



# Mastoidectomy indications and incidence in the indigenous population of Far North Queensland

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**Background:** To review all mastoidectomies performed over a 10-year period in one tertiary hospital in Australia and evaluate the incidence and indications of operations in the Indigenous population.

**Methods:** A retrospective review combining clinical presentations, demographics and intraoperative findings. Outcomes studied were complications on presentation, ossicular/tympanic damage present at time of operation, intra-operative pathology, the extent of the disease and the surgical technique used.

**Results:** There were 158 mastoidectomies were performed in our institution over the 10-year period studied. Cholesteatoma (58%) was the most common indication. Extracranial complications recorded at presentation include; subperiosteal abscess, facial paralysis, labyrinthitis and significant sensory neural deafness. Intracranial complications seen include meningitis, cerebellar abscess, and encephaloceles. Canal wall down and canal wall up surgical techniques were evaluated.

**Conclusions:** A higher number of mastoidectomies are performed on the Indigenous population, the incidence of cholesteatoma reported is lower than expected and disease recurrence rates in canal wall down and canal wall up mastoidectomies are comparable to worldwide data.

**Keywords:** Epidemiology; cholesteatoma; mastoidectomy; indigenous

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## Introduction

The mastoidectomy is a surgery performed for a multitude of reasons, the first and most basic being infection (acute mastoiditis) as first described by Riolan the Younger in the 17<sup>th</sup> century AD (1). Since then, many other indications for mastoidectomy have been recognised; cholesteatoma, chronic middle ear disease, chronic/recurrent tympanic membrane perforations, tumours and surgical access as well as artificial cochlear implantation. These indications mandate a varied surgical approach to the mastoidectomy. Mastoidectomies are commonly categorised into “radical mastoidectomy”, “modified radical mastoidectomy”, “canal wall down mastoidectomy (CWD)”, “canal wall up mastoidectomy (CWU)” and “simple” or “cortical

mastoidectomy” (2). This paper evaluates epidemiological data from CWD and CWU mastoidectomies, as well as revision procedures for both approaches.

The type of mastoidectomy performed varies between surgeons, with most favouring one approach and only differing for exceptions. It is unclear which approach is superior in treating cholesteatoma and chronic discharging ear. The CWD procedure is associated with less recidivism and CWU is associated with better hearing outcomes (3,4).

This study will focus on patients that fall into the catchment area of the Cairns Base Hospital in Far North Queensland, Australia. This hospital serves as a primary otology referral centre for a population of 209,787, with a higher than average population of people identifying as Aboriginal or Torres Strait Islander (19,074, 9.1% by

**Table 1** Patient demographics

Gender	Aboriginal or non-Aboriginal, n (%)		Total, n (%)
	Aboriginal	Non-Aboriginal	
Female	33 (45.8)	39 (54.2)	72 (45.6)
Male	40 (46.5)	46 (53.5)	86 (54.4)
Total	73 (46.2)	85 (53.8)	158 (100.0)

**Table 2** Paediatric patients and pathology compared

Ethnicity	Pathology, n (%)			Total, n (%)
	Cholesteatoma	Granuloma	Retraction pocket	
Indigenous	16 (36.4)	7 (15.9)	2 (4.5)	25 (56.8)
Non-Indigenous	12 (27.3)	2 (4.5)	5 (11.4)	19 (43.2)
Total	28 (63.6)	9 (20.5)	7 (15.9)	44 (100.0)

**Table 3** Pathology versus gender

Pathology	Gender, n (%)		Total, n (%)
	Female	Male	
Cholesteatoma	48 (30.4)	59 (37.3)	107 (67.7)
Granulation/infection	15 (9.5)	18 (11.4)	32 (20.3)
Retraction pocket	8 (5.1)	8 (5.1)	16 (10.1)
Other*	1 (0.6)	1 (0.6)	2 (1.3)
Total	72 (45.6)	86 (54.4)	158 (100.0)

\*, one case of tumour (osteoma) and trauma to the middle ear required a mastoidectomy during the studied period.

population) (5). This study will evaluate the incidence and indications of this operation in the local population to determine if there are differences in the diseases encountered compared to other reported populations.

A current epidemiological study of mastoidectomies performed in Australia and their indications, to the knowledge of the authors, has not been reported and as such, this study will evaluate all mastoidectomies performed in our institution over a 10-year period. Their indications, disease extent and intra-operative findings are reported and discussed below.

## Methods

A retrospective cohort study of all patients (n=158)

requiring a mastoidectomy within the Cairns Base Hospital catchment area from 2003 to 2013, including revision and paediatric operations. There were no exclusions. The variables collected were; clinical presentation, age, gender, ethnicity, surgical technique used (CWD, CWU and revision) and intraoperative findings (pathology found, anatomical location, state of ossicles, state of tympanic membrane). This data was collated from chart reviews using the existing medical records. This data was tabulated and analysed using standard industry spread sheet software. No statistical analysis was performed. Missing data points were omitted from the results.

## Results

The total number of cases included in this study undergoing a mastoidectomy was 158 of which 45.6% were female (n=72) and 54.4% were male (n=86). A further breakdown of the patient demographics is tabulated (*Table 1*).

The average age of patients is 33, the youngest patient receiving a mastoidectomy was 2 years old (acute mastoiditis) and the eldest 82 (cholesteatoma). Of all patient studied, 44 were classed as paediatric (18 years of age and under). Within the paediatric group 63.6% (n=28) of operations were performed for cholesteatoma, 20.5% (n=9) for granulation tissue and 15.9% (n=7) for retraction pocket (*Table 2*). The paediatric population had a higher percentage of indigenous children (56.8%) receiving mastoidectomies than the non-indigenous patients.

The indications for the mastoidectomies are shown below (*Table 3*). The most common indication for mastoidectomy in our population was for Cholesteatoma (67.7%, n=107), followed by granulation/Infection (20.9%, n=33) and retraction pocket (10.1%, n=16). Cholesteatoma comprised 66.7% (n=48) of female operations and 68.6% (n=59) of male operations. Granulation/infection comprised 20.8% (n=15) of female operations and 20.9% (n=18) of male operations. Retraction pockets comprised 11.1% (n=8) of female operations and 9.3% (n=8) of male operations.

The disease extent as recorded intra operatively is shown (*Table 4*).

The state of the tympanic membrane at the time of the operation was recorded and can be compared to the pathology (*Table 5*).

The range of extra cranial complications recorded at time of mastoid were, in order of frequency; acute mastoiditis (n=15), sub-periosteal abscess, facial paresis/paralysis (n=3), sensory neural hearing loss (n=3) and neck abscess (n=1). It

**Table 4** Disease extent and location

Disease extent	Cholesteatoma	Granuloma	Retraction pocket	Trauma	Tumour (osteoma)	Total
Attic only, n (%)	8 (5.06)	2 (1.27)	4 (2.53)	1 (0.63)	–	15 (9.49)
Attic/antrum, n (%)	9 (5.70)	1 (0.63)	2 (1.27)	–	–	12 (7.59)
Attic/antrum/mastoid, n (%)	29 (18.35)	8 (5.06)	–	–	–	37 (23.42)
Canal/mastoid, n (%)	1 (0.63)	–	–	–	–	1 (0.63)
Meso only, n (%)	–	2 (1.27)	3 (1.90)	–	–	5 (3.16)
Attic/meso, n (%)	7 (4.43)	11 (6.96)	7 (4.43)	–	–	25 (15.82)
Meso/attic/antrum, n (%)	9 (5.70)	4 (2.53)	–	–	–	13 (8.23)
Meso/attic/antrum/mastoid, n (%)	44 (27.85)	5 (3.16)	–	–	–	49 (31.01)
Mastoid only, n (%)	–	–	–	–	1 (0.63)	1 (0.63)

**Table 5** Tympanic membrane perforations.

Pathology	Anterior	Central	Nil	Posterior	Sub-total	Total perforation	Total
Cholesteatoma, n	8	23	28	15	26	7	107
Granulation, n	3	8	7	4	11	0	33
Other*, n	0	1	1	0	0	0	2
Retraction pocket, n	1	4	5	1	5	0	16
Total, n (%)	12 (7.6)	36 (22.8)	41 (25.9)	20 (12.7)	42 (26.6)	7 (4.4)	158

\*, penetrating trauma, osteoma.

**Table 6** Surgical approach

Pathology	CWD, n (%)	CWD (revision of CWD), n (%)	CWD (revision of CWU), n (%)	CWU, n (%)	CWU revision, n (%)	Total
Cholesteatoma	59 (55.1)	3 (2.8)	5 (4.7)	37 (34.6)	3 (2.8)	107
Granulation/infection	4 (12.9)	1 (3.2)	1 (3.2)	26 (83.9)	2 (6.5)	31
Tumour (osteoma)	–	–	–	1 (100.0)	–	1
Retraction pocket	–	–	–	16 (100.0)	–	16
Trauma	–	–	–	1 (100.0)	–	1
Total	66 (41.8)	4 (2.5)	6 (3.8)	82 (51.9)	4 (2.5)	158

CWD, canal wall down mastoidectomy; CWU, canal wall up mastoidectomy.

is worth re-iterating that these cases of acute mastoiditis are only those requiring a mastoidectomy and do not reflect the conservatively treated population during this period.

The intra-cranial complications recorded are in order of decreasing frequency; meningitis (n=4), cerebral abscess (n=2), encephalocele (n=2). The facial nerve was dehiscent in 15.8%

(n=25) cases and the lateral semi-circular canal was dehiscent in 3.2% (n=5) cases. There was dehiscent tegmen resulting in exposed dura during operation in 5.7% (n=9) cases.

The variation of mastoidectomy performed is compared against the pathology present (*Table 6*).

There were 59 cases of CWD mastoidectomy and

**Table 7** Hearing ossicles involved in disease at time of mastoidectomy

Ossicles involved	Frequency	Percentage (%)
Stapes footplate	4	2.5
Stapes superstructure	37	23.4
Incus body	21	13.3
Lenticular/long process of incus	33	20.9
Malleus head	10	6.3
Malleus handle	8	5.1

37 cases of CWU mastoidectomy. There were 3 cases of CWD approaches requiring revision and 8 cases of CWU requiring revision. All retraction pockets were performed as canal wall up procedures as were the miscellaneous pathologies (trauma and tumour). Of granulation and infectious cases requiring mastoidectomy the majority (83.9%) were performed CWU.

The state of the hearing ossicles at the time of the operation was recorded (*Table 7*). The most commonly involved ossicular structures were the stapes superstructure (23.4%, n=37), the lenticular process of incus (20.8%, n=33), the incus body (13.3%, n=21) and the malleus head (6.3%, n=10).

## Discussion

The total number of mastoidectomies performed for any indication over the 10-year period studied was 158. This represents an annual incidence rate of 9.9 per 100,000 people. This is comparable to the incidence of mastoidectomy (for any indication) performed in the US, which was reported as 7.3–27.4 per 100,000 (5).

There is a high incidence of operations performed on Aboriginal patients (46.2% of operations) despite this population demographic comprising only 9.2% of the total population (6). This is at least in part due to the increased incidence of chronic middle ear disease in this population (7). The number of mastoidectomies performed on indigenous children for cholesteatoma accounted for the largest subgroup in the paediatric data (*Table 2*) (36.4%) which may be in direct conflict with the existing publications that state that incidence of cholesteatoma in indigenous populations are indeed below the population average (8,9). Possible anatomical and social reasons for this were discussed by Jassar

*et al.* (10). It is reasonable to expect that by collecting this data from patients who underwent mastoidectomies, there is likely a confounding factor in that more cholesteatomas are going to require a surgical intervention than chronic ear disease with or without perforation.

The most common indication for mastoidectomy was cholesteatoma (67%). This represents an incidence of 6.7 per 100,000 people and is lower than the reported incidence rate of 9 to 12.6 cases per 100,000 (11-13). This may represent an underdiagnoses of the condition or a geographical or genetic component of the condition.

Granulation tissue or infection represented the second most common indication for mastoidectomy (20.9% of operations performed). It is well documented in the literature that a high prevalence of chronic suppurative otitis media (CSOM) is present in the Indigenous population in Australia (12–30% of the population) (14). Because of this, it would be expected that surgeries for CSOM including mastoidectomies would be higher.

The most common surgical approach for the treatment of cholesteatoma was the CWD approach (n=59), followed by CWU (n=37). There were 3 recorded cases of CWD procedures requiring revision, and a total of 8 cases of CWU procedures requiring revision (5 of which were revised with CWD approach and 3 of which were revised with a CWU approach). This suggests that CWD approaches result in fewer episodes of disease recurrence. This is consistent with the most recently published research (15).

This study evaluates the epidemiological data obtained over a 10-year period in a rural Australian hospital. The incidence of mastoidectomies performed is comparable with published data, though a higher incidence of operations were performed on indigenous patients. Additionally, our data shows a higher incidence of cholesteatoma in the Indigenous population than previously published articles. A greater understanding of this discrepancy could be obtained from further investigation with a prospective study. Cholesteatoma represents the most common indication for mastoidectomy though the reported incidence is lower than other published data. The incidence of disease recurrence in CWD and CWU mastoidectomies is comparable to worldwide data.

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## Footnote

*Conflicts of Interest:* All authors have completed the ICMJE uniform disclosure form (available at <http://dx.doi.org/10.21037/ajo.2018.09.04>). The authors have no conflicts of interest to declare.

*Ethical Statement:* The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. The study was conducted in accordance with the Declaration of Helsinki (as revised in 2013). Institutional ethical approval and informed consent were waived.

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