was persistent otorrhoea, as similar to previous studies.[6-8] Special attention should be paid to children with persistent otorrhoea especially if blood stained, as one of our patients, a 3-year old boy, who was referred as a case of COM, on mastoid exploration and biopsy was diagnosed as embryonal rhabdomyosarcoma. Another 7 year old boy, presented with only facial paresis, on radiological evaluation (HRCT temporal bone), was found to have congenital cholesteatoma, which was later confirmed on mastoid exploration.

The conductive hearing loss in COM is mainly due to defect in tympanic membrane and ossicular disruption. Resorption of parts or all the ossicles (resorptive osteitis) is seen. The long process of the incus, stapes crura, body of incus and manubrium are involved in that order of frequency. The reason that the long process of the incus and stapes suprastructure are most frequently affected is likely to be due to their delicate structure and location rather than their tenuous blood supply.[9] The most commonly used autograft material has been the incus body, which can be reshaped, and with the advantage of immediate availability, obvious biocompatibility, low cost and low extrusion rate.[10] In our study 62% of patients had ossicular erosion, for which different ossiculoplasty techniques were employed (tympano-plasty- type 2 in 26% and type 3 in 32%). Reconstruction could not be done in 5 patients due to extensive disease. For restoration of functional hearing, the surgeon should acquire enough skills in different techniques of tympanoplasty. Technical proficiency is a direct function of training experience and frequency of performance and thus contributes enormously to the success of the procedure.[11]

Majority of the patients in this study were diagnosed as COM-active mucosal disease and most of them underwent canal wall up surgery. But most of the patients with COM-active squamosal disease had extensive cholesteatoma and so mainly canal wall down surgery was employed for them. This highlights the importance to recognize this disease early so that adequate measures be taken to ensure prompt intervention. In order to obtain more physiological environment in ears after surgery, several canal-preserving techniques are used.[12] In our

study, only 7% with limited cholesteatoma underwent canal wall up surgery with the advantage of better hearing improvement and avoiding cavity problems. The treatment of cholesteatoma should be individualized, no single method is preferable in all cases, and an intact ossicular chain should be preserved.[13]

Facial nerve dysfunction can occur as a complication of the disease as well as surgery for chronic otitis media. Dehiscence to facial canal can be caused by congenital anatomical variation, inflammatory or infectious involvement or iatrogenic procedure. The incidence of facial canal dehiscence has been estimated in several studies ranging from 3% to 40%.[14-17] In our study the incidence of FND was 17.5%, mostly affecting the tympanic segment and one patient had iatrogenic facial injury which required re-exploration. High resolution computer tomography of temporal bone can be used to alert the surgeon to potential intraoperative dangers and complication associated with the particular surgery. However the bony covering over the tympanic part is so thin that it may not be seen in the computed tomography images. Intraoperative microscopic observation still remains the surest way to recognize dehiscence of facial canal; it is important for the surgeon to acquire this skill, to reduce the chances of iatrogenic facial nerve palsy.

Labyrinthine fistula is a common complication of cholesteatoma, the commonest site being the lateral semicircular canal. It can coexist with FND, may be due to the proximity to facial nerve, as described in previous studies.[14-17] In our study also, a statistically significant positive association was noticed between facial canal dehiscence and presence of lateral semicircular canal fistula.

Intracranial complication of COM is associated with high morbidity and mortality and here mastoid surgery becomes a lifesaving procedure. Dural plate erosion was noticed in 14 patients, which could have led them to life threatening complications, had there been a delay in intervention. A positive association was noticed also between facial canal dehiscence and dural plate erosion.

Contracted antrum was observed in 15.3% cases; it usually coexisted with a low lying dura and/or anteriorly placed sinus plate (association was found statistically significant in our study). The surgeon should be cautious in this situation to avoid major intraoperative complications like CSF leak, sigmoid sinus bleed etc.

CONCLUSION

The ear surgeons in the tertiary centre should have a thorough understanding of anatomical and pathological abnormalities that can be encountered on mastoid exploration, and adequate skill development should be ensured, which allows the surgeon to individualize the procedure appropriate for each patient and optimize the outcome of surgery. An increasing awareness should be generated among the primary care physicians, for early detection, not only to prevent complications but also for better post-surgical functional outcome. Early referral to the nearby otological centre should be promoted for prompt intervention, thus reducing the burden of illness of COM in society.

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