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ABORIGINAL, TORRES STRAIT ISLANDER AND PACIFIC ISLANDER EAR HEALTH MANUAL



**Harvey Coates AO DM FRACS
Kelvin Kong FRACS
Alastair Mackendrick OAM, FRACS
Paul Bumbak FRACS
Chris Perry OAM RFD FRACS
Peter Friedland M.Med FRACS
Peter Morris PhD FRACP
Oh Chunghyeon MD**

With

**Murali Mahadevan FRACS
Sharon Weeks MA
Ann Jacobs B.App.Sci.
Azizah Roe B.App. Sci.
Jacinda Burgess, Doctoral Candidate**

**Helen Goulios PhD
Rachel Meddings PhD
Lara Shur Doctoral Candidate
Annette Kaspar PhD Candidate
Sam Harkus MPH**

Introduction

The state of a nation's health can be measured by the prevalence of children with chronic suppurative otitis media (CSOM). Otitis media in all of its forms is a disease of poverty. When the World Health Organization defines a 4% prevalence rate of CSOM as being a major public health problem, then the current rates of many times that in some Aboriginal communities is a serious indictment of the poor living conditions in these communities. Aboriginal children experience up to 32 months of conductive hearing loss in their first five years of childhood. This has a life-long impact on the child's speech and language development and subsequent educational and vocational outcomes.

It is in light of these concerns that public health initiatives to improve the general health of Aboriginal communities by improving housing and access to water, nutrition and medical care have been advocated. In addition, publications such as the "Systematic review of existing evidence and primary care guidelines on the management of otitis media in Aboriginal and Torres Strait Islander populations" from the Office of Aboriginal and Torres Strait Islander Health have become standard reference protocols for management of otitis media. The purpose of this manual is to supplement these guidelines with background teaching material and resources. In addition, this manual and its accompanying videos of images and common ear procedures will be available on line.

The authors are grateful to Kimberley Health and the Health Department of Western Australia for permission to base the manual on the excellent second edition of The Kimberley Ear Health Manual. We also appreciate the updated 2017 Recommendations for Clinical Care Guidelines on the Management of Otitis Media in Aboriginal and Torres Strait Islander Populations. We thank Hearing Australia for the use of some of their teaching materials. We also thank previous co-authors including the late Louis Leidwinger, the late Irene Nannup, Professor Francis Lannigan and all those who have contributed to this manual previously but are no longer in the field. We welcome our new co-authors who add increased diversity to this manual and Dr Rachel Meddings for her skilled organisation of this manual.

This fourth edition of the Aboriginal and Torres Strait Islander and Pacific Islander Ear Health Manual was made possible by a grant from The Garnett Passe and Rodney Williams Memorial Foundation who expressly requested us to include Pacific Islander peoples in this manual. The first and third editions of this Aboriginal Ear Health Manual were made possible by a seeding grant from the American Society of Pediatric Otolaryngology and the Telethon Foundation in Perth, Western Australia.

This manual is dedicated to Kiara, Lewis, Ellery, Billie,
and Lyn, Matthew, Katie, Sam, Will and Georgia.

Authors

Clinical Professor Harvey Coates AO, DM, MS FRACS, Department of Otolaryngology Head and Neck Surgery, University of Western Australia, Honorary Distinguished Research Associate, Telethon Kids Institute.

Associate Professor Kelvin Kong FRACS. Consultant ENT Surgeon to John Hunter Hospital Newcastle.

Mr. Alastair Mackendrick, AOM, FRACS, Former Consultant ENT Surgeon to Kimberley Health Service.

Professor Peter Friedland MMed, FRACS, Departments of Otolaryngology Head and Neck Surgery, Universities of Western Australia and Notre Dame. Senior ENT Surgeon Sir Charles Gairdner Hospital, Perth.

Associate Professor Christopher Perry OAM, RFD, FRACS. Senior ENT Surgeon Princess Alexandra Hospital and Lady Cilento Children's Hospital. ENT founder of Deadly Ears Programme, QLD.

Dr Oh Chunghyeon MD, Consultant Otolaryngologist, CWM Hospital, KOICA global doctor, Fiji

Mr Murali Mahadevan FRACS. Clinical Director / Surgeon at Starship Children's Hospital, Auckland.

Professor Peter Morris PhD, FRACP. Director of Paediatrics Royal Darwin Hospital, Professor at Menzies School of Health Research.

Mr Paul Bumbak FRACS Consultant Paediatric ENT Surgeon Perth Children's Hospital, Perth.

Samantha Harkus BA, DipAud, MPH (Aboriginal Health and Wellbeing) MAudA CCP
Principal Audiologist Aboriginal and Torres Strait Islander Services. Hearing Australia.

Lara Shur BA (Speech & Hearing Th. Hons), Masters, Cert Business Mgmt. Doctoral Candidate,
Director Clinical Services Earbus Foundation of Western Australia.

Azizah Roe B. App.Sci, INDCHL, Aboriginal Community Engagement Officer, Northern Western Australia, Hearing Australia.

Sharon Weeks MAud, Research Audiologist, Telethon Kids Institute.

Ann Jacobs B. App.Sci, Speech Pathologist in Private Practice, Perth, WA.

Jacinda Burgess, Doctoral Candidate, Audiologist, Sydney Cochlear Implant Centre, Newcastle NSW.

Dr Helen Goulios, PhD, MClinAud, MAudA CCP, Clinical Director Audiology, School of Human Sciences, University of Western Australia.

Annette Kasper, Audiologist and Doctoral Candidate, University of QLD.

Dr Rachel Meddings BSc (Hons), PhD, MClinAud, Audiologist, Earbus Foundation of WA

Foreword

Hearing loss has a disproportional impact on Aboriginal and Torres Strait Islander people due to high levels of ear disease during childhood.

Otitis media and associated hearing reduction can profoundly affect our people's lives, from early childhood and into adulthood, impacting on language development and their capacity to learn, gain employment and live rewarding lives.

Our Government, along with state and territory governments and non-government organisations, are investing to close the gap for Aboriginal and Torres Strait Islander ear and hearing health. These efforts require a willingness to work together and a strong focus on outcomes for patients. And of course, we must constantly listen to and act on the views of our people.

Our commitment to improving the lives of Aboriginal and Torres Strait Islander people has culminated in Australia's first *Roadmap for Hearing Health*, which is being progressed through the COAG Health Ministers' Council.

The Roadmap includes a framework to deliver collaborative policies and programs to close the gap for Aboriginal and Torres Strait Islander ear and hearing health. Health Ministers across Australia have agreed to work together to end avoidable deafness.

Complementing this, our Government has committed \$160 million to create the 10-year Indigenous Health Research Fund, with one of its key priorities the ending of avoidable deafness.

At the centre of all of this work is the need to reduce the level of ear disease, as we continue to build on efforts to date.

The *Aboriginal and Torres Strait Islander Ear Health Manual* provides a valuable resource for health professionals working with Aboriginal and Torres Strait Islander families and patients.

The commitment of the many health professionals who have ensured the manual remains based on the latest and best available evidence is appreciated and will help pave the way to a healthier and happier future for thousands of Aboriginal and Torres Strait Islander people.

The Honourable Ken Wyatt AM, MP
Minister for Indigenous Australians
Federal Government of Australia.



The Garnett Passe and Rodney Williams Foundation was established in 1986 by the late Mrs Barbara Williams to honour the memory of her two husbands, otologist Garnett Passe and stockbroker Rodney Williams. Mrs Williams had a vision to fund otolaryngology research and training in the pursuit of excellence within Australia and New Zealand. Upon her death in 1991, the Foundation became operative and her bequest was one of the largest bequests ever in Australian medicine. Since 1993 the Foundation has invested more than \$75 million in Australian and New Zealand Otolaryngology, Head and Neck Surgery. \$56 million of this has been provided to support early- and mid-career scientific and clinical researchers, in addition to partnering with research institutions to establish sustainable, longer term research programs and expertise in the field. In addition, three GPRWMF Chairs have been established in Australasia.

The contribution by the GPRWMF to Australian and New Zealand Otolaryngology has been outstanding, successfully accomplishing the Foundation's mission to keep the specialty at the forefront of world clinical and scientific practice. One area in which the Board of the Foundation has expressed interest, both in basic, translational and clinical research is the massive problem of middle ear disease in Aboriginal children, amongst the most severe in the world. From the earliest major studies in Queensland with Dr Gerald McCafferty, audiologist Neil Lewis and myself examining 16,500 Aboriginal children in a ten year period in the 1970's through to the pioneering research in the NT and WA, efforts to treat the recalcitrant disease have been prodigious. With the Foundation's assistance, sufficient high class research in the field has led to the establishment of a Centre for Research Excellence in Otitis Media based at Menzies School of Health Research and other Australian academic centres.

Part of research translation is to apply these research findings clinically, and by supporting this ATSI and Pacific Islander Ear Health Manual, the Foundation provides a teaching and learning resource for those at the coalface and becomes an advocate for improvement in the ear health of our Indigenous people.

Yours Sincerely,

Emeritus Professor William B Coman AM,
Foundation Chair, The Garnett Passe and Rodney Williams Memorial Foundation.



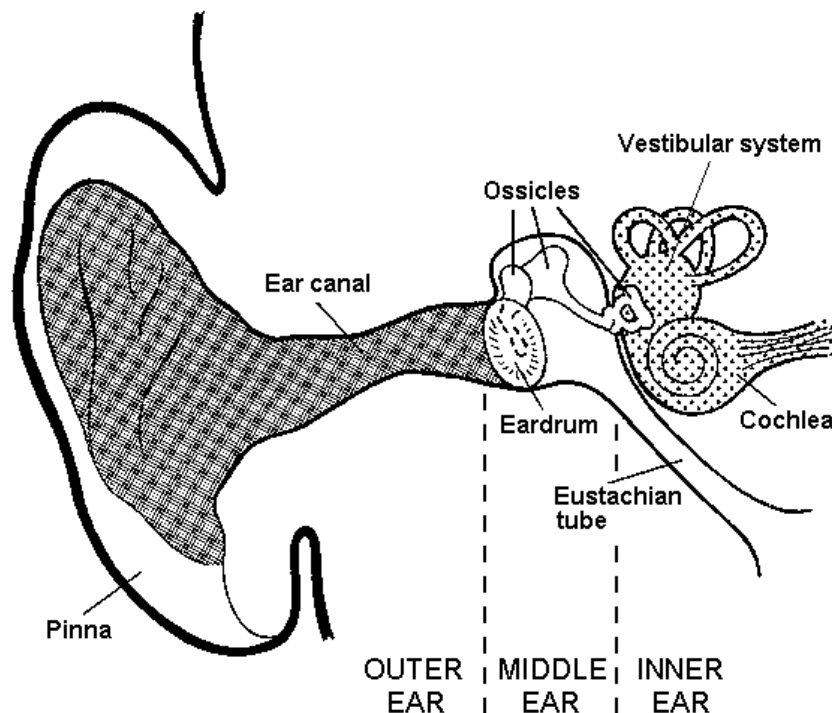
Contents

1. Anatomy and Function of the Ear	6
2. Causes of Hearing Loss	8
3. Hearing Loss - Types and Effects	9
4. Hearing and the Development of Language	11
5. Questions About Hearing Loss	13
6. The Development of Otitis Media	14
7. Addressing the Social Determinants of Otitis Media	18
8. Investigations	
• Otoscopy Examination of the Ear	22
• Pneumatic Otoscopy	24
• Audiology: The Measurement of Hearing	25
• Tympanometry	30
9. Middle Ear Disease and School	35
10. Children with Hearing Loss – General Classroom Strategies	37
11. Listening Strategies at Home	38
12. Common Conditions	39
• Acute Otitis Media (AOM)	40
• Chronic Suppurative Otitis Media (CSOM)	42
• Otitis Media with Effusion (OME or Glue Ear)	44
• Otitis Externa (Swimmer’s Ear)	46
13. Medical Treatment for Chronic Suppurative Otitis Media (CSOM)	47
14. Pacific Islander Ear and Hearing Health	49
15. Telemedicine	54
16. Algorithms for Treatment	56
• Does this child have a middle ear infection (Otitis Media)?	57
• Management of bilateral otitis media with effusion (OME)	58
• Management of acute otitis media without perforation	59
• Management of acute otitis media with perforation	60
• Management of Chronic suppurative otitis media (CSOM)	61
• Management of dry perforation	62
• Hearing loss due to middle ear infection	63
17. The unsafe or ‘at risk’ ear	64
18. Surgical Procedures	67
• Ventilation Tubes (grommets)	67
• Myringoplasty	69
19. Complications of Otitis Media	71
20. Resources	72

Anatomy and Function of the Ear

Study of the structure and function of various parts of the ear is needed to understand the different types of hearing loss and the methods used in preventing or treating hearing loss. The ear can be divided into three parts, which work together, they are the outer ear, the middle ear and the inner ear.

Basic Anatomy of the Ear



The Outer Ear

The outer ear consists of the pinna and the ear canal ending in but not including the eardrum. The outer ear works like a funnel. It directs sound down the ear and helps localize sound. The ear canal is about 24mm (1 inch) long. It has two bends and ends at the ear drum. The outer two thirds of the canal is formed of cartilage and the rest is bone.

The ear canal is lined with skin. The skin of the outer two thirds is the same as on the rest of the body. The skin contains sweat glands and special glands, which produce wax (cerumen). The wax is sticky and antibacterial and helps waterproof the canal. This prevents small particles from entering the canal and keeps a healthy ear free from infection. The skin is covered with hairs that help move dirt out of the canal. The ear canal ends at the eardrum.

The eardrum has three layers. The outer layer is skin; the middle layer is fibre which gives the ear drum its bounce; and the inner layer of mucous membrane which is part of the lining of the middle ear.

The Middle Ear

The middle ear is an air filled cavity, bridged by the ossicular chain. It passes sound from the eardrum to the inner ear. The ossicular chain is made up of three small bones, the hammer (malleus), anvil (incus) and stirrup (stapes). The hammer is attached to the eardrum. The stapes footplate rests on the membrane-covered oval window of the inner ear. When sound waves move the eardrum, they are transferred mechanically through the ossicular chain to the inner ear.

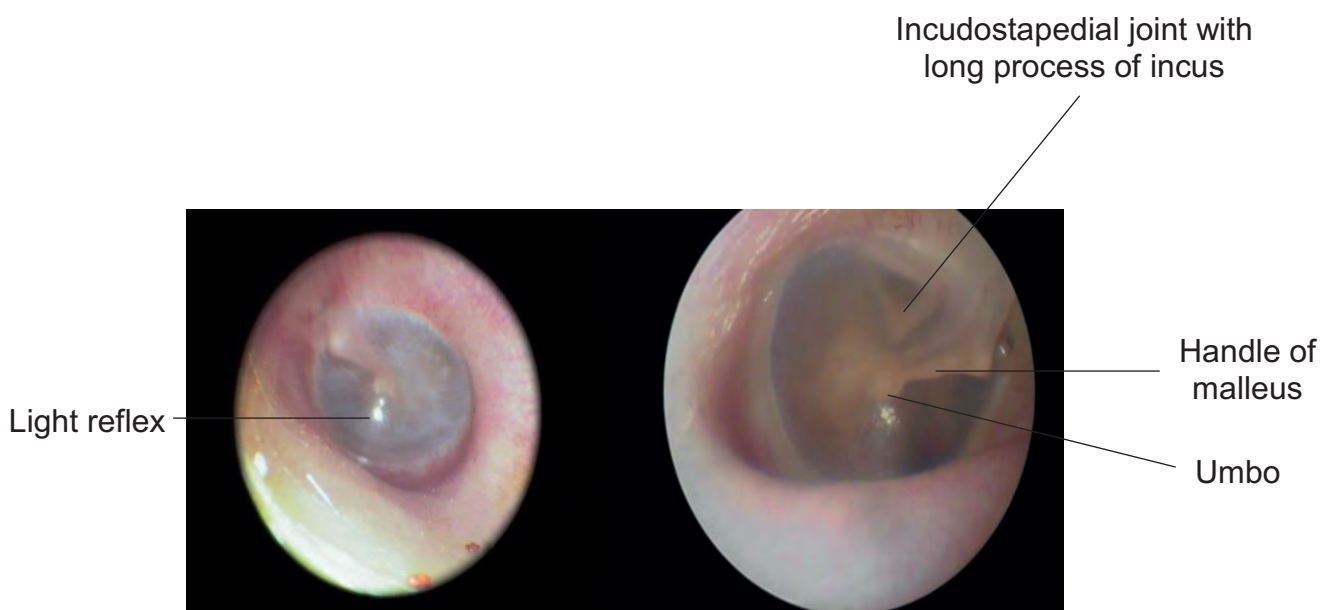
The middle ear is connected to the back of the nose by the Eustachian tube. This connection allows for pressure to be equalized during swallowing, yawning and sneezing. It also acts as a drain. The Eustachian tube is shorter in children and is more likely to get contaminated from the back from the nose. It is because of the difference in the shape and function that makes young children prone to ear disease.

The Inner Ear

The inner ear is a very delicate mechanism. For protection it is located deep in the skull behind the eyes. The inner ear is filled with fluid and contains two sensory systems, the balance and the hearing systems. The back section of the inner ear consists of three canals which give us our balance and help in the stabilisation of eye movement. These are the semi circular canals and are known as the vestibular system.

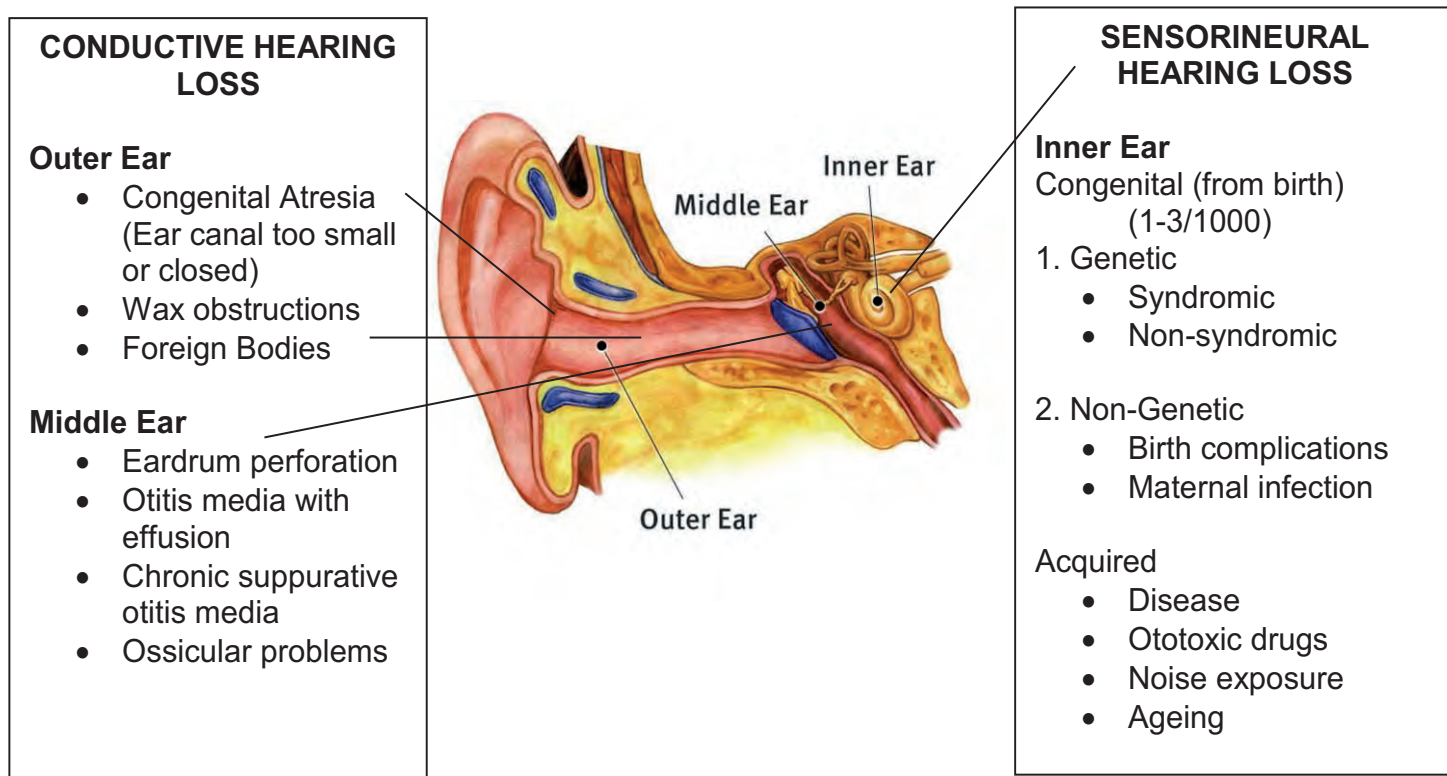
The hearing system is contained in the cochlea and the auditory nerve. The purpose of the cochlea is to change the signal from a sound message to an electrical message. These electrical messages are sent to the brain by the auditory nerve. The cochlea is a fluid filled snail shell like structure. In it there are about 30,000 tiny nerve endings called hair cells and all these connect to the fibres of the auditory nerve which transmits the sound message to the brain.

Otoscopic features of the eardrum showing the ossicular chain



Causes of Hearing Loss

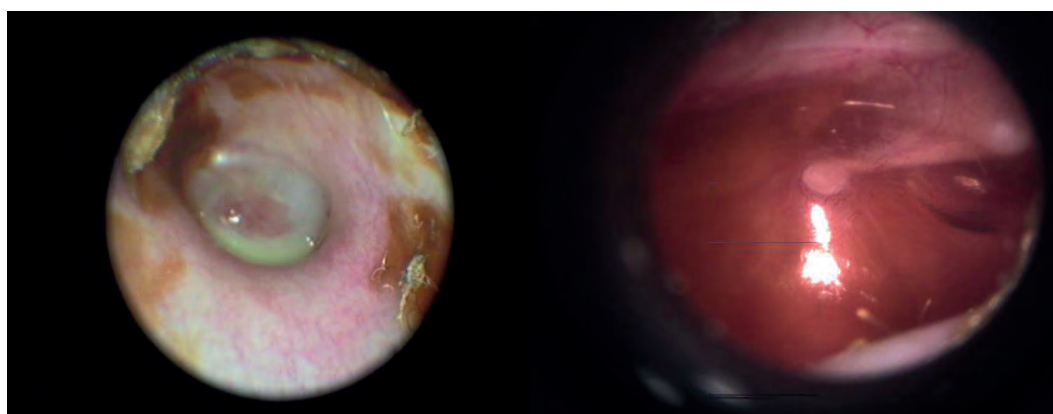
The main cause of hearing loss in Aboriginal and Torres Strait Islander children is otitis media or middle ear infection and its complications including otitis media with effusion (glue ear) and chronic suppurative otitis media (runny ear).



Otoscopic features of chronic suppurative otitis media (CSOM) and otitis media with effusion (OME)

CSOM

OME



Hearing loss – types and effects

There are three types of hearing loss. Below is a brief description of them.

Conductive

Conductive hearing losses are caused by some physical blockage or mechanical problem, which interferes with sound transmission through the outer or middle ear. Causes of conductive hearing loss include wax blockage, perforated ear drum, the various forms of otitis media, otosclerosis, a break in one of the middle ear ossicles, etc. Most, but not all, conductive hearing losses can be medically and/or surgically treated, resulting in improved hearing, frequently to near normal levels. Some people with conductive hearing losses use amplification instead of surgery.

Sensorineural

Sensorineural hearing losses are caused by damage to the hair cells of the inner ear, auditory nerve or brain. There are several causes of sensorineural hearing losses such as noise exposure, aging, meningitis, genetic factors, certain drugs, certain pre-natal conditions, some viruses, etc. Most, but not all, sensorineural hearing losses are permanent and do not get better. A majority of people with sensorineural hearing losses can be helped with amplification. Often people with sensorineural hearing loss will experience tinnitus, or ringing in the ear.

Mixed

A mixed hearing loss has both conductive and sensorineural components to the loss. As in pure conductive hearing losses, medical and/or surgical intervention with the conductive component can often improve the hearing.

The effect of hearing loss

To understand the effects of hearing loss it is important to understand the need for good hearing. Good hearing is essential for the development of normal language and communication. Even a mild, fluctuating conductive hearing loss, which can be associated with otitis media, can have a negative effect on language and learning in many children.

If a child has a hearing loss it will cause problems in the development of various skills. The amount of problems that happen will depend on two main aspects of the hearing loss:

- The age of onset - the earlier in the child's life, the greater these skills are impacted.
- The degree of hearing loss - the greater the hearing loss, the greater these skills are affected.

The 2017 Recommendation for Clinical Care Guidelines on the Management of Otitis Media in Aboriginal and Torres Strait Islander Populations have different definitions of mild and moderate hearing impairment in Aboriginal and Torres Strait Islander children. It defines a mild hearing loss as from 21 – 30 dB HL and a moderate hearing loss as greater than 30dB HL.

These are some of the effects of different degrees of hearing loss on learning and classroom performance

Slight (16 - 25 dB)

Understand conversation at 3 m in quiet
Speech/language development may be affected because of hearing loss
Should understand most classroom discussion
A few children may require some degree of amplification
Difficulty listening and understanding in background noise

Mild (26 - 40 dB)

Understand conversation at 1 - 1.5 m in quiet
May have delayed speech/language development
Will miss up to 50% classroom discussion
Will need amplification, hearing aids or FM system
May need special education attention
Difficulty listening and understanding in background noise

Moderate (41 - 55 dB)

Understand conversation at 0.5m in quiet
Will have difficulty at school
Likely will have speech/language delay
Will require hearing aids and/or FM systems
Will need special education assistance and probably special training for listening
Uses vision for additional cues to understand spoken messages

Moderately Severe (56 – 70 dB)

May understand speech at ~25 cm in quiet
Will hear moderately loud environmental sounds
Will have delayed speech/language
Requires use of hearing aids and FM systems
Will need special education assistance and special training for listening

Severe (71 - 90 dB)

May understand some speech at <15 cm in quiet
Hears loud environmental sounds
Will have delayed speech / language
Requires use of hearing aids and FM systems
Requires auditory training
Uses vision for additional cues to understand spoken messages
Speech / language will not develop spontaneously if loss present before 1 year old
May be a candidate for cochlear implantation

Profound (> 91 dB)

May only be aware of very loud sounds
Speech and language will be defective
Visual and gestural cues essential for learning
Needs full time special education assistance
Requires use of a hearing aids and FM systems
May be a candidate for a cochlear implant

Hearing and the development of language

To understand the effects of hearing loss it is important to understand the need for good hearing. Good hearing is essential for the development of normal language and communication. A person with normal hearing can hear a wide range of frequencies (sound pitches) from 20Hz to 20,000 Hz. Human hearing is most sensitive to the frequencies that comprise speech which range from 500Hz to 4000Hz. Humans can detect very soft sounds from around 0 decibels (dB) to very loud sounds 120dB. Sounds that are louder than 120dB can be painful. A history of Otitis media in early childhood has been found to interfere with the development of an efficient and accurate speech processing system, especially children who are learning more than one language and or dialect.

When babies are born, their most highly developed sense is hearing. Universal newborn hearing screening is available in Australia, New Zealand and limited parts of the Pacific Islands (Guam, American Samoa). Its purpose is to identify babies with a hearing loss so they can receive early intervention which dramatically improves outcomes for these babies. For the first few months of life, babies without middle ear disease or a profound hearing loss will exhibit a stereotyped startle response to sudden loud sounds, the Moro reflex. A sudden loud sound will cause the baby to extend its arms and legs and throw its head back. This particular reflex normally will disappear by about 4 months of age. After 4 months of age, a baby will simply “jump” at sudden loud sounds, much as an adult will do.

From a very early age (days), babies can distinguish subtle cues in speech sounds, for example, the difference between a spoken “ba” and “pa”, or “ba” and “da. By one month of age, a baby will lay still in response to certain sounds, particularly the mother’s voice.

Between 4 and 6 months babies begin to locate sound by shifting their eyes or turning their heads towards the sound. This behaviour is a reflex at this stage.

From about 6 months of age, babies will turn their head towards a sound. At this stage they are able to participate in hearing assessments utilizing puppets and sounds coming from speakers (soundfield) or ear inserts. This type of testing is referred to as visually reinforced orientation audiometry (VROA).

At around 6 months of age, babies will produce speech-like sounds. Within a short time, a couple of months, the baby will then only produce speech sounds of the language(s) spoken around it.

In addition, around 6 months of age, babies will smile at soothing sounds, and cry at harsh or angry sounds. They begin to recognize sounds like the rattle of the spoon in a plate. They will localize sounds more directly and can follow the conversation of familiar people by turning and watching as each person speaks.

By 12 to 15 months, the child will start using single words with meaning, and is able to understand some conversation. The child should be beginning to point to items and objects of interest and people.

At 18 to 20 months of age, a child should start to put 2 words together in short phrases. The child should now be following simple instructions such as “Put it in the bin” and “Where’s Daddy?”



By 2 years of age a child has learned to interpret all sorts of sounds and the words and actions of people in their environment. The child may have 50 words and talk in 3 word sentences. From here language continues to rapidly expand so that by 3 years of age it is possible to have an intelligible conversation with the child. By 6 years of age, most children have developed language skills to a high level. They use these language skills in many ways

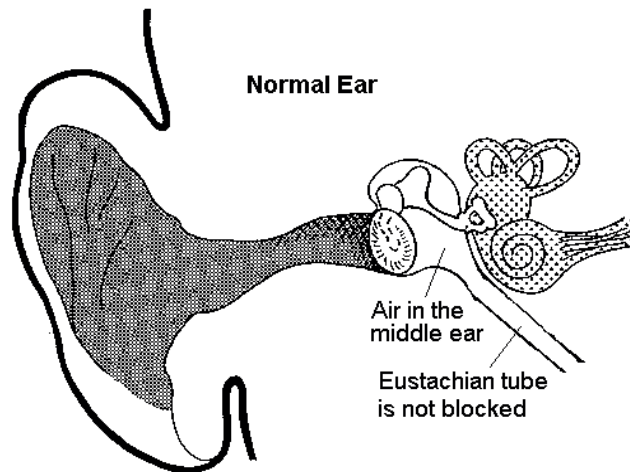
- To communicate and socialize with others
- To think (cognitive skills)
- To learn through reading, writing and listening

Important questions you can ask parents and caregivers about their child's hearing

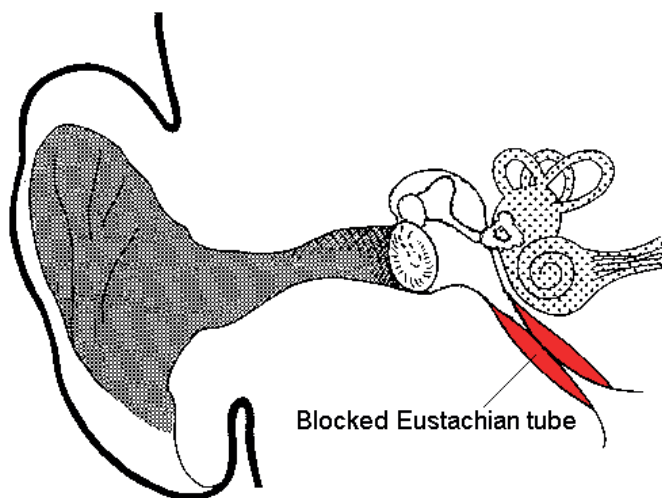
Sometimes parents and caregivers will attend and express concerns about their child's ability to hear or not hear different sounds. You can learn a great deal about a child's hearing by asking the caregiver some specific questions at stages of their life from new born to 2 or more years of age. If the child is not showing these hearing or speech behaviours, they may have a hearing loss and need a full hearing test.

AGE	QUESTIONS TO ASK CAREGIVERS
<i>Newborn to 4 months</i>	<ul style="list-style-type: none"> • Did baby have a newborn hearing screen? • Did baby pass or was referred on their newborn hearing screen? • Do sudden, loud noises wake the baby? • Does the baby cry at very loud noises? • Does an awake baby jump at sudden, loud noises like a door slamming or a dog barking nearby?
3 to 4 months	<ul style="list-style-type: none"> • Does the baby sometimes turn its eyes or start to turn its head to see where a noise comes from? • Is the baby distracted from feeding by moderately loud noises close by?
4 to 7 months	<ul style="list-style-type: none"> • Does the baby frequently turn straight to sounds? • Does the baby make a variety of babbling sounds? • Does the baby enjoy playing with noisy toys or objects? • Can you soothe the baby with your voice?
7 to 9 months	<ul style="list-style-type: none"> • Does the baby turn to find things heard but not seen? • Does the baby gurgle, coo or babble to unseen sources of voices or other sounds?
9 to 24 months	<ul style="list-style-type: none"> • Does the baby show pleasure when hearing sounds like the bath running, food being prepared or kids coming home? • Does the baby copy words and sounds? • Does the baby by about 15 months use some single words spontaneously? • Does the baby respond when you call from another room?

The Development of Otitis Media

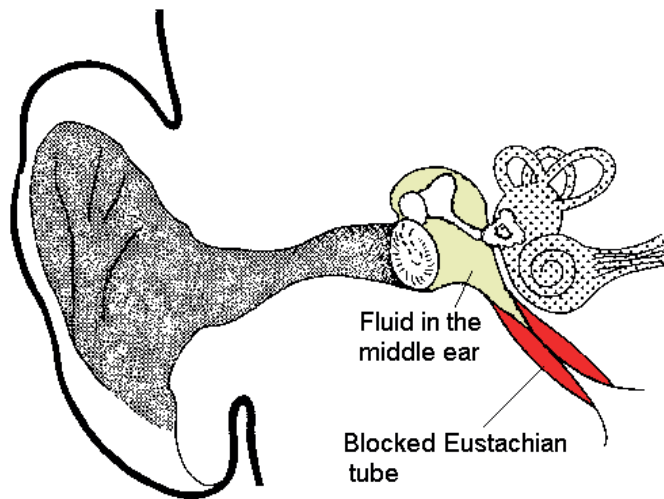


In a normal ear there is air in the middle ear. The Eustachian tube opens when yawning and swallowing to let air get into the middle ear.



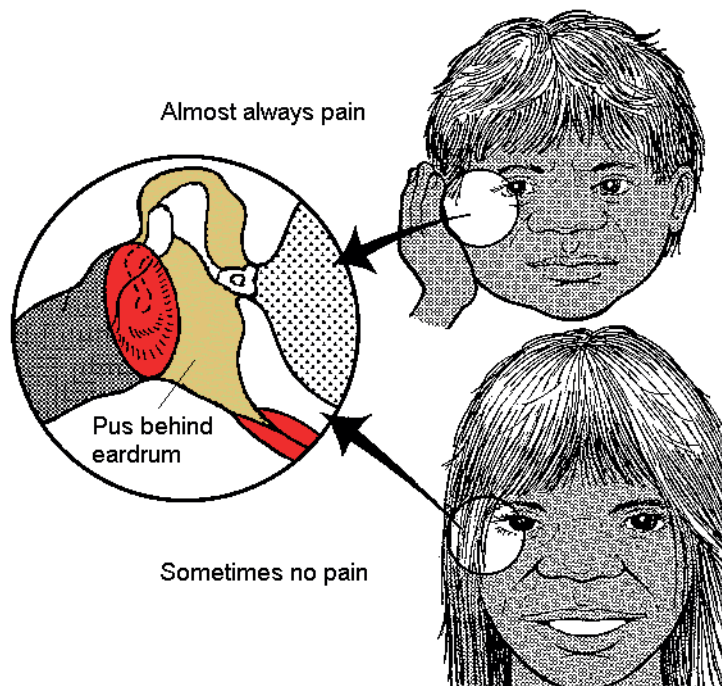
The Eustachian tube can swell and become blocked. Air cannot get into the middle ear and fluid cannot drain out of the middle ear. This may happen with an upper respiratory tract infection (common cold).

Keeping the nose clean and doing the Breathing, Blowing and Coughing Program can help unblock the Eustachian tube.

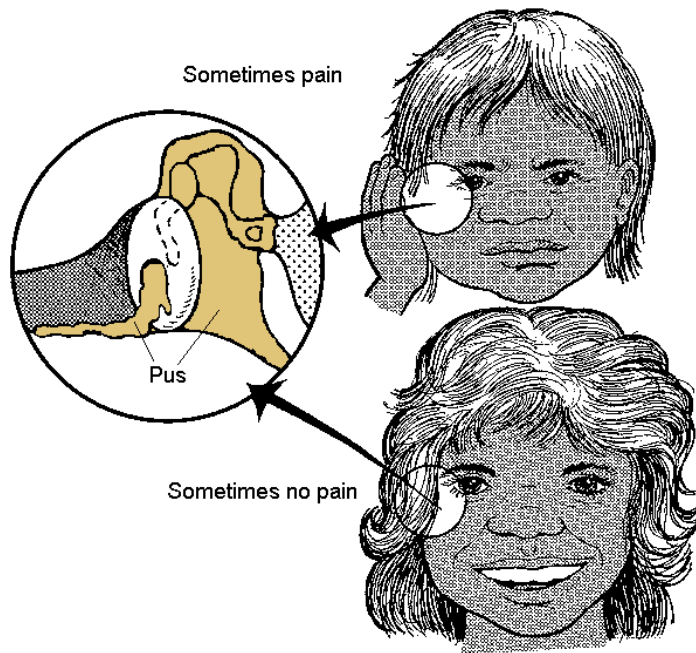


Fluid can build up behind the eardrum. At this point the ear is not infected. This is called otitis media with effusion. If the fluid is present for 3 months or more, it is called glue ear.

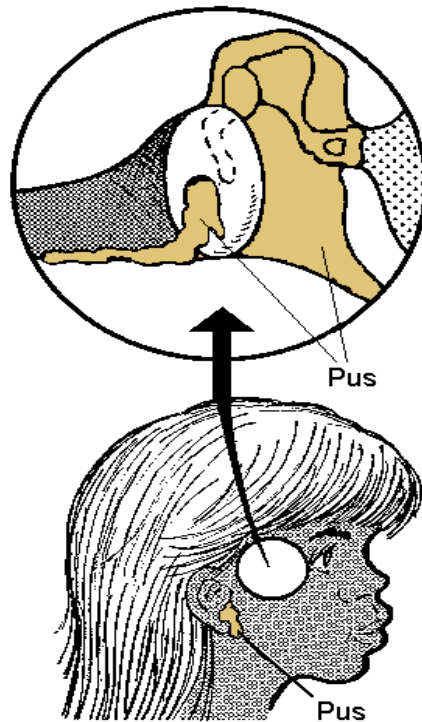
Keeping the nose clean and doing the Breathing, Blowing and Coughing Program may help the fluid go away.



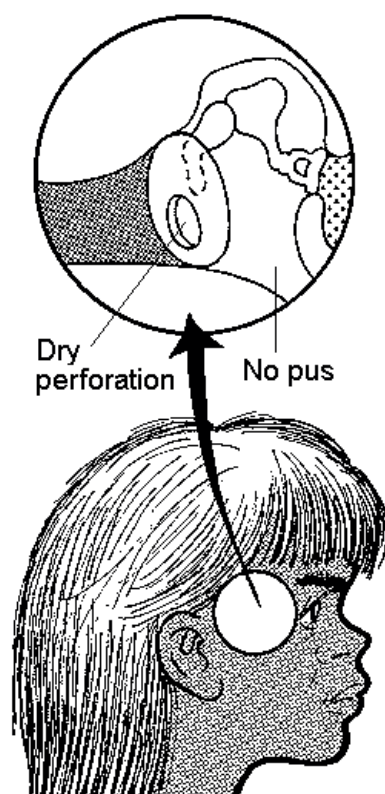
The ear can become infected and the fluid turns to pus. The eardrum becomes red and bulges out. There is almost always much pain. This condition is called acute otitis media.



The eardrum can burst and the pus drains out. After the eardrum bursts, the pain usually goes away. Sometimes the eardrum will heal up on its own, and sometimes it will not.



If the pus keeps draining from the ear for a long time, it is called chronic suppurative otitis media, or runny ear.



If the runny ear is syringed and treated with antibiotic ear drops, the pus can go away and the ear becomes dry. Sometimes the eardrum will heal up on its own. If it does not, and the hearing is bad, the ear surgeon can put a patch or graft on the eardrum.

If the pus does not go away with syringing and antibiotic ear drops, there may be a cholesteatoma or 'skin cyst' in the middle ear. Cholesteatoma is a serious condition which can lead to life threatening complications. It is on the increase in Australian Aboriginal people and can be seen in up to 20 % of chronic runny ears. The ear surgeon will need to examine the ear, arrange a special X-ray and in most cases perform surgery.

Addressing social determinants of health

Amongst the Indigenous communities of the world, there are higher rates of chronic suppurative otitis media (CSOM) and associated hearing loss. CSOM or 'runny ear' has been described as a disease of poverty, mirroring those factors which result from inadequate or overcrowded housing, a lack of fresh water, access to medical care, poor diet and issues with hygiene. These factors are also known as the Social Determinants of health and are a critical factor in preventing the last four percent of children with CSOM achieving clearance of their ear infections.

CSOM and its associated hearing loss leads to poor schooling, vocational, behavioural and health outcomes. Improved public health measures play an important role in reducing the prevalence of ear infection rates, hearing loss, and improving quality of life and social outcomes.

Strategies that address the social determinants of ear health include the following

- Improving the home environment.
- Avoiding overcrowding – a bed for each child
- Clean water for washing and showering.
- Improve nutrition, more fresh, healthy food and less 'junk' food.
- Increase breastfeeding and for six months if possible.
- Protection against infection.
- Keep flies away from ears, nose and throat, and food.
- Hand and face washing, nose blowing and Breathe, Blow, Cough (BBC) program.
- Ensure vaccinations are up to date, especially the pneumococcal vaccines.
- Reduce passive smoking
- Don't smoke around babies and children.
- Regular health checkups.

The four following programs are examples of groups and services which are addressing the social determinants of health in different ways.

Deadly Ears Program, Queensland

The Queensland Government recognised the impact of middle ear disease and associated conductive hearing loss on the childhood development and educational outcomes in Aboriginal and Torres Strait Islander children by establishing the state-wide Deadly Ears Program. This unique program combines the delivery of frontline ENT and allied health services across Queensland with leadership of the state-wide *Deadly Kids: Deadly Futures* (DK:DF) policy framework.

Deadly Ears clinical services are currently delivered in eleven discrete Indigenous locations across Queensland. Services are provided by three Deadly Ears teams:

(1) The Primary Health team supports local communities with professional development and health promotion. This ensures local services are regularly conducting ear and hearing checks, prioritising 0-4 year olds, treating children in accordance with clinical guidelines, and making appropriate referrals to the program's ENT team.

(2) The ENT Outreach team delivers clinic, surgery and audiology in remote communities to children with significant ear disease and hearing loss.

(3) The Allied Health team supports children with significant hearing loss and associated impacts, and works closely with local services to address children's early development and education needs.

Implementation of key actions under the DK:DF framework is governed by a multi-agency steering committee and published in an annual DK:DF Action Plan. In order to address the underlying social determinants affecting ear health, the current DK:DF Action Plan includes two projects designed to ameliorate these issues. Queensland Health and other agencies are developing and piloting 'healthy housing' projects to improve the functionality of homes and support family healthy living, modelled upon NSW Health's 'Housing for Health' program which achieved a 40% reduction in hospitalisation for infectious conditions in the first ten years of its operation.

In addition a second multi-agency DK:DF project will address many of the other social determinants of health in North Queensland in 2019-2020. Links to the Deadly Ears website are in the appendix.

EON Foundation

EON Foundation was formed some fourteen years ago to address the poor nutrition causing preventable and chronic disease in remote Aboriginal communities by growing, in partnership with Aboriginal communities, edible gardens and practical, healthy eating programs that sow the seeds of changing attitudes to nutrition for generations to come.

The 'hands on' grassroots EON Thriving Communities Program has five year, and longer commitment to remote communities in the Pilbara, Kimberley's, Northern Territory and the mid-West, providing edible gardens in remote Aboriginal schools along with fresh food, education on gardening, nutrition, cooking and hygiene. The qualitative outcomes of these programs have been significant, with reported improvements in health outcomes in participating children along with long term behaviour changes relating to food and health, improved school attendance and engagement as well as training and employment opportunities for adult community members.



Earbus Foundation of Western Australia

Earbus Foundation of Western Australia [EFWA] is a registered charity that works to reduce the incidence and impact of Otitis Media (OM) on Aboriginal and other at-risk children in Western Australia below the World Health Organization benchmark of 4%. EFWA works collaboratively with Aboriginal Medical Services, Royal Flying Doctor Service, Starlight Foundation and WA Country Health Services in rural and remote regions of Western Australia. EFWA is the largest provider of paediatric hearing services in the non-government sector in WA.

EFWA's experienced and expert clinical team includes Audiologists, GPs, Nurse Practitioners, Aboriginal Health Workers, Nurses and ENT (Ear Nose & Throat) Specialists. This team travels together providing services at the same time in each community. The focus is on combating chronic OM and its potential life-long effects including its effect on preventing Aboriginal children from accessing education and thereby reaching their true potential. Once children can hear well, they can attend and succeed in school and beyond, ultimately opening up a potential pathway from poverty via education. The Earbus Program has significantly reduced the incidence and impact of Otitis media in Aboriginal communities in both the Pilbara and Goldfields regions of WA. Similar patterns of disease reduction are evident across these regions with rates of less than 4% achieved within 3 years of starting services in some regions.



Earbus Program design tackles ear disease holistically, closely aligning with traditional Aboriginal perspectives on health. The innovative WA Earbus model was designed by Aboriginal people for Aboriginal communities. It addresses those inequalities in the health of Aboriginal and Torres Strait islander children, by helping address the social determinants of ear health, especially with respect to timely and consistent primary health care. In view of the increasingly young ATSI population, increase in health services will necessarily need to increase to maintain equity of health services.

Aboriginal Medical Services

Throughout Australia, more than 140 Aboriginal Medical Services (AMSs) operate in urban, rural and remote communities forming a network under the aegis of the National Aboriginal Community Controlled Organisation (NACCHO) but each AMS is autonomous and independent of each other and government. Aboriginal health means not just the physical well-being of an individual but refers to the social, emotional and cultural well-being of the Whole Community in which each individual is able to achieve their full potential as a human being, thereby bringing about the total well-being of their community.

AMS's provide the following services.

- Clinical services both primary care, population health and pharmaceutical supply system.
- Support services, staff training, infrastructure and management structures, plus
 - externally, support for visiting specialists and allied health professionals
 - and student training.
- Special programs such as ear health programs.
- Advocacy and Policy Development and support for the community on local, state and federal issues.



Otoscopy

Examination of the ear

This section indicates the steps to carefully and safely examining a child's ear, including the all important history from the parent or caregiver.

History

Ask the child or parents about the ear and/or the infection:

- Is the ear sore?
- How long has it been sore for?
- Has any pus been coming out of the ear?
- How long has it been coming out for?
- Has the child been swimming, and where?
- Can the child hear as well as before?

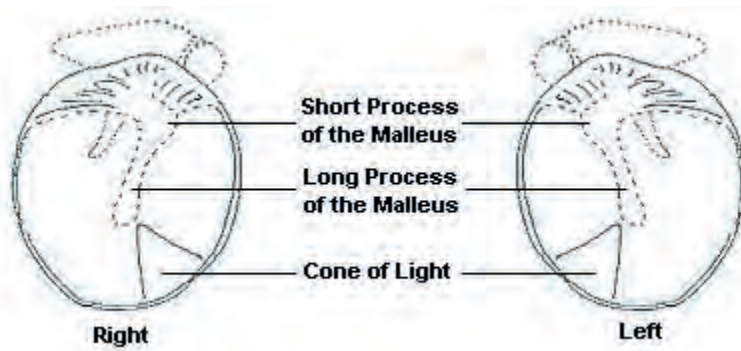
Ear examination

Sit on a chair when looking at the child's ear so that your eye is at about the same level as the child's ear. For very young children, have them sit on someone's lap. If you approach the child from a standing position you will tend to focus on the blood vessels of the ear canal. If you look in a child's ear in this manner tilt the light of the otoscope upwards and you will see the eardrum. However if it is possible it is preferable to sit on a chair when looking in a child's ear. It not only makes it easier to view the eardrum but may make the child feel more comfortable.

- Look at the ear from the outside noting any pus coming out etc.
- Show the child the otoscope and explain what you are going to do.
- Using the otoscope.
 - For children, gently pull the pinna (outer ear) up and back to straighten the ear canal. Hold the otoscope in such a way that you can brace your little finger against the child's head. In this way if the child moves suddenly, the otoscope will not be jammed into their ear.
 - For infants, gently pull down and back on the ear lobe to straighten the ear canal.



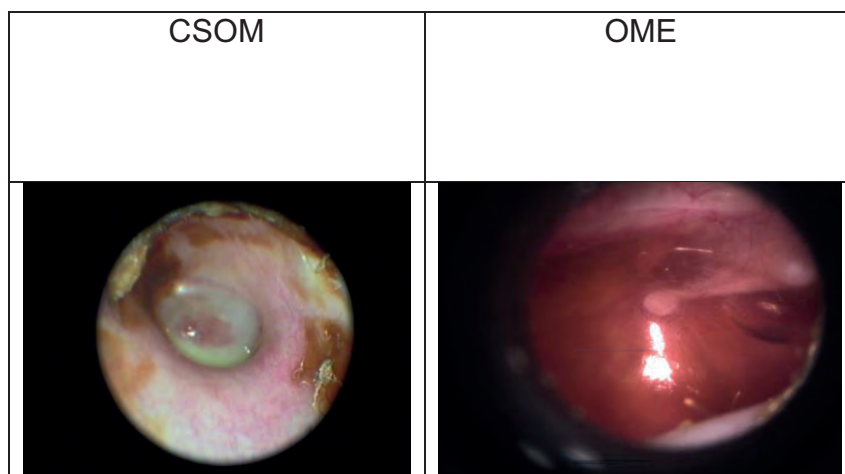
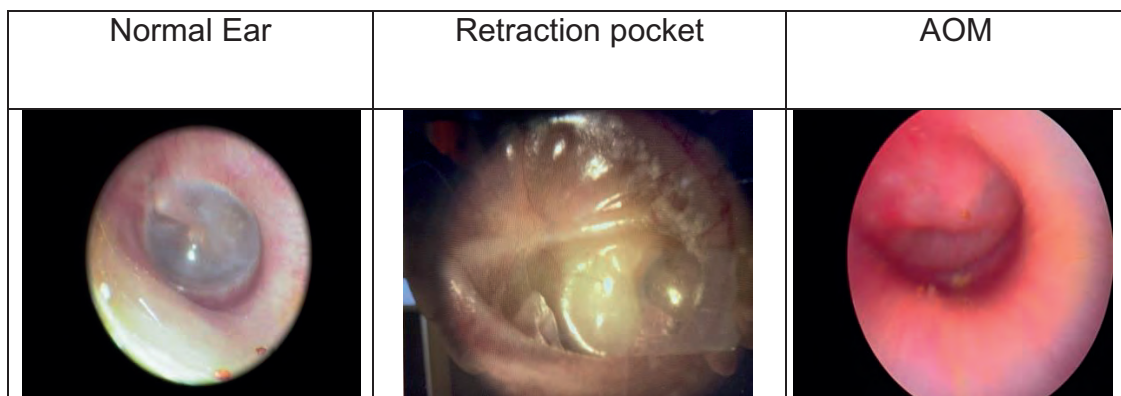
- Looking in the ear. The following figure depicts normal right and left eardrums. The major landmarks are the long process of the malleus, the cone of light reflected from where the long process of the malleus connects to the ear drum (umbo), and the short process of the malleus. Some eardrums are so transparent that other features behind the eardrum can be seen.



However, a large number of children may have abnormal appearing eardrums due to a history of repeated bouts of otitis media. Consequently, when looking at eardrums it is important to report one of the following attributes and record them accordingly.

Is the eardrum:

- Normal?
- Intact?
- Perforated?
 - dry, wet or with pus
 - small, medium or large perforation
- Foreign object?
- Healed perforation?
- Excessive wax?
- Unsure?



Pneumatic Otoscopy

Pneumatic otoscopy is a subjective measure of tympanic membrane and middle ear status. Although there is a shortage of evidence-based literature on its use, it remains a common diagnostic procedure. It is used to diagnose possible eustachian tube dysfunction or otitis media.



The pneumatic otoscope is a hand held instrument similar to an otoscope but with the ability to seal the ear canal with the speculum. It has a light source with a pneumatic tube attached to the otoscope which allows a puff of air to be placed into the ear canal. By squeezing a bulb connected to the pneumatic tube the pressure can be changed in the ear canal. The puff or air allows for the observation of how the eardrum responds to changes in ear pressure. The pressure required to move a normal tympanic membrane ranges from 10-15 mm of water pressure.

However the pressure needed to move a tympanic membrane with a significant middle ear effusion may be from 40-116 mm.

Pneumatic otoscopy requires that the pneumatic otoscope is correctly functioning, that is, the battery should be fully charged and there should be a strong light source to allow for optimal visualization. The pneumatic seals should also be checked to ensure they are functioning.

The use of the pneumatic otoscope requires some practise. Observation of the movement in the posterior superior part of the tympanic membrane is most indicative of the middle ear status. To perform the test the child should remain quite still. The pneumatic otoscope is inserted into the ear canal with appropriate sized speculum to obtain a seal. There is often reported pain and discomfort to patients during the test and as a result the test may not be used frequently. This discomfort is due to the pressure being introduced exceeding that which is required to move the tympanic membrane. The presence of cerumen partially or completely obstructing the ear canal may need to be removed and reviewed to obtain a clear view of the tympanic membrane.

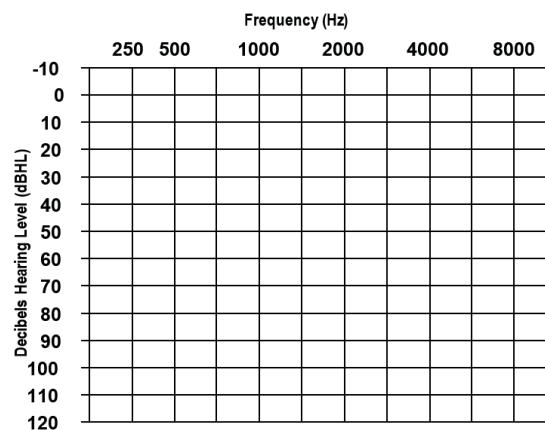
If the tympanic membrane moves well then the eardrum is intact and there is no middle ear fluid. If the eardrum has restricted movement or no movement at all and the tympanic membrane is intact, then the child may have a middle ear effusion.

Audiology

The Measurement of Hearing

The results from a hearing test are displayed on an audiogram. An audiogram is a graph that shows the softest sounds a person can hear for a range of different **frequencies** (or pitches) as shown on the graph below.

The horizontal axis (across the bottom of the audiogram) shows these frequencies and they typically range from 250 hertz (Hz) to 8000 Hz. These frequencies are the most important ones as they are most needed for hearing speech sounds. The vertical axis (going from the top to the bottom of the audiogram) is the loudness intensity scale in decibels (dB) hearing level. The softest sounds are at the top of the audiogram and the loudest sounds are at the bottom of an audiogram.



Hearing Thresholds

The actual symbols plotted on an audiogram are called **hearing thresholds** and these represent the softest sound a person can hear at each frequency. A threshold is defined as the intensity level at which a person can hear a specific sound 50% of the time. There is a specific standardised procedure used to measure each threshold.

Thresholds are measured for both the left and right ears and different symbols are used to differentiate the ears. Thresholds are also measured performing air conduction testing and bone conduction testing to establish the type of hearing loss present. This may be sensorineural, conductive or mixed in nature. The type of hearing loss represents where along the auditory pathway ear pathology is present.

Air and Bone Conduction Testing

Air conduction is performed using standard headphones or insert earphones where a sound is presented at the opening of the ear canal and travels the entire auditory pathway before it is heard. Air conduction testing assesses the outer, middle and inner ear. Bone conduction testing is performed using a bone vibrator which transmits sounds to the bones of the skull, and these stimulate the inner ear directly. Bone

conduction testing assesses the function of the inner ear. When we compare the air conduction thresholds with the bone conduction thresholds, we can then determine the nature of the hearing loss.



Nature of Hearing Loss: Sensorineural, Conductive or Mixed

A **sensorineural** hearing loss is indicated when the air and bone conduction thresholds are the same in an ear. This suggests that there is no outer or middle ear problem and that the pathology is in the inner ear. An example of this might be if you develop a hearing loss after exposure to loud sounds or through ageing.

A **conductive** hearing loss is indicated if the bone conduction thresholds are normal and the air conduction thresholds are not. This suggests that there is a problem in the outer or middle ear blocking the sound from getting to the inner ear. An example of this might be if you develop a hearing loss through an ear infection which leads to fluid in the middle ear.

A **mixed** hearing loss is indicated if both the air and bone conduction thresholds are not normal AND the bone conduction thresholds are better than the air conduction thresholds. This suggests that there is a problem in the inner ear AND the outer or middle ear. An example of this might be if you have developed a hearing loss through ageing AND also have fluid in the middle ear.

Masking

When testing hearing, the sound stimulus being presented may need to be made so loud on the test ear, that it is heard by the non-test ear. This is called **crossover**. To make sure that the test ear is hearing the sound, it is necessary to cover up the non-test ear with a masking sound. Masking is necessary when there is a 40db or more difference between the air conduction threshold of the test ear and the bone conduction threshold of the non-test ear. The masked threshold is the true threshold. It is beyond the scope of this manual to provide a comprehensive discussion of masking. The concept has been included in order for one to recognise the masked audiometric symbols and to interpret an audiogram.



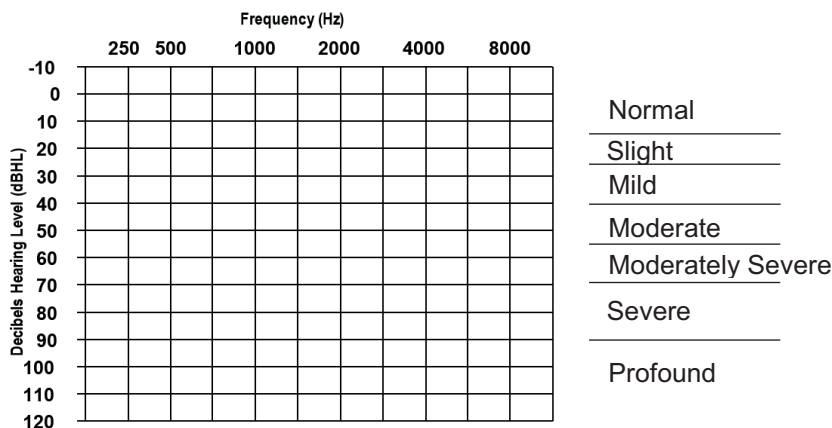
Audiometric Symbols

Audiometric symbols are used to indicate whether the left or right ear has been tested, whether the testing was performed using headphones (air conduction) or a vibrator (bone conduction) and whether masking was required to ensure the results truly represent the test ear. Occasionally the symbols will be colour coded red (representing the right ear) and blue (representing the left ear). Any symbol with an arrow attached to it pointing downwards indicates there was no response at the maximum level for a given frequency available on the audiometer. Most audiograms will contain a key to the audiometric symbols. The table below shows the commonly used standard symbols.

	Air Conduction		Bone Conduction	
	unmasked	masked	unmasked	masked
Right	O	● or △	<	[
Left	X	⊗ or □	>]

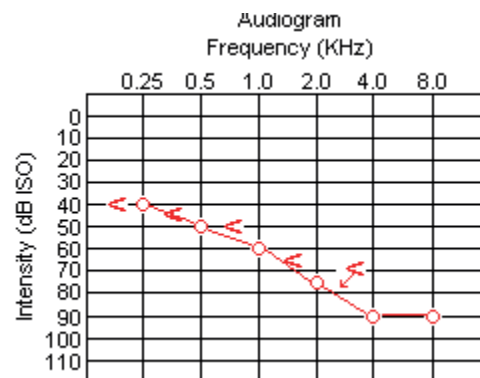
Interpreting Audiograms

An audiogram shows the degree and type of hearing loss and typically both ears are included on the same audiogram. The degree of hearing loss ranges from normal hearing to profound hearing loss. The type of hearing loss refers to the nature of the loss and this may be sensorineural, conductive or mixed. The audiogram below shows the ranges that are typically used to describe the severity of hearing loss.



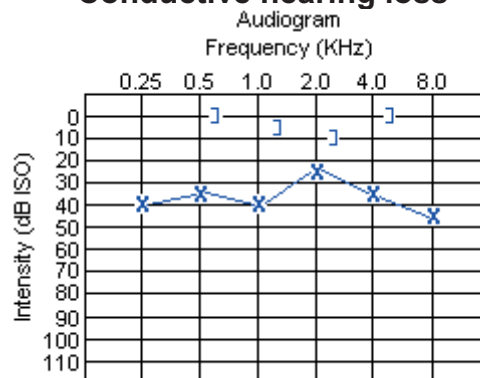
The Audiograms below give examples of sensorineural, conductive and mixed hearing losses.

Sensorineural hearing loss



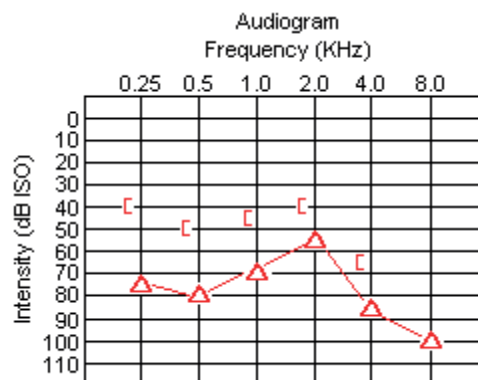
Moderate to severe sensorineural hearing loss. The difference between air and bone conduction is less than 15 dB HL and these thresholds are outside normal limits.

Conductive hearing loss



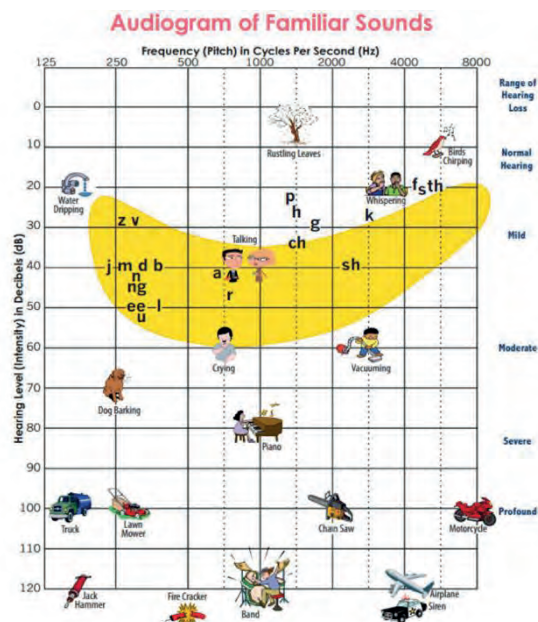
Mild to moderate conductive loss. The bone conduction thresholds are more than 15 dBHL better than air conduction thresholds and bone conduction thresholds are within normal limits.

Mixed hearing loss



Moderately severe to profound mixed loss. This audiogram has both a conductive and sensorineural component.

The audiogram below shows the frequencies and loudness levels of normal conversational speech sounds. This is often referred to as the **Speech Banana** (shown in yellow). For a person to hear all the speech sounds of normal conversational speech, their audiogram symbols would all be located at the top of the graph. That is, they can hear the softest sounds and all the sounds louder than this including normal conversational speech. The audiogram below also shows the frequencies and loudness of some familiar environmental sounds.



Reference: <https://ohns.ucsf.edu/audiology/education/peds>

Tympanometry

What is tympanometry?

Tympanometry is a technique used to look at the function of the middle ear. It is not a hearing test. It is a test used together with otoscopy (looking into the ears) and audiometry (testing the hearing) and is useful in helping to determine how the middle ear is functioning.

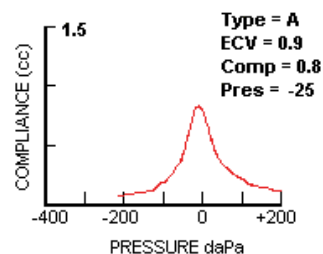


How does a tympanometer work?

The procedure of tympanometry involves inserting a probe into the outer ear canal and creating an air-tight seal. The probe contains a tiny speaker, a microphone and an air pump. The air pump changes the air pressure range (typically +200 daPa to -400 daPa) in the ear canal. The speaker introduces a calibrated tone into the ear canal, which changes in frequency and loudness. Some of the sound produced by the speaker will be passed through the middle ear, while some of the sound will be reflected back off of the tympanic membrane. The microphone measures the amount of reflected sound in the ear canal. The “compliance” of the eardrum and middle ear (i.e. how well this system responds to sound) is then determined by the tympanometer as the air pressure changes.

What is a tympanogram?

A tympanogram is a chart which can tell us how well the middle ear is functioning.



What does a tympanogram tell us?

Tympanograms are classified into types according to the shape of the tympanometric trace (“peak”), which is dependent upon the middle ear pressure, and the middle ear compliance.

A tympanogram can provide three helpful pieces of information:

Middle ear pressure

This is the air pressure of the air contained within the middle ear. It is shown by where the “peak” of the tympanometric trace falls along the pressure axis.

Middle ear pressure values ranging from +50 daPa to –200 daPa for children, and +50 daPa to –50 daPa for adults is generally considered normal.

Compliance

The compliance of the middle ear system is a measure of how well the system responds to sound. This is shown by the height of the “peak”. Middle ear compliance values from 0.3 to 1.5 cc are usually considered normal.

Equivalent volume of the ear canal

Normative ear canal volumes vary as a function of age. Typically for children a volume range of 0.5 to 1.5 cc is typically considered normal, while for adults the range is 0.5 to 2.00 cc. This value is reported by the tympanometer, but not shown on the tympanogram graph.

In general, classification of tympanograms is as follows:

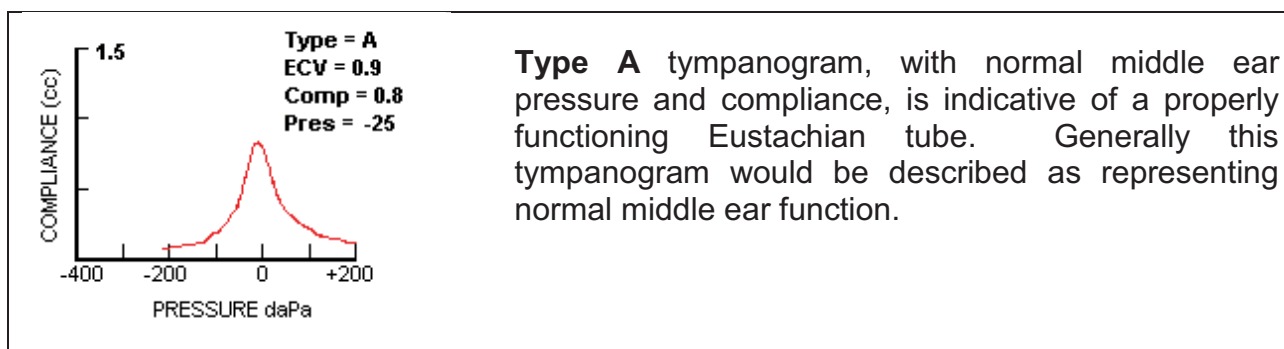
Type A tympanograms normal middle ear pressure
Peak between +50 daPa to –200 daPa for children

Type C tympanograms abnormally low middle ear pressure
Peak less than –200daPa for children

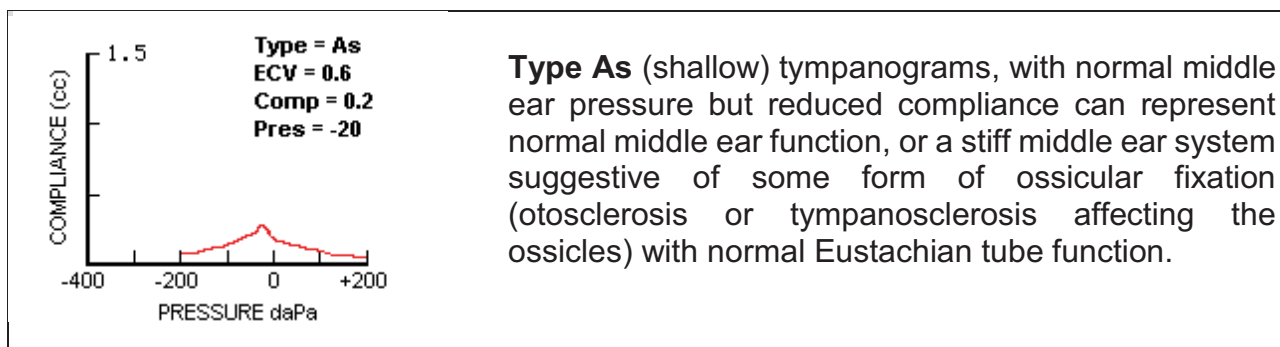
Type B tympanograms no pressure peak

Compliance values and equivalent ear volume allow classification into subtypes, and provide valuable information for diagnosis.

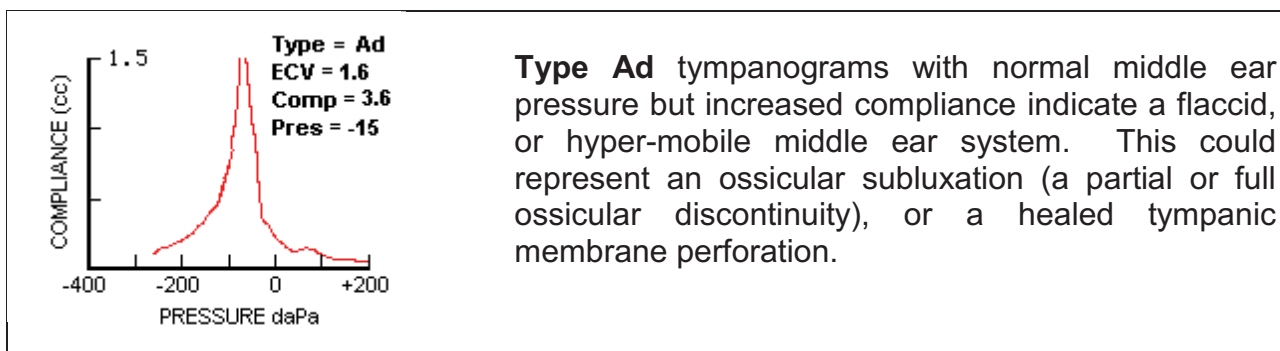
There are three sub-types of Type A tympanograms, A, As and Ad. All Type A tympanograms have normal middle ear pressure peaks. Following are illustrations of the Type A sub-types:



Type A tympanogram, with normal middle ear pressure and compliance, is indicative of a properly functioning Eustachian tube. Generally this tympanogram would be described as representing normal middle ear function.



Type As (shallow) tympanograms, with normal middle ear pressure but reduced compliance can represent normal middle ear function, or a stiff middle ear system suggestive of some form of ossicular fixation (otosclerosis or tympanosclerosis affecting the ossicles) with normal Eustachian tube function.



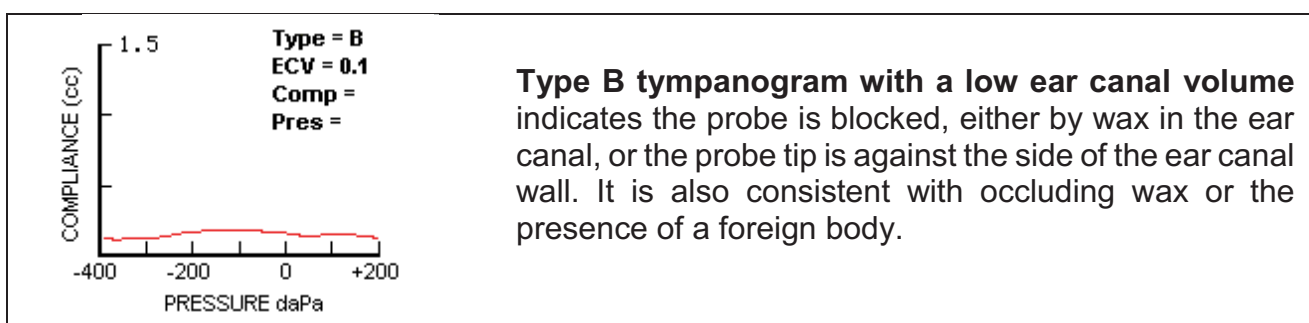
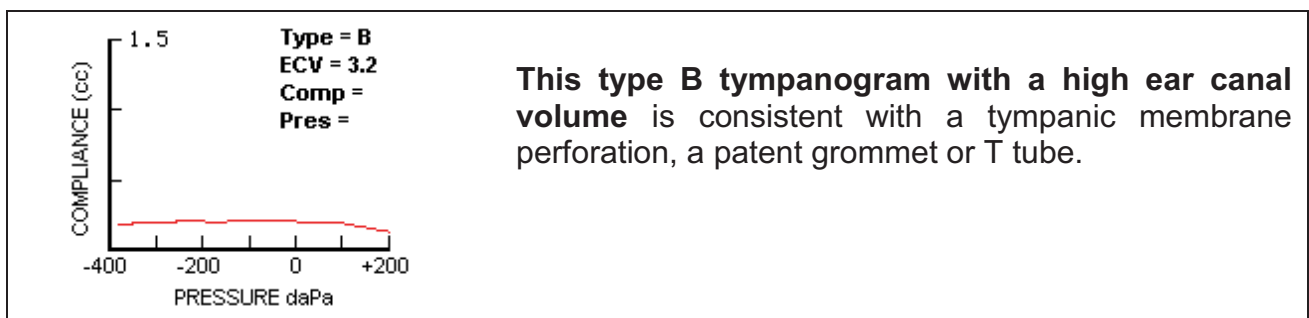
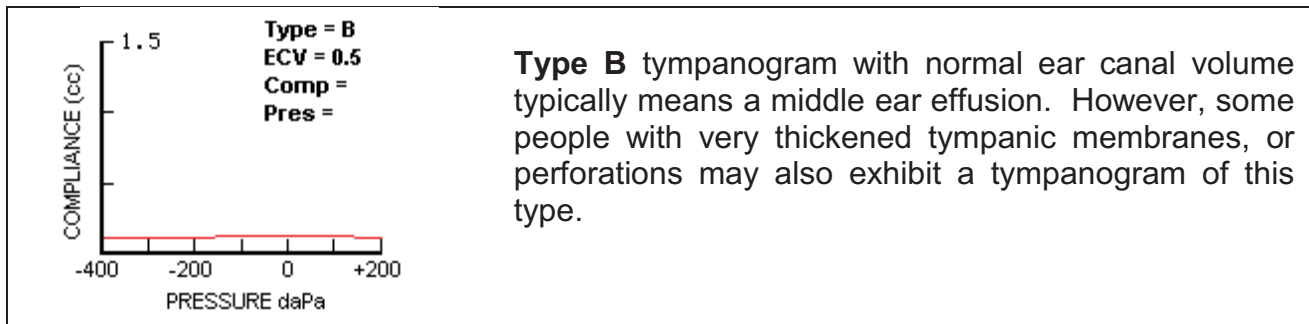
Type Ad tympanograms with normal middle ear pressure but increased compliance indicate a flaccid, or hyper-mobile middle ear system. This could represent an ossicular subluxation (a partial or full ossicular discontinuity), or a healed tympanic membrane perforation.

Type B:

Type B tympanograms exhibit no air pressure peaks and are generally described as “flat” tympanograms. There are several middle ear conditions, which can result in Type B tympanograms.

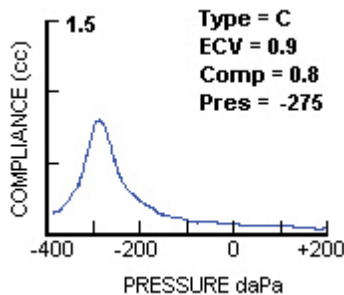
Type B subtypes are

- those with normal equivalent ear canal volume
- those with high equivalent ear canal volume
- those with low equivalent ear canal volume.

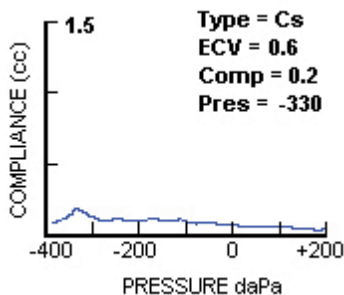


Type C:

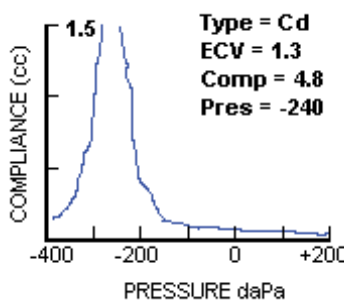
Type C tympanograms generally have similar compliance values and shapes as Type A tympanograms. What sets them aside from Type A tympanograms is that the middle ear pressure is abnormally low indicating Eustachian tube dysfunction.



Type C tympanogram with normal compliance but low middle ear pressure typically means a Eustachian tube dysfunction without the presence of middle ear effusion.



Type Cs (shallow) tympanogram with reduced compliance and low middle ear pressure, in addition to indicating a Eustachian tube dysfunction, most likely also means there is some fluid in the middle ear as well as some air.



Type Cd (deep) tympanogram, with increased compliance and low middle ear pressure, also suggests either an ossicular subluxation, or healed tympanic membrane perforation (similar to Type Ad) with Eustachian tube dysfunction.

When should you not use tympanometry?

Otосcopy should always be carried out before tympanometry. It gives information that helps decide whether to proceed with tympanometry. Under the following circumstances tympanometry should not be performed

- recent ear surgery (myringoplasty, tympanoplasty)
- discharge in the ear canal
- large or sharp foreign body
- bulging ear drum with pain

Middle ear disease and school

All children who suffer from middle ear disease face difficulties with learning. In the case of Aboriginal children, learning may be further complicated by:

- English being a second language
- English being the language used for instruction in the classroom

Otitis media in the early childhood years may mean that young Aboriginal children may have a poor grasp of their own first language by the time they enter school. Children who do not hear properly will find it difficult to pick up the sounds of their own language, and even harder to then learn a second language. In addition, there are a number of sound differences between English and Aboriginal languages. High frequency English sounds such as s, f, t, th don't exist in Aboriginal languages and these sounds will be first affected by any amount of hearing loss.

A hearing loss, even a mild fluctuating loss caused by otitis media, will affect learning. Some difficulties that may occur include:



- Telling the difference between sounds
- Putting sounds in words together
- Sequencing and remembering sounds
- Listening for sounds in noisy conditions
- Developing word usage due to poor vocabularies
- Remembering and explaining words
- Understanding questions properly
- Replying to questions properly

When children go to school, they have to rely on their hearing a lot more. At home when they don't hear something properly, they can always figure out what is going on by looking, or asking or waiting till someone tells them what is going on. At school, teachers often only give instructions once and they do not like the children to be looking around or asking someone else what they should be doing. This is very frustrating for the child and he/she can find him/herself always in trouble for not concentrating and disturbing others.

The other problem that children with a conductive hearing loss will find is that their auditory processing system is not developed enough for them to learn to read and write easily. The combination of hearing problems in the classroom and a history of poor hearing means that school is very hard, even for bright children.

Central Auditory Processing Disorder (CAPD)

“Central Auditory Processing Disorder (CAPD), also known as Auditory Processing Disorder (APD), is an umbrella term for a variety of disorders that result in a breakdown in the hearing process. In short, our brain cannot make sense of what our ears hear because the auditory signal is distorted in some way” (*Australian Hearing*).

As a result, one of the biggest problems experienced by individuals with CAPD is difficulty listening in background noise. It cannot be explained on the basis of a normal peripheral hearing loss. Children that have central auditory processing problems may have one or more of the following symptoms; be distractible, constantly asking for repeats, have difficulty understanding speech in background noise, be sensitive to loud sounds, have difficulty following complex instructions, or have poor memory for chains of digits or words. The child may also have reading spelling and other academic difficulties or display behaviour problems. The most common cause for CAPD is long standing conductive hearing loss such as glue ear or chronic suppurative otitis media that later causes inefficiency in the brain processing of the electrical output from the ear.

The condition can be assessed with specialized testing particularly in children over the age of 6 years. If the diagnosis is confirmed there are several classroom strategies that the audiologist may recommend and in some cases further treatment may also be suggested such as speech therapy, occupational therapy or computer based learning using one of the several programs available.

Sometimes children do not understand that their problems are caused by a hearing loss - they think that they are stupid. It is extremely important that all children are educated about middle ear disease so they can tell the Health Worker or Teacher and adjustments can be made to the program.

Social Emotional Aspects of Hearing Loss

For anyone suffering long term hearing loss in early life and childhood (and this is not exclusive to Indigenous people) it can have life long negative consequences in the following areas;

- language development
- socialization
- education - hence literacy and numeracy
- social/emotional wellbeing and self esteem
- training and employment opportunities
- mental health and self harm
- domestic violence
- and as a consequence of the above factors, can be a reason for the over representation of Indigenous people in the criminal justice system

The effects of auditory sensory deprivation from hearing loss especially in the first 5 years of life can lead to abnormal brain development that is manifested as central auditory processing disorders, or more simply termed, learning problems or listening problems. Even if a person's hearing becomes normal at a later age, these listening problems remain. Consequently they can have significant impacts on adult education, training, and employment. Hence the need to address hearing loss as early as possible.

Children with a hearing loss

General strategies that teachers can use in classrooms

Strategies to help children with a hearing loss

- Be aware of the factors in the environment which affect listening:
 - noise from people talking and moving
 - general background noise e.g. traffic, air conditioners
- Write the key vocabulary on the board
- Use pictures or objects to illustrate a point and maintain interest
- Ask a peer to adopt a child and give prompts
- Inform parents or clinic staff about children who have sore ears
- Remind children and parents of the importance of healthy ears to learning
- Make sure the role model is speaking clearly at all times
- When the students want to talk to the teacher, make sure they are quiet and facing you
- Keep the students close to the teacher
- Keep plenty of light on your face when talking
- Make sure that you keep your hand away from your face when you are talking
- Use non-verbal gestures to help give meaning



- Use language that is accessible and explaining difficult terms if they are used
- Implement a blow, breathe and cough (BBC) program daily in the classroom
- Provide the students with tissues on a needs basis to frequently clear noses

Strategies to help children with Central Auditory Processing Disorder

Some children will appear to be helped by most suggestions but some will be difficult to help no matter what is tried.

- Reduce distractions – this involves getting the child's attention before giving instructions.
- Preferential seating- seat the child away from known distractions such as open windows, pencil sharpeners, doors, air conditioners.

- Delivery style – avoid multiple commands, give instructions in the simplest form possible.
- Speak at a slower rate than normal and clearly as research has shown that background noise is often equal to or louder than the teacher’s voice.
- Instructional transitions – utilizing review of the previous material before beginning new lessons to give the student a feeling of success.
- Utilization of words such as “Listen” “Ready” and “Remember” seem to be effective for signaling an important message.
- Visual aids include overheads, opaque projectors and computers can be utilized to supplement the teacher’s oral presentations as well as to provide an alternative mode to the auditory channel. Combining the visual and auditory modes of learning may benefit all students in the classroom.
- Some children may benefit from the child having an FM system and the teacher wearing a microphone during class.

Listening Strategies at Home

Hearing loss related to OM can last for a few days or weeks or even years. Any hearing loss can have an effect on the child both in the short and long term. It is important for support of their hearing needs to start at home and extend in to the school environment. Families are the first line of support for children with OM and hearing loss.

Some suggestions for support of children who are having treatment for OM, waiting for grommets or other surgery, or are waiting for further assessment of their hearing include

Ensure the child can hear you easily by

- Have the child within arms’ length and facing you
- Have the child on your lap or sitting next to you when reading
- Remind them to “look at me and listen”
- Ask them how their ears are working today, are they the same or is one better
- Have a regular hearing test

Help them with language and learning by

- Practicing recognising and hearing soft speech sounds such as /s/, /f/, /t/, /th/
- Do all reading and storytelling in a quiet place
- Reduce distractions such as TV screens, computer/phone screens, etc. when doing language work and reading
- Ask them to retell a familiar story. Ask them to name who the main characters were in the book or movie
- Ask them to think of strategies to help them hear in the class – “Is it better near the door or the windows?”

Ensure their safety and support their learning environment

- Check that they can locate a sound – “Where was that sound?”
- Make sure they know safety commands – “Stop!”, “Look for the cars”
- Make sure their teachers are aware of their hearing status and needs
- Ask if classroom amplification is available or ask if personal amplification (a hearing aid) is needed

Common Conditions

This chapter features diagnosis, audiogram, tympanogram, management and complications for

Acute Otitis Media (AOM)

Acute otitis media without perforation (AOM) – Presence of middle ear fluid with symptoms or signs of suppurative infection, which may include otalgia, fever, irritability, vomiting or diarrhoea.

Acute otitis media with perforation – Acute suppurative infection with recent discharge from the middle ear (within the last 7 days).

Chronic Suppurative Otitis Media (CSOM)

Persistent discharge from the middle ear through a tympanic membrane perforation for more than 6 weeks.

Otitis Media with Effusion (OME or Glue Ear)

Presence of middle ear fluid without symptoms or signs of suppurative infection.

Otitis Externa (Swimmer’s Ear)

Infection of the ear canal.

ACUTE OTITIS MEDIA (AOM)

FEATURES

MOST COMMON SYMPTOMS

- Otagia (ear pain) or pulling of the ear
- Irritability
- Fever

OTHER SYMPTOMS

- Anorexia
- Vomiting
- Diarrhoea
- Otorrhoea (runny ears)
- May be relatively "silent"

DIAGNOSIS

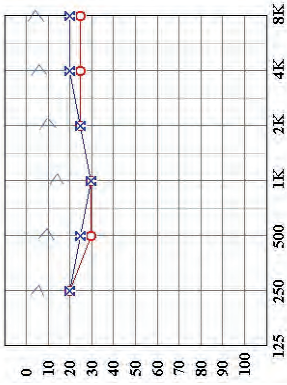
- Bulging red ear drum
- Decreased mobility with pneumatic otoscopy or 'B' tympanogram.
- Ear drum may rupture \leftarrow discharge in ear canal

AGGRAVATING FACTORS

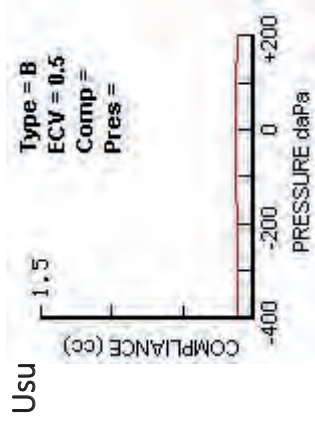
- Upper respiratory tract infection (cold)
- Stopping breast feeding early
- Reflux
- Passive cigarette smoke exposure
- Overcrowding
- Poor hygiene
- Poor nutrition

AUDIOLOGY

Mild Conductive hearing loss

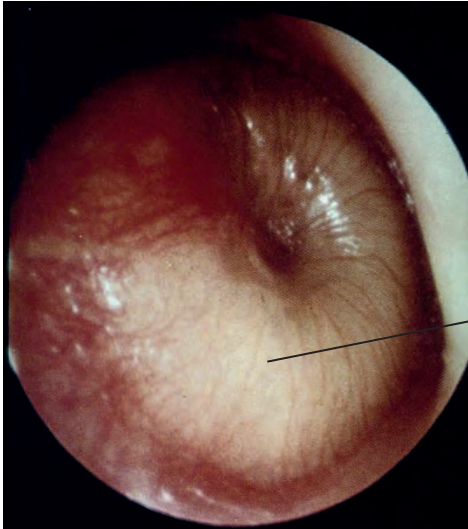


TYMPANOMETRY



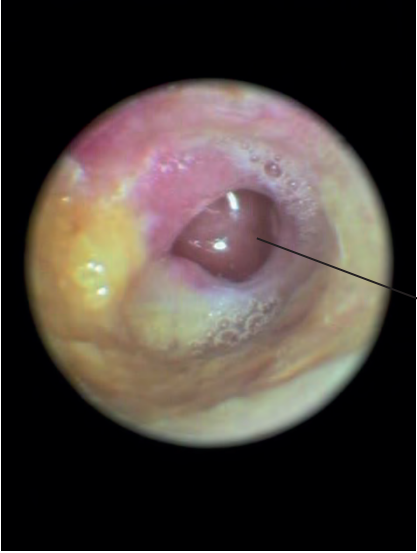
PREVENTATIVE MEASURES

- Continue breast feeding for at least 12 months
- Avoiding smoking around babies and children
- Avoid dummies after 12 months
- Avoid prop-feeding, with the baby lying flat and the bottle "propped up"
- Vaccination including Prevnar
- Early treatment of ear infection to avoid chronic discharge



Bulging eardrum of AOM

ACUTE OTITIS MEDIA (AOM)

TREATMENT	COMPLICATIONS	INDICATIONS FOR REFERRAL
<p>Low risk child</p> <ul style="list-style-type: none"> • Watchful waiting 48 hours & review after then. Analgesics if pain. Antibiotics e.g. Amoxicillin 50mg/kg/day 2-3 times/day for 7 days • If allergic to Penicillin –Rulide D /Septtrin • Azithromycin single dose 30mg/kg if no refrigeration or compliance difficulty • Analgesia e.g. paracetamol • Local anaesthetic ear drops (if no perforation) • If no improvement in 48 hours, Augmentin/Cefaclor. <p>High risk child</p> <ul style="list-style-type: none"> • Amoxicillin 50mg/kg/day in 2-3 doses. For 7 days. Or single dose Azithromycin 30mg/kg if compliance or refrigeration issue. • Review –if AOM persists high dose Amoxicillin 90mg/kg/day in 2-3 doses, or Augmentin/ Azithromycin. Review after 1 week. <p>Treatment of otorrhoea</p> <ul style="list-style-type: none"> • Non-ototoxic topical antibiotic ear drops e.g Ciloxan /Ciproxin HC ear drops—if pinhole perforation continue oral antibiotics. 	<ul style="list-style-type: none"> • Otorrhoea (if perforated ear drum) • Chronic otitis media • Otitis media with effusion • Perforation • Acute mastoiditis • Facial nerve palsy • Cholesteatoma • Meningitis • Sensorineural hearing loss 	<ul style="list-style-type: none"> • Persistent otitis media • If complications are suspected • Persistent otorrhoea after one week of treatment • Recurrent otitis media <ul style="list-style-type: none"> • 3 attacks in 6 months • 4-6 attacks in 12 months • presence of middle ear effusion for 3 months or longer • balance problems, speech/language delay • Suspected cholesteatoma
		<p>Acute perforated eardrum</p>

CHRONIC SUPPURATIVE OTITIS MEDIA (CSOM)

FEATURES

MOST COMMON SYMPTOMS

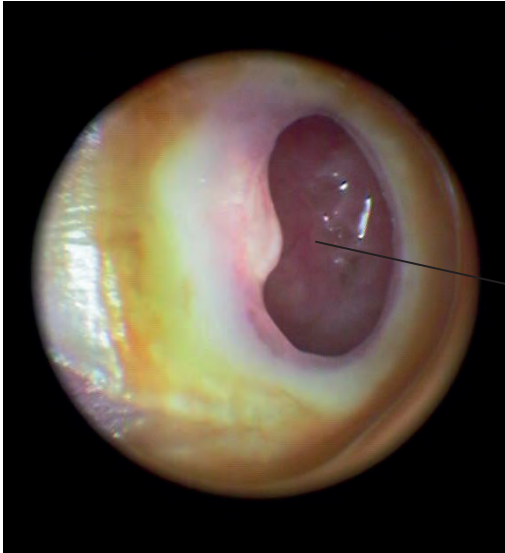
- Otorrhoea (discharge from ear)
- Itchy ear
- Hearing loss

DIAGNOSIS

- Otorrhoea (discharge from ear) with perforation of tympanic membrane
- Perforated tympanic membrane
- Ear drum may rupture \leftarrow discharge in ear canal for > 6 weeks

OTHER AGGRAVATING FACTORS

- Contaminated water entering the ear
- Upper respiratory tract infection (cold)
- Stopping breast feeding early
- Reflux
- Passive cigarette smoke exposure
- Overcrowding
- Poor hygiene
- Poor nutrition



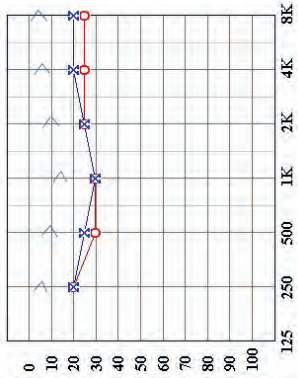
Moist moderate tympanic membrane perforation



Small perforation will produce discharge

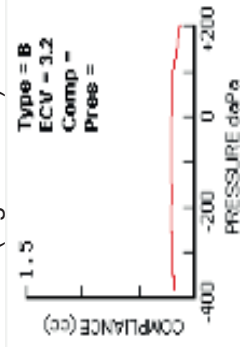
AUDIOLOGY

Mild - moderate conductive hearing loss



TYMPANOMETRY

Usually Type B Tympanogram
(high volume)



PREVENTATIVE MEASURES

- Continue breast feeding for at least 12 weeks
- Avoiding smoking around babies and children
- Avoid prop-feeding, with the baby lying flat and the bottle "propped up"
- Vaccination including Pevnar
- Early treatment of ear infection to avoid chronic discharge.

CHRONIC SUPPURATIVE OTITIS MEDIA

TREATMENT
<ul style="list-style-type: none"> • Betadine ear toilets / dry mopping • Antibiotics – topical fluoroquinolones eg. Ciloxan eardrops 2-5 drops 2-4x/day. Water precautions. • Culture of middle ear fluid • Myringoplasty to close perforation (once ear is dry) – usually age >7 years • If the perforation is very small, topical treatment may not be effective and oral

COMPLICATIONS
<ul style="list-style-type: none"> • Hearing loss • Granulation tissue and polyps • Cholesteatoma • Chronic mastoiditis • Meningitis • Intracranial abscess



Cholesteatoma

INDICATIONS FOR REFERRAL
<ul style="list-style-type: none"> • Hearing loss > 30dB – referral to Hearing Australia –FM/amplification. • Discharge that fails to resolve despite adequate medical treatment • Non-healing perforation after 6 months • In a child over 7 years.

The prevalence of cholesteatoma of ATSI children as a complication of OME and CSOM is increasing, affecting up to 20% of children with long standing middle ear disease. If otorrhoea persists for longer than six weeks in children with CSOM consider whether there is an underlying cholesteatoma which may require referral to an ENT surgeon and imaging to detect. Persistent CSOM after 4 months may benefit from oral sulfamethoxazole (18mg/kg twice daily for 6-12 weeks)

OTITIS MEDIA WITH EFFUSION (OME OR GLUE EAR)

FEATURES

SYMPTOMS IN YOUNG CHILDREN (0-3)

- Balance problems
- Delayed speech development
- Hearing loss (fluid in the middle ear blocks the conduction of sound)
- Irritability and pulling at ear

SYMPTOMS IN OLDER CHILDREN (3-7)

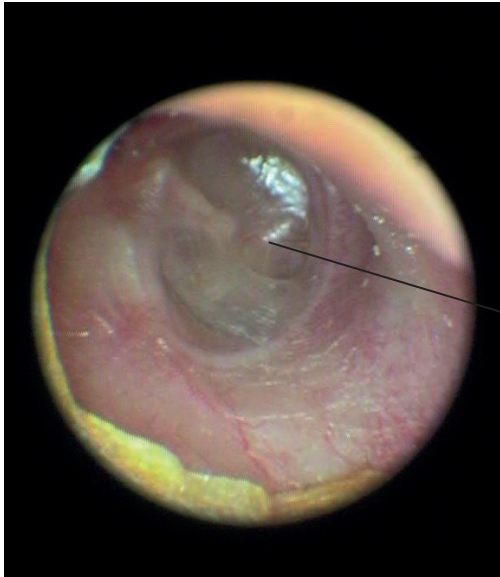
- Hearing loss
- Difficulty at school
- Behaviour problems
- Delayed speech and language (may affect reading development)

DIAGNOSIS

- Retracted ear drum
- May show fluid levels or bubbles
- Decreased mobility on pneumatic Otoscopy / B or C tympanogram.
- Different colours – from red to white to yellow / 'bicycle spoke' appearance.

OTHER AGGRAVATING FACTORS

- Upper respiratory tract infection (cold)
- Reflux
- May follow acute otitis media (AOM)
- Blocked Eustachian tube
- Prematurity / low birth weight



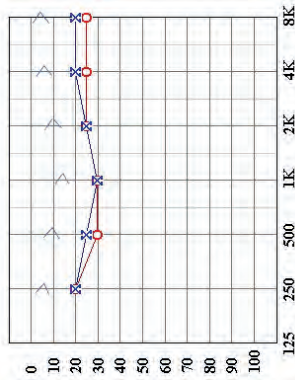
Diffusely retracted ear with OME



OME with attic retraction pocket

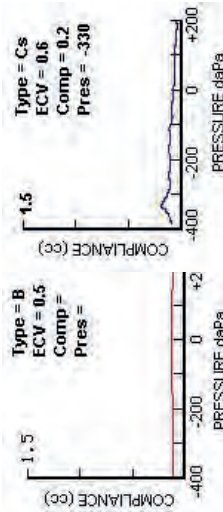
AUDIOLOGY

Mild-moderate conductive hearing loss



TYMPANOMETRY

Type B or Type C Tympanogram



PREVENTATIVE MEASURES

- Treatment of colds and upper respiratory tract infections
- Avoid smoking around babies and children
- Early treatment of acute otitis media
- Regular ear health checks

OTITIS MEDIA WITH EFFUSION (OME OR GLUE EAR)

TREATMENT

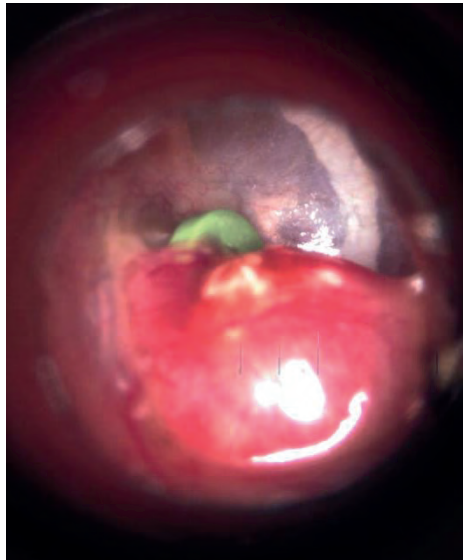
- Antibiotics if severe/ persistent. Eg. Amoxicillin 50mg/kg/day 2-3x/day for 2-4 weeks.
- BBC program/ autoinflation.
- Steroid nasal spray if allergic child
- Hearing aids
- Grommets (ventilation tubes)

COMPLICATIONS

- Acute otitis media
- Cholesteatoma
- Ossicular problems
- Language problems/reading difficulties
- Central auditory processing disorder
- Hearing loss in background noise as adult

INDICATIONS FOR GROMMETS

- 3 attacks of otitis media in 6 months
- 4 attacks of otitis media in 12 months
- Handicapping hearing loss for 3 months
- Severe retraction pocket/atelectasis.



Different types of grommet tubes in tympanic membrane, with a grommet polyp in the first photograph.

OTITIS EXTERNA (SWIMMER'S EAR)

FEATURES
<ul style="list-style-type: none"> • Pain and tenderness of the ear canal (may spread to the outer ear) • Discharge • Itching • Swollen ear and ear canal • Occasionally reduced hearing • Sometimes noises in the ear (tinnitus)

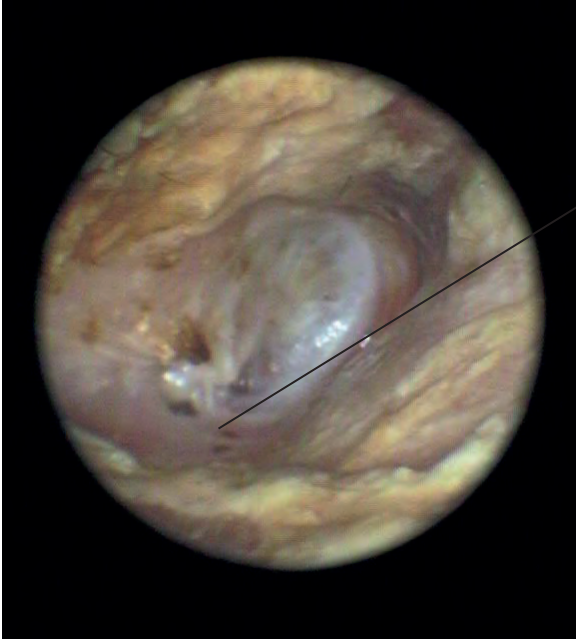
DIAGNOSIS
<ul style="list-style-type: none"> • Otoscopy – appearance of skin of outer ear canal <ul style="list-style-type: none"> • red scaled and peeling • “soggy” cardboard like appearance • fungal-white Candida sp. Black— Aspergillus niger. • Ear canal may be inflamed and swollen and painful to touch • Swab to establish bacteria or fungal.

OTHER AGGRAVATING FACTORS
<ul style="list-style-type: none"> • Swimming • Hot and humid climates • Eczema • Cotton bud use

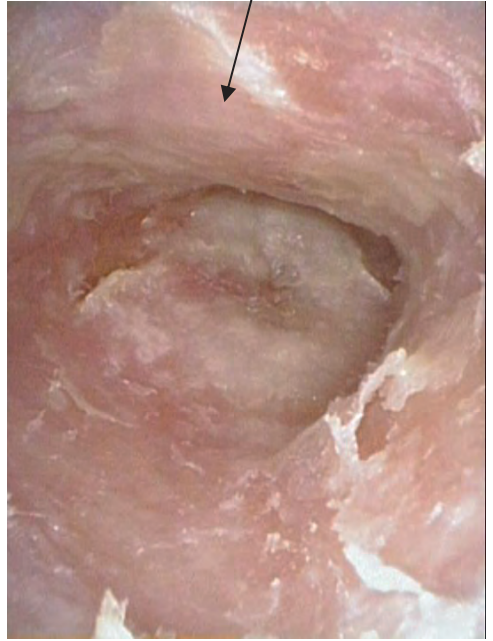
TREATMENT
<ul style="list-style-type: none"> • Dry ear toilet • Antibiotic drops (Ciproxin HC as ear drops) • Use of otowicks for swollen ear canal • If fungal- Loca-corten vioform , Lotremin or Kenacomb drops twice daily.

COMPLICATIONS
<ul style="list-style-type: none"> • Narrowing of the ear canals • Facial cellulitis • Malignant otitis externa leading to osteomyelitis of the temporal bone • Fungal infection

INDICATIONS FOR REFERRAL
<ul style="list-style-type: none"> • Failure to resolve after 1 –2 weeks of treatment
PREVENTATIVE MEASURES
<ul style="list-style-type: none"> • Avoid water entering ear • Ear protection when swimming and bathing • Avoid use of cotton buds or inserting other objects into the ear



Classical Otitis Externa showing infected debris and slight swelling of ear canal



Severe otitis externa and swelling

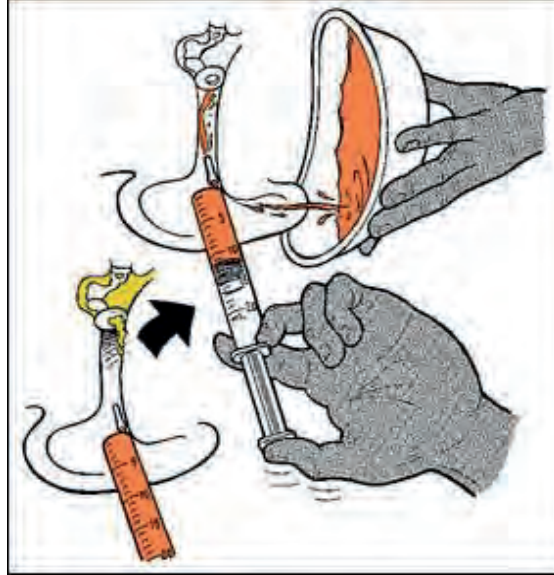
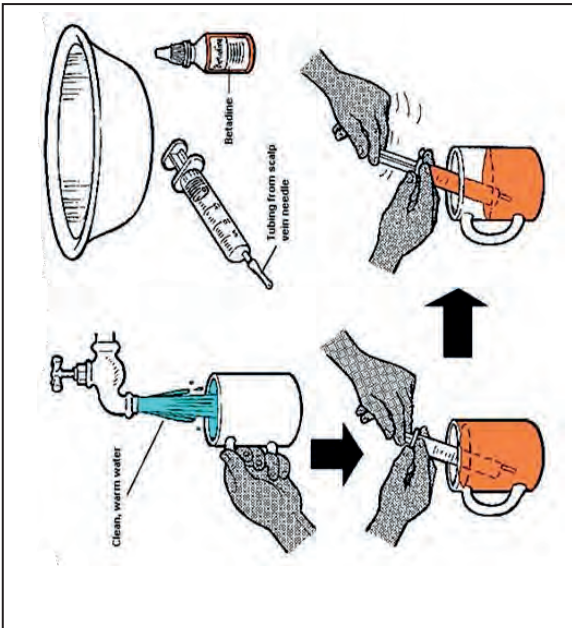
MEDICAL TREATMENT CHRONIC SUPPURATIVE OTITIS MEDIA (CSOM)

Ear toilets using Betadine 0.5%

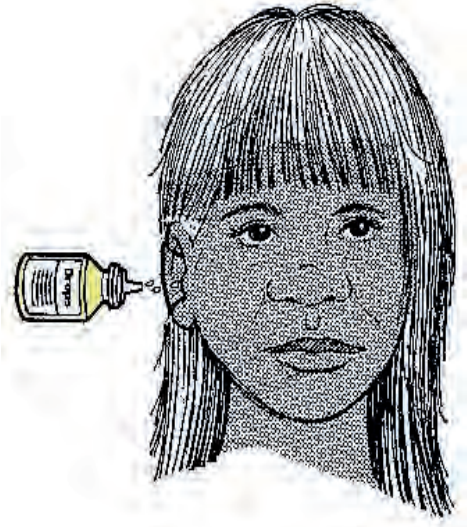
- Ear syringing is done to wash pus due to suppurative otitis media out of the ear canal and middle ear. Getting rid of the pus then allows the instillation of antibiotic ear drops to treat the infection.

PROCEDURE

Dilute 5ml (one teaspoon) of 10% solution of Betadine with 100ml of clean warm water
Use a 10 or 20ml disposable plastic syringe.



Hold the syringe up to the ear and point the tip so that the solution does not directly hit the ear drum
The person having their ear syringed, or care giver, should hold a kidney dish or bowl under the ear to catch the solution that comes out of the ear. A towel should be placed over the shoulder
Syringing is continued until no more pus comes out. The ear is then dried with tissue spears.
A spraywash kit called Otoclear provides an excellent alternative to the syringe.



EAR DROPS PROCEDURE

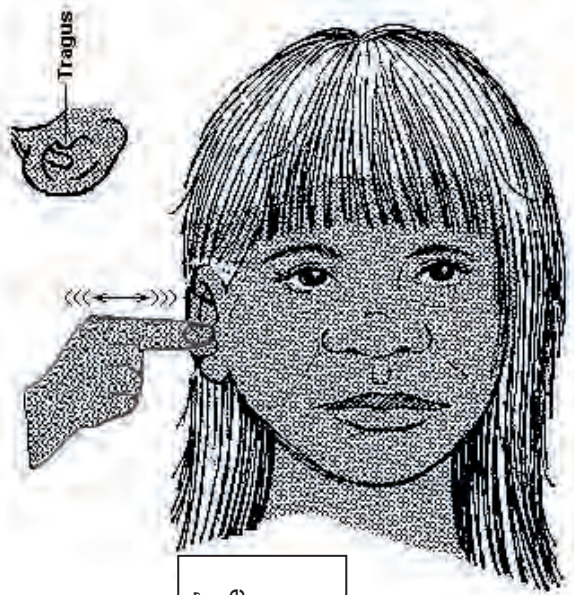
Clean out the discharge using irrigation with Betadine
Use a tissue spear to dry the ear
Instill the drops as shown
Treatment is three drops twice a day for three to five days

MEDICAL TREATMENT OF CHRONIC SUPPURATIVE OTITIS MEDIA (CSOM)

EAR DROPS (Continued)

With the person lying on their side, the recommended number of ear drops are put into the ear

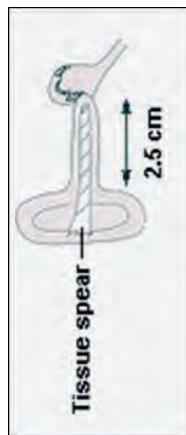
With the finger on the tragus, the tragus is "pumped" to force the medicine through the perforation into the middle ear where it is needed. Sometimes the person will report tasting the medicine



Drying the ear canal using tissue spears

PROCEDURE

A tissue spear is made by twisting a square of toilet tissue or facial tissue into a "rat's tail".
 The tissue spear is then inserted into ear by rotating it.
 The tissue spear is inserted to about 2.5 cm, or until the child blinks.
 The tissue spear is left in place 1-2 minutes.
 Remove and repeat until the tissue is dry.



PRIMARY EAR AND HEARING CARE IN THE PACIFIC ISLAND COUNTRIES AND TERRITORIES

Introduction

The Pacific island countries and territories (PICS) (American Samoa, Cook Islands, Federated States of Micronesia, Fiji, Guam, Kiribati, Marshall Islands, Nauru, Niue, Northern Marianas, New Caledonia, Palau, Papua New Guinea, Pitcairn, Samoa, Solomon Islands, Tahiti, Tokelau, Tonga, Tuvalu, Vanuatu and, Wallis and Futuna) that comprise the Pacific community are located on small islands, scattered over large geographical areas.

According to epidemiological studies and model estimates indicate a high prevalence of hearing impairment and ear infection in children in some of these countries and territories, for example, 9.6% of the population in Fiji is living with disabling hearing impairment and ear disease in Fiji is 3–5 times greater than other Australasian countries. In children, chronic suppurative otitis media incidence of 6% and otitis media with effusion of 20% is reported.

Providing accessible hearing and ear health services to all the population remains a challenge in many of these countries because of resource constraints and competing health priorities. A major challenge for the Pacific island countries is to develop and maintain a health workforce. There are two ENT specialists in Fiji with 900000 population; One ENT specialist in Tonga with 11000 population; Samoa, Vanuatu, Solomon Islands have general surgeons who can provide ear, nose and throat services. Due to the shortage of ear specialised doctors or nurses, almost all ear disease and hearing impairment patients are managed by general physicians or nurse practitioners at primary health care level. In case of severe ear problems, they are able to refer to only one ENT clinic in the country or for overseas treatment. Some visiting ENT or audiologist teams help take care of chronic ear disease and hearing care in PICS.

Not only human resources shortage, but also basic equipment and essential medicines for proper ear disease & hearing care are limited. For example, it is difficult to access audiology testing due to an absence of audiologists or audiometers. For proper diagnosis of ear infection, an otoscope is basic equipment but seldom available in clinics. In case of ear discharge with ear drum perforation, doctors or nurse practitioners are not able to prescribe safe antibiotic ear drops because they may be not affordable. So, doctors or nurse practitioners in PICS need to figure out how to examine ear drums without otoscopes, how to do hearing tests without audiometers, and how to treat chronic suppurative otitis media without non-ototoxic quinolone antibiotic ear drops.

Public health approach of ear disease and hearing care in PICS

- Ear disease & hearing loss prevention
- Ear & hearing care awareness
- Immunisation
- Noise regulation
- Ear and hearing care human resource training
- Primary ear and hearing care training
- Ear nurse training
- ENT specialist training
- Proper ear and hearing care manual & guideline provision.

Specific topics relevant to pacific island ear and hearing health

Ear hygiene

- DO NOT put anything into your ear – You may harm it
- DO NOT try to clean your ears with cotton bud, hairpins, tooth picks or anything else – It will clean itself
- DO NOT let dirty water go into your ears, in particular, you may cause ear drum damage.
- DO NOT leave cotton wool in your ears
- If you feel something in the ear canal – get it checked at your clinic
- Do only use medication in your ears that has been prescribed for you
- Do use clean towels to dry your ears

Examining the ear without an otoscope.

- Don't give up trying to examine the ear canal and ear drum
- Ask the patient gently pull the tragus anteriorly with finger to open the ear canal.
- With one hand gently pull the pinna away from the head to straighten the ear canal:
 - Adults – pull pinna back and up.
 - Children – pull pinna back and down
- With the other hand, use lantern, pen light, cellular phone light or sunlight to see ear canal and ear drum
- To see what the patient is complaining about
- To see if there is any wax in the ear canal
- To see if there is any infection in the ear canal
- To see if there is anything in the ear canal
- To see if the eardrum can be seen



Ear wax and foreign body removal by irrigation

Ear wax spreads to cover the ear canal and helps to keep it healthy. The ear canal normally cleans itself and clears the ear wax out by itself. We don't need to remove ear wax unless you need to examine the ear drum clearly or impacted ear wax is causing problems, for example ear fullness or ear pain.

If you have fine ear instruments, suction machine and otologic microscope, you can easily remove ear wax and ear foreign body with clear view. But in the environment of

PICS, it is difficult to expect to find this equipment in your clinic. If you find an ear foreign body or if you need to remove impacted ear wax without fine ear instruments, suction machine and microscope, you can try to remove it with ear flushing. Studies have shown many over the counter wax softeners are ineffective. The simplest and probably best ear drop is one made from a level teaspoonful of sodium bicarbonate (NaHCO₃) or baking soda in 15mls of warm water with the drops used as six drops daily for a week. The residual softened wax can then be irrigated out using a plastic syringe and soft tip and water at body temperature. Firm wax can be removed after softening with the sodium bicarbonate drops 15 minutes before the irrigation or flushing. See Page 47 in this manual (ear wash).

NOTE

- The water used to syringe the ear **MUST** be the same as body temperature (37°C), warm but comfortable on the hand. If you use cold or hot water for ear flushing the patient may feel dizzy, nauseous or may start vomiting. If the patient complains of being dizzy, please stop syringing and make the patient comfortable with support.
- Do not direct the water straight onto the foreign body. If you do the water will push the foreign body further into the ear canal.
- **Do not syringe if the ear if you know or suspect there is a dry perforation in the ear drum.** Refer these patients. If you flush a dry ear drum perforation, you may cause an ear infection.
- If you see any trauma to the ear canal after you have removed the foreign body fill the ear canal with antibiotic eardrops, give the patient eardrops to take home and use four times each day. Check the ear again after two days.

Non-ototoxic antibiotic ear drops

Chronic suppurative otitis media (CSOM) is one of the most common diseases amongst children in PICS. According to Fiji ear disease and hearing survey, 6 % of school aged children in Fiji have chronic suppurative otitis media or dry ear drum perforation. Many antibiotic ear drops especially the aminoglycosides are potentially ototoxic if they are used for ear infections in the presence of a perforated tympanic membrane or grommet tube. Medical officers in Fiji generally prescribe chloramphenicol ear drop when children have ear discharge in health centre. But, Chloramphenicol and aminoglycoside ear drops are prohibited for ear drum perforation patients due to ototoxicity. Chloramphenicol ear



drops are only allowed for otitis externa without ear drum perforation. Ciprofloxacin or ofloxacin ear drops are the only antibiotic ear drops that are approved as ototoxicity free for ear infection control with ear drum perforations. But, ciprofloxacin ear drops are not affordable in most PICS. If you cannot prescribe ciprofloxacin ear drops for ear infection control with ear drum perforation due to price, you have two options. One option is that you may prescribe ototoxic ear drops for no more than 2 weeks with risk discussion. The other alternative safe option is to use a fifty percent solution of 10% Betadine as an anti-fungal, antibacterial ear drop using 5 drops twice daily for up to a week. Betadine also does not have bacterial resistance issues like topical antibiotic ear drops.

Ear infection conditions requiring rapid referral.

The ear infection patients in PICS who need proper treatment tend to delay visiting health centres. There are mainly three reasons. The first is the low awareness of ear infection treatment. The second is that health centre or medical facilities are located at a distance, precluding easy access. The final reason is financial issues. If they visit a health centre for an ear check-up, they have to pay for transportation, accommodation and may need to give up one day's salary even though health service is free.

Due to above three reasons, ear infection patients with severe complications frequently turn up in your clinic. Look out for the following five danger signs.

- tenderness & swelling behind the ear with ear discharge (acute mastoiditis),
- unexplained rapid loss of hearing with otitis media (sudden deafness),
- sudden dizziness and vertigo with ear discharge (balance problem),
- headache, vomiting drowsiness, high fever with ear discharge (meningitis / brain abscess / sigmoid sinus thrombosis),
- asymmetrical facial movement with ear discharge (facial palsy).

If you find any of these five danger signs with middle ear infections, you should do emergency treatment or refer the patient as soon as possible. Patients may need emergency operation or IV antibiotics or systemic steroid administration.

Hearing screening and testing in resource limited situations

All hearing impairment should be tested with an audiometer. The audiometer measures the sound levels that people can hear in units called decibels in hearing level (dB HL). For example people with normal hearing may be able to hear a sound at a level of 0 decibel (0 dB HL). A person with hearing loss may only be able to hear a sound at a level of 50 decibels which is in the range for moderate hearing impairment. But, most primary care clinics in PICS don't have an audiometer for hearing testing. It is important to try to refer the patient who you think may have hearing impairment to an ENT clinic or audiology centre where the hearing can be tested with special equipment because earlier diagnosis and treatment of ear conditions and early identification of hearing impairment leads to better long-term outcomes.

But, in case the ENT clinic or audiology centre is far from the health centre or even there are no audiometers in the country, how can we deal with patients with hearing impairments? In this situation, we can use voice hearing screening test and tuning fork

test at your desk. Don't give up hearing testing due to resource limited environment. Voice hearing screening test is helpful to assess the severity of hearing loss and the tuning fork test is beneficial to differentiate between conductive hearing loss and sensory neural hearing loss. With your voice and a simple tuning fork, you can gain important information about origin, severity, diagnosis and treatment plan of hearing impairment. For more details refer to the Clinical guidelines for primary ear disease and hearing care in Fiji (see resources section).

Hearing aid / lip reading / sign language

If the patient has moderate sensory neural hearing impairment with the better hearing ear hearing aids are usually recommended. In particular, children with mild or moderate hearing loss may not speak clearly. They should have hearing aids for speech development. In PICS, It may be difficult to get hearing aids because there are no hearing aid fitting audiology centres or hearing aids are too expensive to buy. But don't give up looking for hearing aids. There are a number of hearing aid companies and organisations that donate hearing aids.

Even if you cannot find proper hearing aids for patients, you should consider alternative way for proper communication with hearing impairment patients. They may need to use signs as well as words to assist them in learning. Children with severe or profound loss may need to attend a special school and learn sign language. The family should be encouraged to learn with them. If the child is deaf and a "Deaf School" is not available, encourage the parents to start non-verbal communication. They will have to make up signs for food, members of the family and important objects and activities. If the child has some hearing then using signs as well as words helps the child to learn lip-reading. Often these children can hear low frequency sounds but not high frequency sounds and this means that many words will not be heard properly and using signs and lip reading helps them to understand what has been said.

Parents and family members play an important role in the life of a person with hearing impairment or deafness. Family members can develop a simple sign language to support their speech when talking to a hearing impaired or deaf person. They should include the hearing impaired or deaf person in all activities in and around the home.

Community awareness about ear disease and hearing care.

Ear discharge, ear pain and mild hearing impairment may tend to be considered self-limited symptoms in PICS. But, simple ear discharge and pain can become chronic ear infections, severe ear infective complication, long term hearing impairment, speech development and learning & social problems. You should inform all expectant mothers about the importance of prevention, early detection and treatment of ear infection for hearing loss prevention. The potential effects on language and education should be emphasised. The ear infection patient need to attend health centre as soon as possible whenever a child develops ear pain or discharge, particularly if the child is young (See the chapter on strategies to prevent ear infections).

Telemedicine

Telemedicine and specifically teleotology, allow the transmission either “live “ or of stored images of the ear drum to specialists for diagnostic and treatment recommendation. A video otoscope (the Welch Allyn MacroView is a commonly used hand held video otoscope) with a built in digital camera which allows the image of the eardrum (tympanic membrane) to be shown on a computer to the patients/carers. In addition the live images can be transferred to a central telemedicine unit often with a whole room view allowing patients/carers to talk to the ENT specialist and discuss their treatment options. On occasion the computer image can be stored and later sent to the ear surgeon for comment (store and send) along with history, audiometry and tympanometry. This whole process of telemedicine allows the Aboriginal Health Worker, nurse or doctor in rural and remote regions to obtain specialist opinion via email or live telemedicine conference.

How to use a video otoscope

Using the video otoscope is surprisingly easy to those who have otoscopic skills with conventional otoscopes. The main problem for the viewer is usually the presence of wax, debris or infection in the ear canal obscuring their view of the eardrum. It is crucial to remove the wax/infection either by syringing or by direct removal with a wax hook and headlight by those trained in that technique. The ear canal must be dry when using the video otoscope or the lens may fog up. If the ear canal is wet it can be dried with a tissue spear.



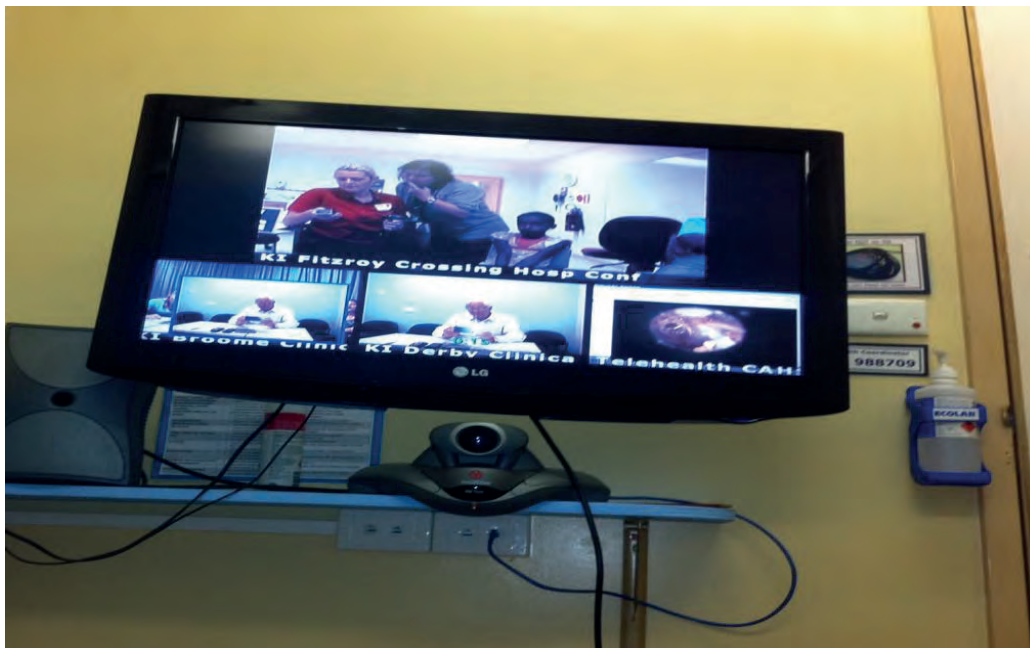
The video otoscope is held upright and a finger propped against the patient's head to steady the instrument and prevent hurting the patient's ear canal if they move suddenly. The viewer's other hand gently pulls the outer ear upward and backwards to straighten the ear canal to allow the introduction of the video otoscope in the ear canal. If the viewer needs to “store and send” the image, then it can be captured by pressing either a camera button or in some cases a foot pedal. On occasions the video otoscope is used to capture a video of the eardrum's movement when the patient holds

their nose and “pops” (Valsalva) their ear or the examiner blows air into the sealed ear canal (pneumatic otoscopy) to see if the eardrum is mobile. There is a learning curve with the use of the video otoscope but with patience and practice will be rewarded with every improving images of the eardrum.

Videoconferencing

“Live view” telemedicine allows the Aboriginal Health Worker, nurse, doctor and patient/carer to directly discuss with the Ear Specialist history and treatment options for their ear condition. The viewer screen at each end of the teleconference can have multiple images of the patient’s eardrum, of the audiogram and of the patient/carer and medical attendants. This enables the patient/carer to be fully assessed by the ear Specialist and for medical and surgical treatments to be discussed and arranged, saving much time for the patient/carer who might otherwise have

months to wait to see the visiting specialist.



Algorithms for Treatment

The algorithms on the following pages are based on the 2017 version of 'The Recommendations for Clinical Care Guidelines on the Management of Otitis Media in Aboriginal and Torres Strait Islander Populations', initially published in 2001 and revised in 2010. Treatment recommendations have been rated as weak or strong based on the quality of evidence using the GRADE framework (Grading of Recommendations, Assessments, Development and Evaluations).

 Weak recommendation for treatment

   Strong recommendation for treatment

The GRADE approach has been used in the 2017 update, which was funded by the Centre of Research Excellence in Ear and Hearing Health in ATSI Children.

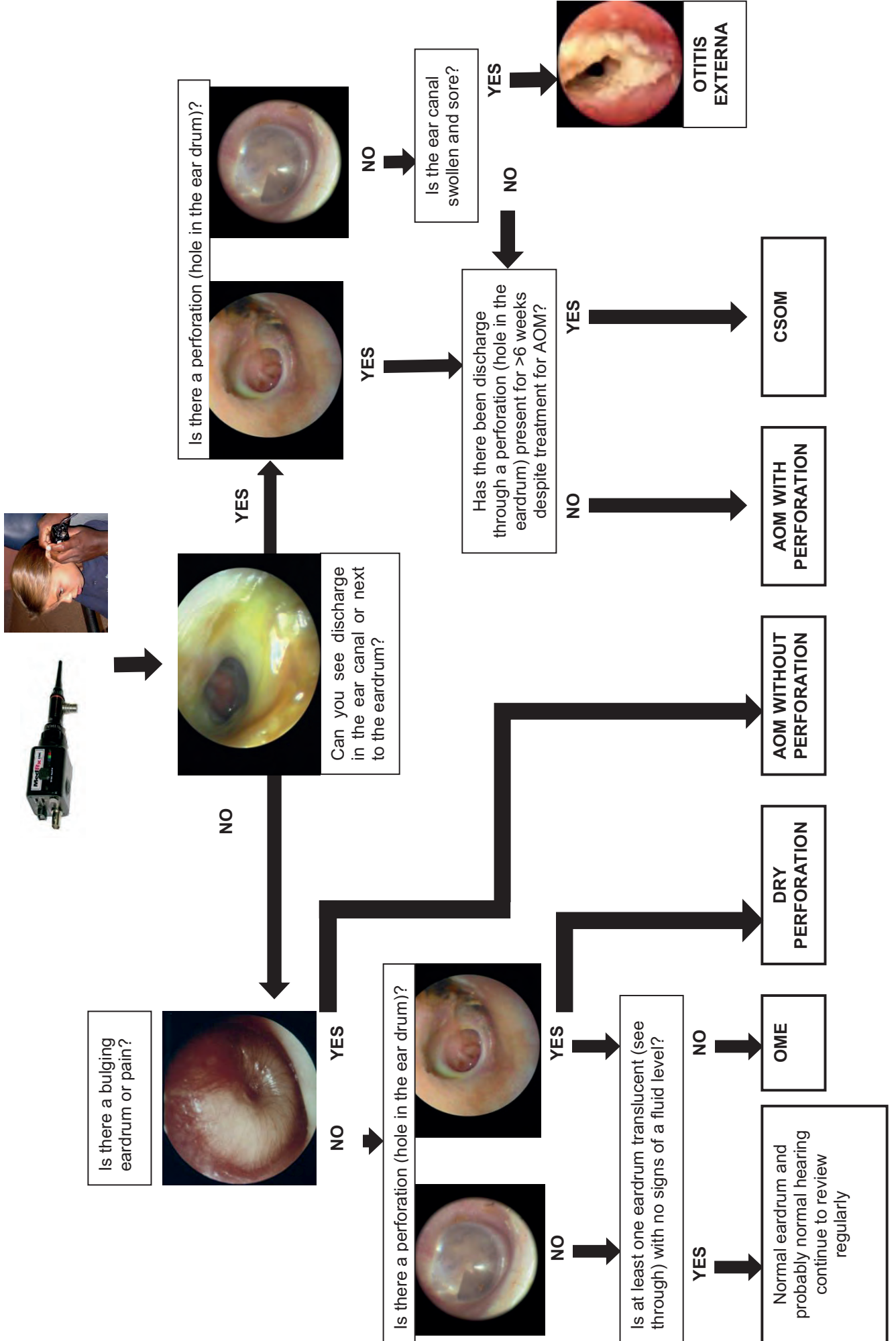
There are significant differences in some aspects of the new guidelines compared with those in 2010.

These include changes which are relevant in remote Australia where referral waiting time to a visiting ENT surgeon may well be so long that, in many cases, initial referral to Hearing Australia for hearing amplification, and early trial of medical treatment is warranted. Hearing loss at 30dB (defined as moderate) or above requires referral to Hearing Australia, and hearing loss of 21-30dB is defined as mild. Where patient or carer compliance with antibiotic regimens is difficult or no home refrigeration exists, Azithromycin treatment for AOM may be optimal. High risk children with longstanding OME may benefit from antibiotic treatment.

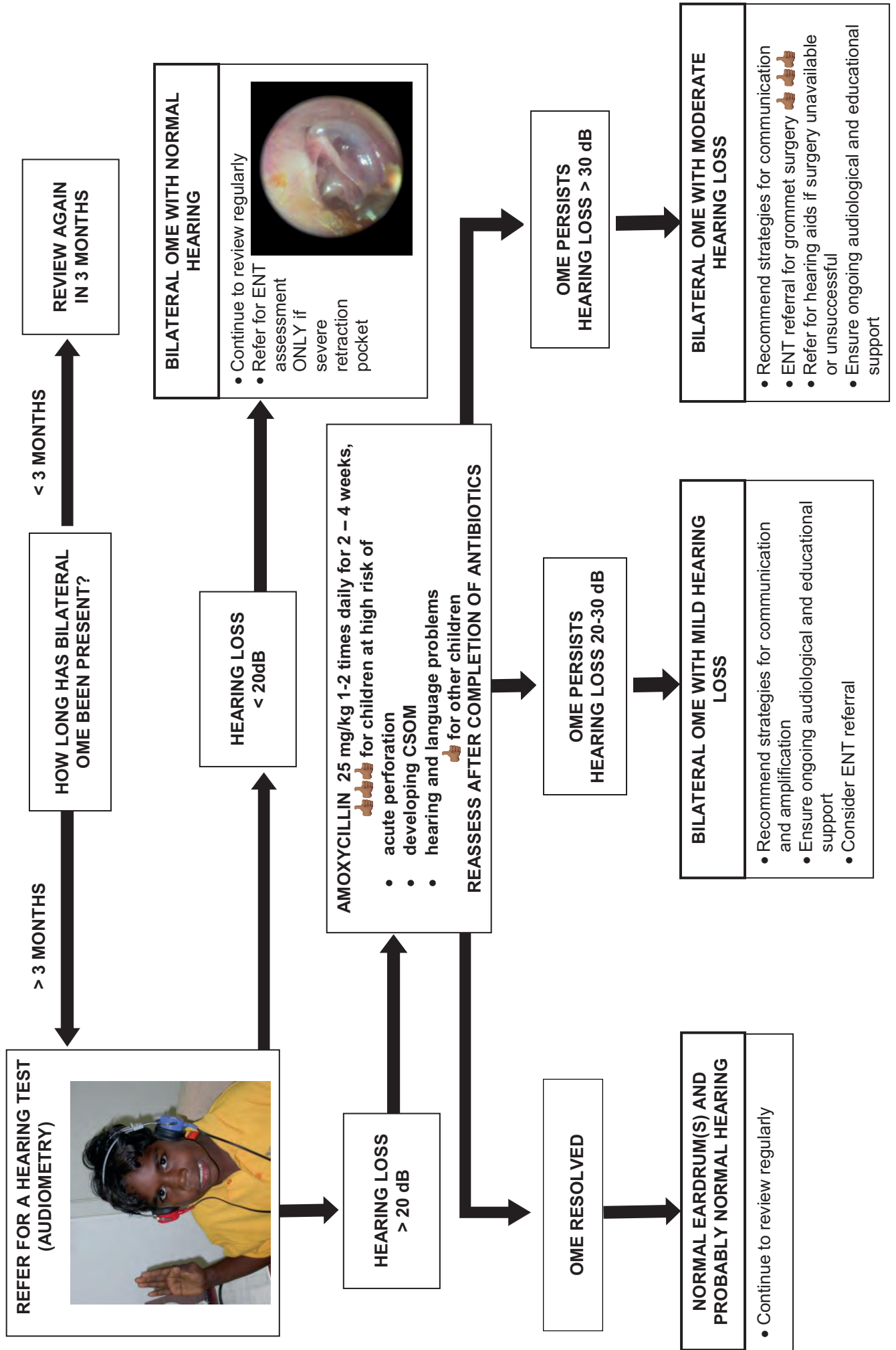
The OMap is highly recommended for more detailed algorithms to those detailed below.

- Does this child have a middle ear infection?
- Management of OME.
- Management of AOM with perforation.
- Management of AOM without perforation.
- Management of CSOM.
- Management of dry perforation.
- Hearing loss due to otitis media.

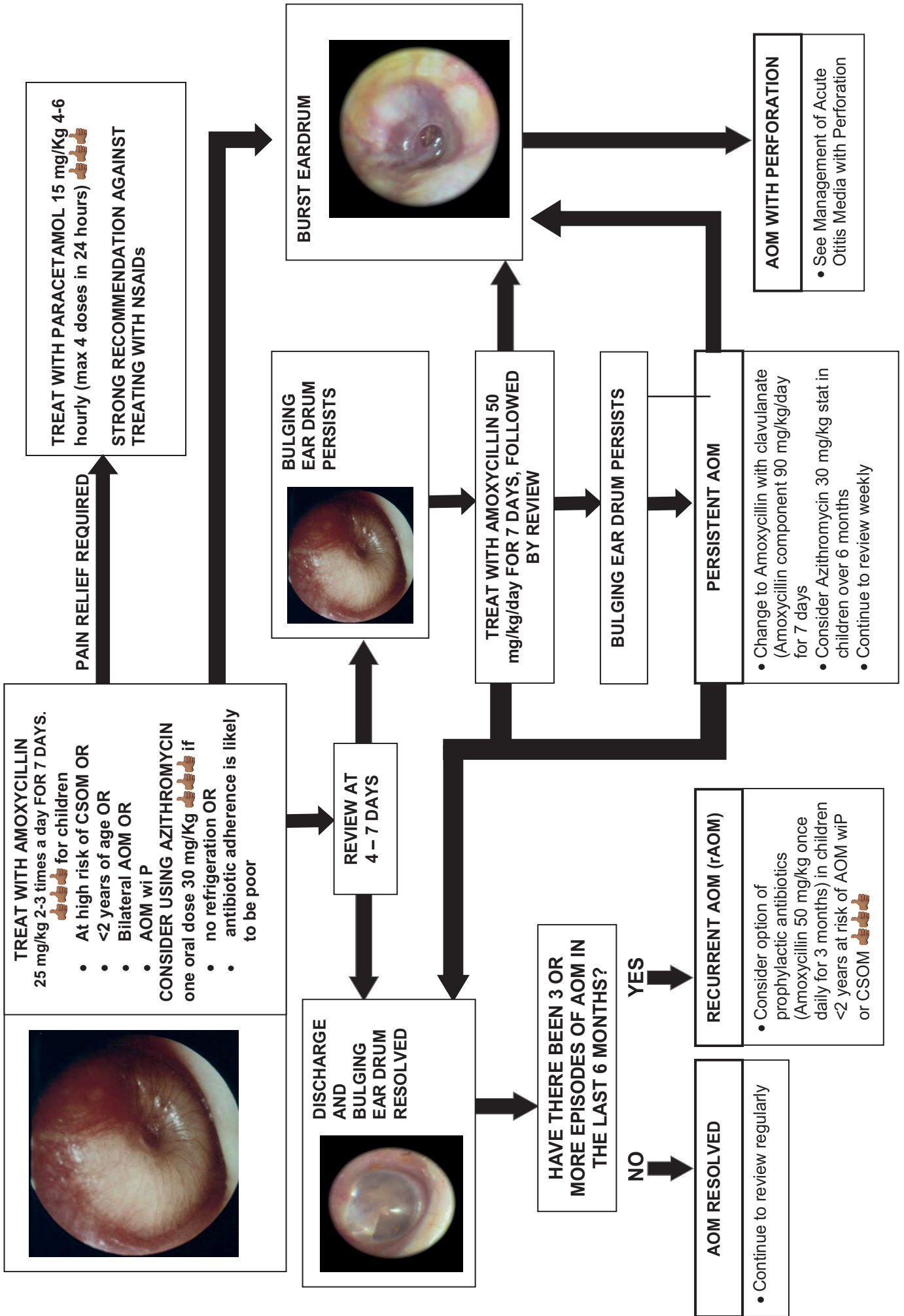
DOES THIS CHILD HAVE A MIDDLE EAR INFECTION (OTITIS MEDIA)?



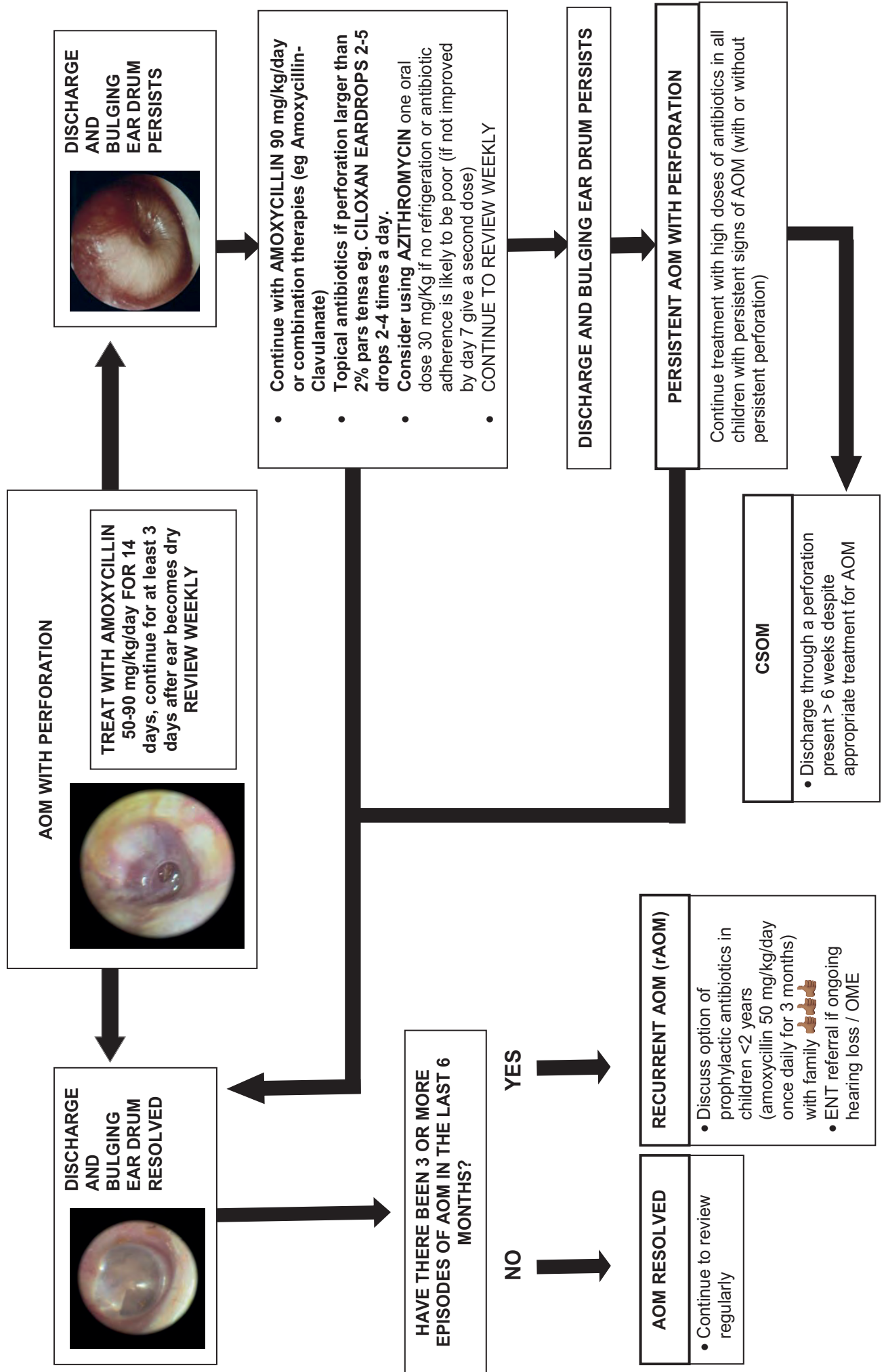
MANAGEMENT OF BILATERAL OTITIS MEDIA WITH EFFUSION (OME)



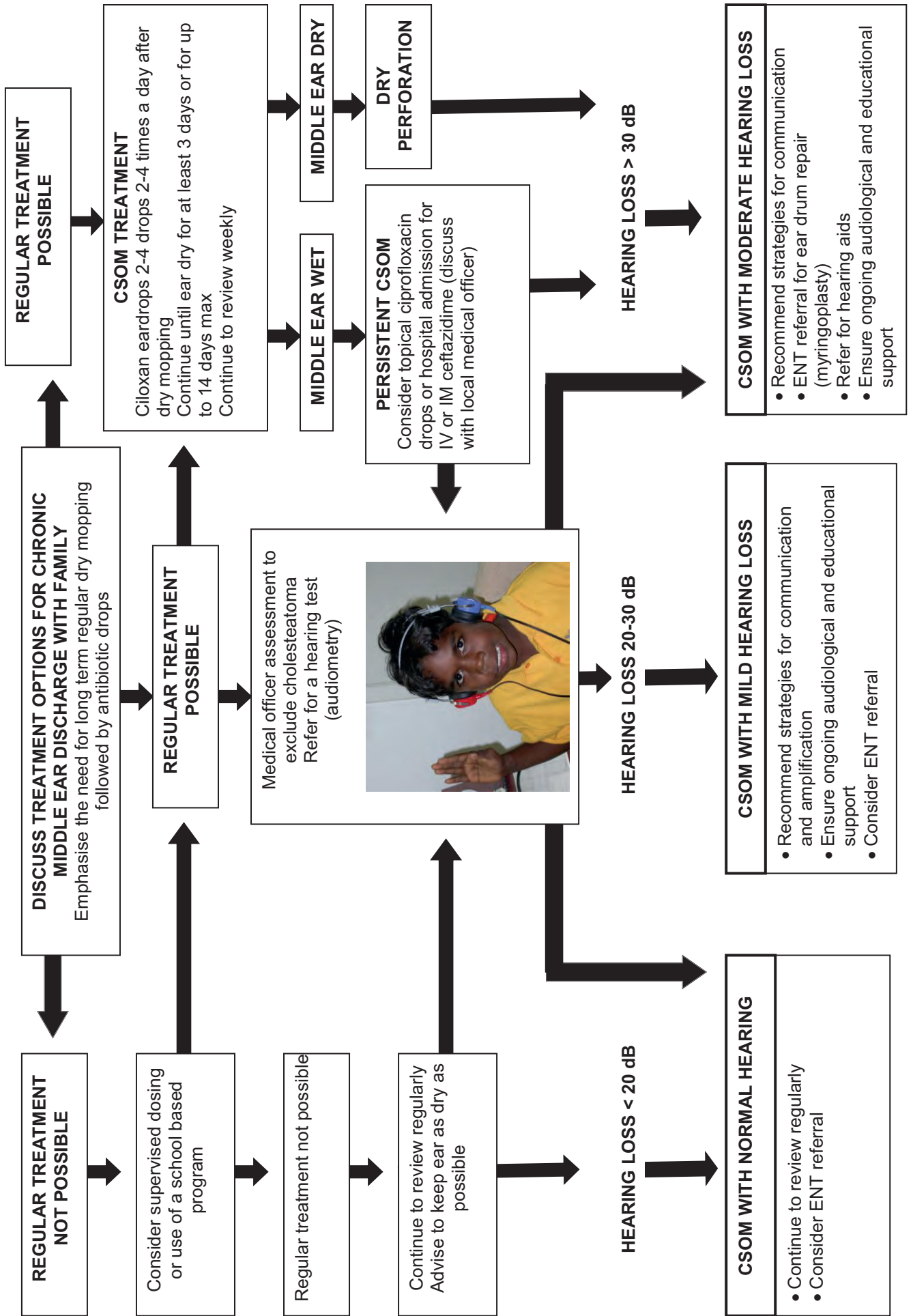
MANAGEMENT OF ACUTE OTITIS MEDIA WITHOUT PERFORATION



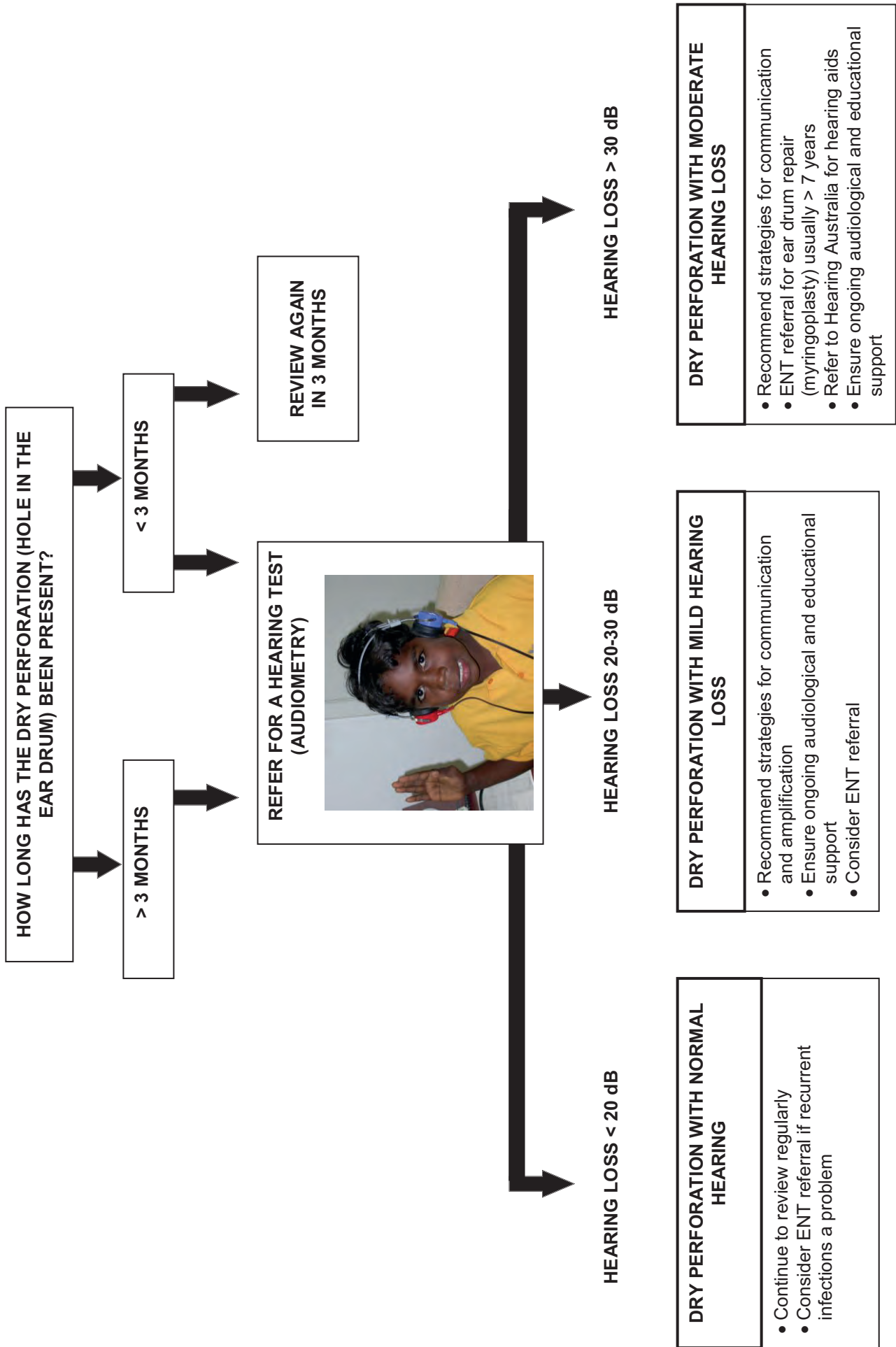
MANAGEMENT OF ACUTE OTITIS MEDIA WITH PERFORATION



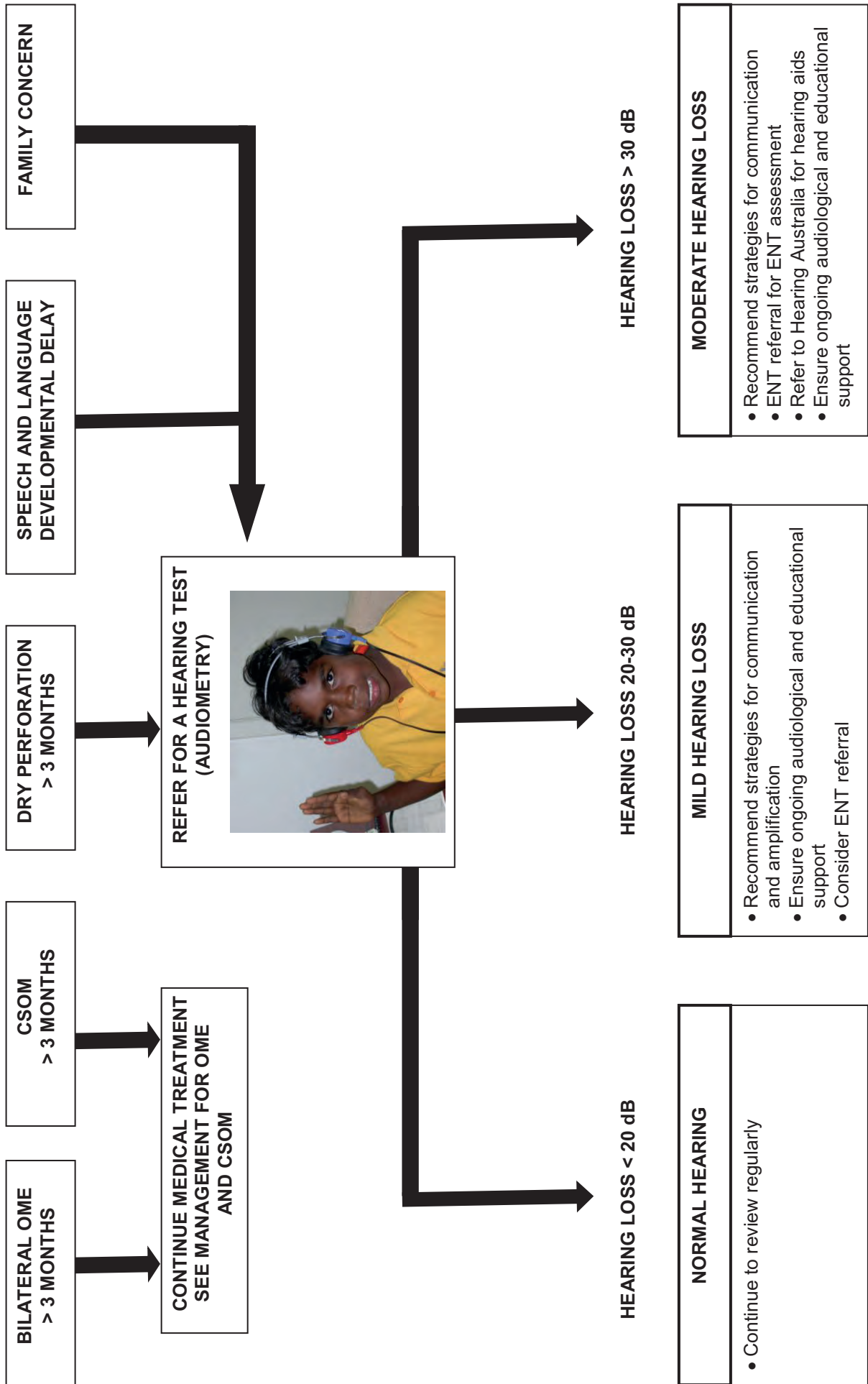
MANAGEMENT OF CHRONIC SUPPURATIVE OTITIS MEDIA (CSOM)



MANAGEMENT OF DRY PERFORATION



HEARING LOSS DUE TO MIDDLE EAR INFECTION



THE UNSAFE OR 'AT RISK' EAR

It is critical for the primary healthcare worker to be aware of those ear conditions that may lead to the development of cholesteatoma in the middle ear and surrounding structures.

Recent studies have shown that in longstanding OME and CSOM, the prevalence of cholesteatoma may be between 10-20% in Aboriginal and Torres Strait Islander children. It is possible that as the rate of children with perforation decreases, the rate of cholesteatoma may increase. This may occur for a few reasons, but most important is negative pressure in the middle ear space. There is a potential of serious complications such as mastoiditis, facial nerve paralysis, meningitis and brain abscess if cholesteatoma is not detected and treated early.

Cholesteatoma is defined as the abnormal growth of skin into the middle ear and mastoid bone. The cholesteatoma enters the middle ear either through an ear drum perforation or a retraction pocket. These can be picked up by otoscopy.

In the accompanying images we see a severe OME. There is a retraction pocket in the ear drum, and the drum is draping over the incus and stapes bones. We can't see where the pocket ends, which is worrying because there may be a hidden cholesteatoma sac eroding into nearby vital structures.

In the second image, a polyp can be seen near an ear drum perforation, and a cholesteatoma (white pearly material) is visible in the middle ear. A polyp is a non-cancerous, fleshy growth in the ear canal or arising from the middle ear and it's significant because it may be the herald sign of an underlying cholesteatoma.



Severe OME with posterior pocket over the middle ear bones.

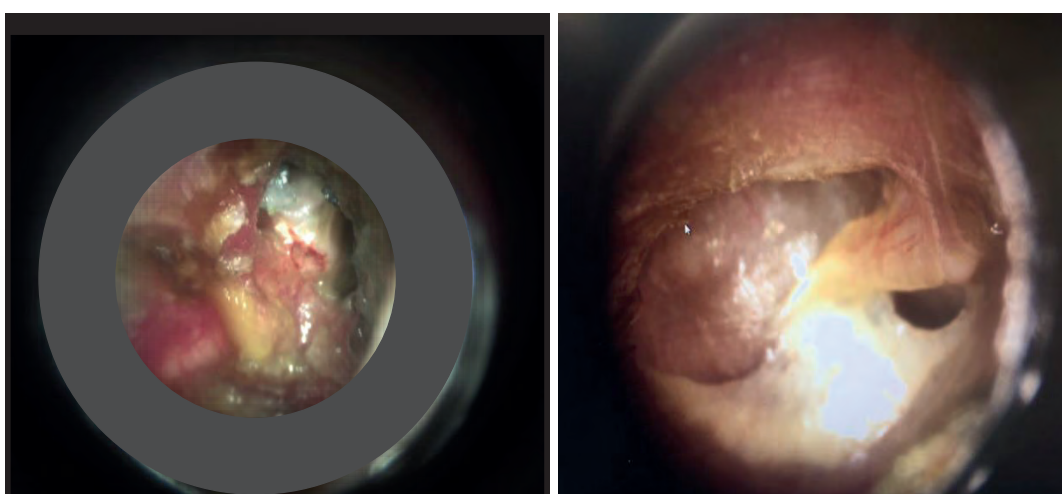


Middle ear cholesteatoma with a polyp present near the perforation.

Cholesteatomas can be either present from birth, which is rare, or develop later. A cholesteatoma forms when there is longstanding negative pressure as seen with OME or glue ear, and a weak or flaccid part of the eardrum retracts and forms a little pocket. The retraction pocket can either be in the attic or top part of the eardrum, or in the posterior-superior part of the eardrum as in the figure above.

Within the retraction pocket the skin cells shed, collect in the pocket and can't escape. Consequently they secrete enzymes which erode bone as the pocket enlarges.

Sometimes cholesteatoma forms at the edge of a perforation at the edge of the ear drum. Skin from the edge of the perforation grows into the middle ear, eventually causing a cholesteatoma.



Attic perforation with cholesteatoma Significant retraction pocket with extent not visible.

Granulation tissue (new healing tissue) or polyps may arise near the retraction pocket or perforation and should be regarded as cholesteatoma until proven otherwise. These often develop due to chronic infection and inflammation, hence must be looked at with concern. Some polyps will shrink or disappear with a week or more of antibiotic-steroid ear drops, allowing a better view of the ear drum.

The commonest symptoms and signs of a probable cholesteatoma include

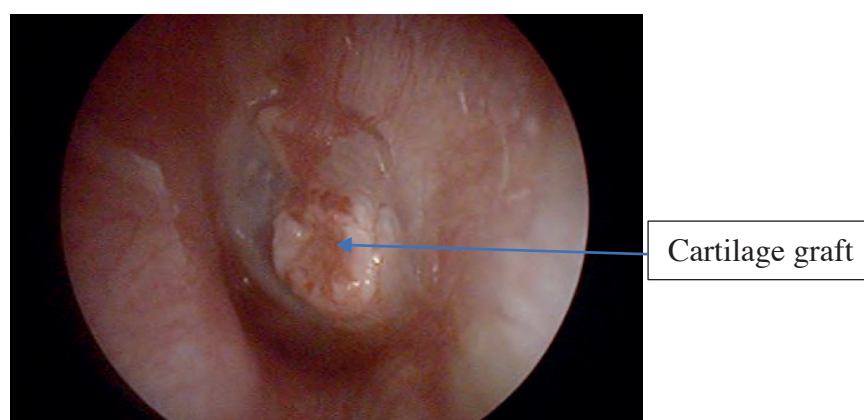
- Conductive hearing loss
- Foul smelling discharge from ear.
- Persistent OM or OME
- Earache.
- Vertigo or dizziness
- Facial weakness.

Facial nerve weakness can be tested by asking the patient to smile and observing whether there is a difference in movement of the face on the side with the suspected cholesteatoma.

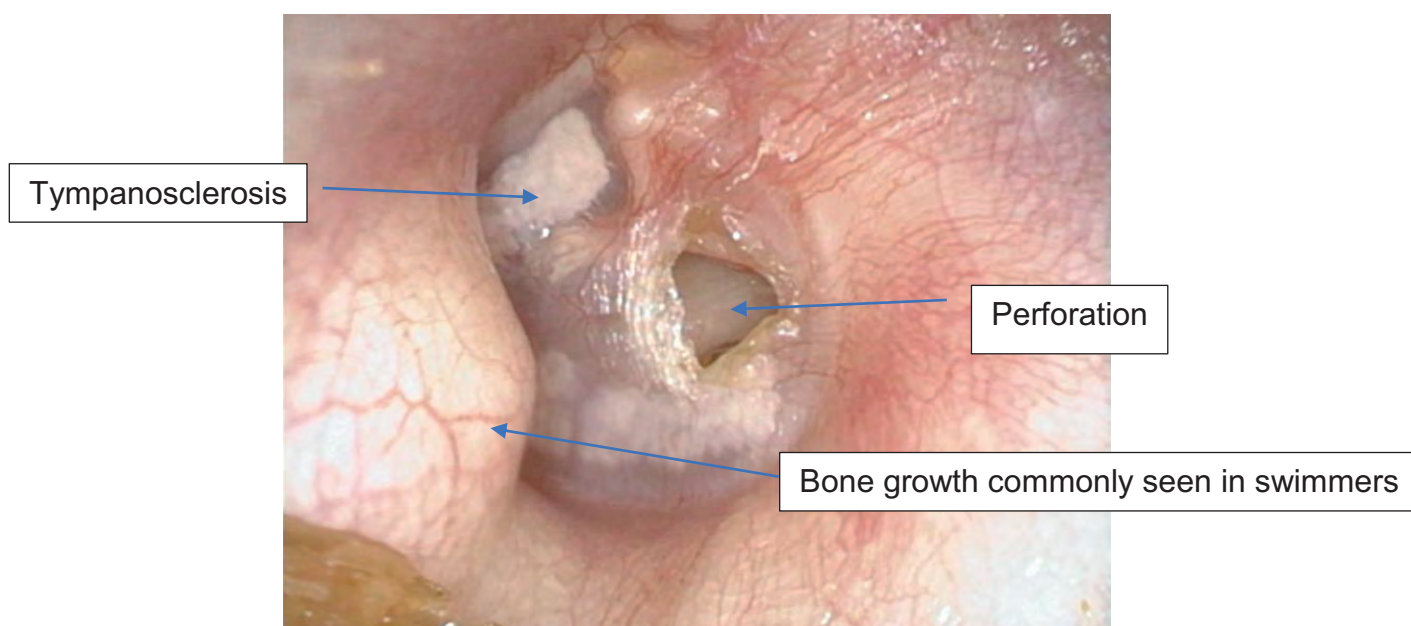
Investigations for cholesteatoma include audiometry, CT scanning to see if there is bone erosion, and occasionally MRI (Magnetic Resonance Imaging) to rule out intracranial spread.

Differential Diagnosis of cholesteatoma may include the following which can appear like cholesteatoma on otoscopic examination.

- Tympanosclerosis or scarring of the tympanic membrane.
- Cartilage grafts used to repair tympanic membrane perforations.
- Osteomas or exostoses of the ear canal.
- Fungal debris near the tympanic membrane.
- Malignancy of the external ear(uncommon).



Cartilage myringoplasty



Tympanosclerosis, perforation and exostosis.

If the primary healthcare worker is concerned that there is a patient with a possible unsafe ear then prompt referral to an ENT surgeon or, if available, a video-otoscopic image emailed to a regional ear coordinator or ENT surgeon, with audiology and a brief history is another option.

Surgical Procedures

Ventilation Tubes (Grommets)

Why is the operation needed?

Grommets (ventilation tubes) are usually inserted for treatment of otitis media with effusion (glue ear), or recurrent middle ear infection. Grommets may be needed in these cases:

- Four to six separate attacks of otitis media in 12 months
- Three separate attacks of otitis media in 6 months
- A handicapping hearing loss, which affects the child for 3 months
- A mild hearing loss for 12 months or greater
- Speech and language delay
- Balance problems

How is the operation performed?

The procedure can be done either by itself or with another procedure. If it is done by itself, sometimes the child can go home the same day (same day care unit). If done with another procedure then the child may spend a night in hospital.

How long do grommets stay in?

Grommets usually remain in place for between 3 and 9 months, at which time they come out of the eardrum by themselves into the ear canal. A second set of grommets is required in approximately 20% of children.

What will I notice after the operation?

There should be no significant pain for more than twenty four hours and usually there should be little in the way of discharge or bleeding from the ear. Often there will be antibiotic drops given post operatively to help keep the grommet from blocking or getting infected.

What should I do after the operation?

Do not let water go into the ear. To stop water getting into the ear, use:

- silicon ear putty
- "blue tac"
- ear plugs

Children should not do "bombies" or dive or swim underwater, as water may enter the ear despite the ear protection. Children are reviewed every 6 - 9 months while the tubes are in place, to make sure that no discharge or problems have occurred, and to check the child's hearing after the operation. Children are reviewed once the tubes have come out as well, to check on the healing of the eardrum and to make sure that no fluid is behind the eardrum.

What if water gets into the ear?

If water does get into the ear, or the patient has a cold, there may be some drainage from the ear. This can be easily treated with antibiotic eardrops. The treatment for discharging grommets is the application of 5 drops of Ciloxan (Ciprofloxacin) ear drops twice daily for seven days. Occasionally ear washouts are necessary using Betadine 0.5% solution and a plastic syringe followed by the use of the drops as described.

What complications may happen after the operation?

Complications may include discharge (as mentioned above), polyps and bleeding, or development of retraction pockets or cholesteatoma at the site of the operation. In rare cases, where there is infection that does not respond to eardrops and oral antibiotics, admission to hospital for IV antibiotics and removal of the tube may be needed. In 1.6%-10% of cases, a hole (or perforation) may remain once the grommet has come out. A further operation to repair the hole in the eardrum (myringoplasty) may be needed.



Photograph of Ventilation Tube (grommet) in situ.

Discharging Grommet

Ensure discharge is cleared using either tissue spears or dilute (1 in 20) betadine washes. Apply Ciloxan (Ciprofloxacin) ear drops 5 drops twice daily for seven days. Ensure drops enter middle ear by pressing tragal flap in front of the ear several times. If there is associated bleeding with the otorrhoea, there may be a granulation polyp present requiring several week's treatment with Ciproxin HC drops (Ciprofloxacin and hydrocortisone).

Blocked Grommet

Grommets can become blocked usually with dried discharge or 'glue' but occasionally blood or wax. Blocked Grommets can be unblocked with betadine washouts (1 in 20), or application of dilute 2% hydrogen peroxide solution. If these treatments fail it may be necessary to replace the grommet.

Adenoidectomy

There is much evidence that removing the adenoids at the back of the nose reduces the need for further grommets by half, as well as reducing nasal discharge and snoring. The adenoids are removed either by a curette or suction diathermy at the time of the grommet operation.

Myringotomy alone

In tropical Australia some ear surgeons believe that removing the fluid in the middle ear alone via a myringotomy incision and allowing the eardrum to heal over the next week is more practical than grommet insertion. This allows swimming without the concern of grommet infections from water contamination.

Surgical Procedures

Myringoplasty

(repair of holes in the eardrum using a special graft)

How do holes in the eardrum occur?

A hole in the eardrum, or perforation, may come from a previous ear infection or if the eardrum does not heal after grommets (ventilation tubes) have come out.

Why is the operation needed?

Repair of the eardrum (myringoplasty) is an operation that is performed to reconstruct the eardrum if there is a perforation. Material is grafted over the hole in the eardrum allowing the eardrum to heal. This improves the hearing, allows the child to swim and prevents skin at the edges of the perforation growing into the middle ear (cholesteatoma).

What is used to repair the hole?

The graft material varies, but is always taken from the patient. The graft material used is either subcutaneous tissue/fat/fascia, or a tragal cartilage graft. Graft material is sometimes taken from behind the ear or from the front of the ear (tragus). This requires a small cut and occasionally a larger cut behind the ear.

What will I notice after the operation?

There will be blood stained discharge draining from the ear for up to four weeks. If the discharge becomes smelly, please see a doctor. There may be some "popping" sounds. Long-lasting pain is not usual, and you should see a doctor. If you become very dizzy after leaving hospital, also see a doctor.

What should I do after the operation?

Water should be kept off the small cut to remove the graft material for one week. Do not let water go into the ear. To stop water getting into the ear, use:

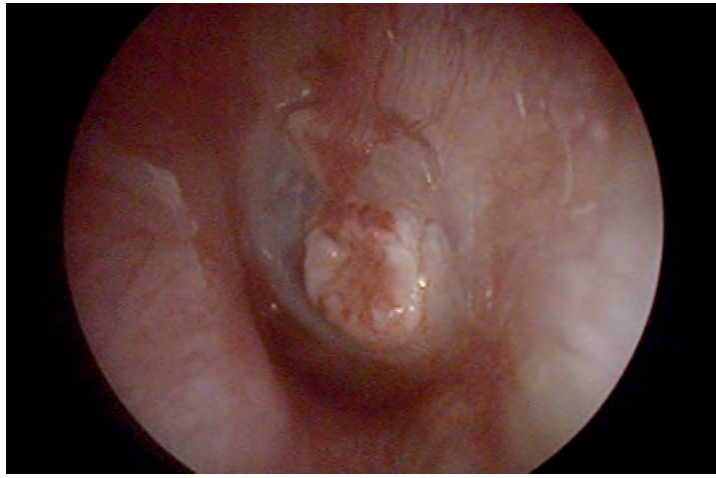
- silicon ear putty
- "blue tac"
- ear plugs
- Vaseline and cotton wool

How successful is the operation?

The success of the operation varies according to the size of the hole, and the presence or absence of infection both before and after the operation. Success rate varies between 50-90%.

What complications may happen after the operation?

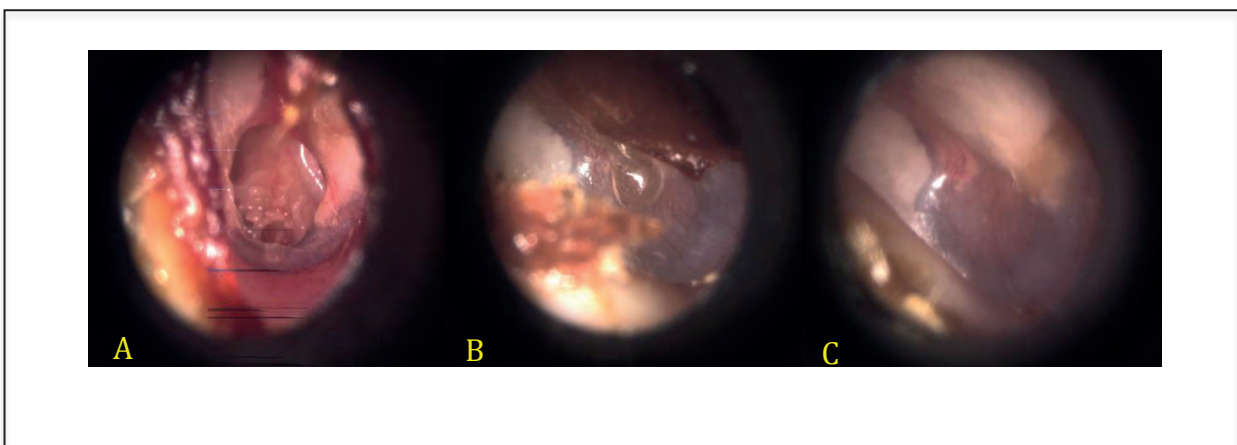
Complications include infection and rejection of the graft, hearing loss (uncommon), ringing in the ears (tinnitus) and dizziness and loss of balance (vertigo), and very rarely (1 in 10,000) facial nerve palsy.



Example of cartilage myringoplasty.

Tissue Engineered Regeneration of Ear Drum

Exciting recent developments in Japan by Professor Kanemaru have shown a method of regenerating the eardrum in people with chronic ear drum perforations by a short procedure under local anaesthetic in adults and under general anaesthetic in children. This uses a tissue growth factor which stimulates the growth of the three components of the tympanic membrane or ear drum, to grow along a gelatine foam scaffold to successfully repair the perforations in a significant number of patients in pilot studies in Japan. This technique has been performed in Perth for the first time in Australia with success. It is hoped in the future that this procedure will be available throughout Australia if Australian pilot programs show success rates equivalent to conventional myringoplasty.



Otosopic images of pre-operative tissue engineered myringoplasty, (A), Appearance 2 weeks postoperatively (B), and complete healing 2 months post-operatively(C).

Complications of Otitis Media

Which patients to refer for urgent treatment?

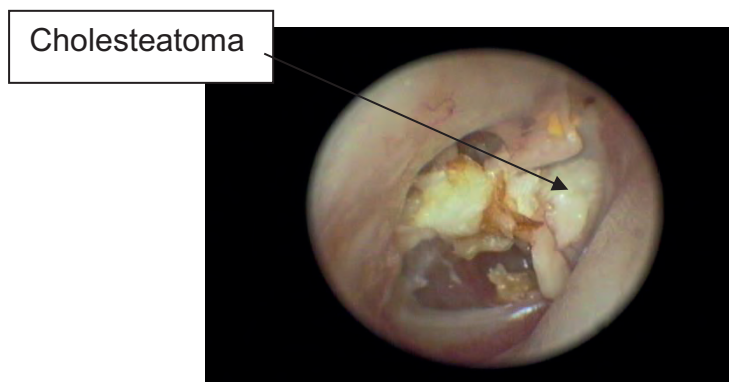
Despite the common use of antibiotics, there is still the risk of complications of otitis media and chronic suppurative otitis media of infection involving the middle ear, mastoid, inner ear and intracranial cavity.

Mastoiditis

Acute mastoiditis involves the development of an abscess within the mastoid bone behind the external ear, often accompanied by systemic symptoms and a tender lump between the external ear and the mastoid region, which may cause the outer ear to stick out. In acute mastoiditis the crease behind the ear is usually blunted or absent.

Suspected cholesteatoma

Cholesteatoma occurs when the normal lining skin of the eardrum accumulates in the middle ear or other parts of the temporal bone. Usually it develops from a retraction pocket in the eardrum or migration of skin through a defect of the eardrum such as a perforation. Clinically, the diagnosis is made by the visualisation of a white mass in the tympanic membrane or middle ear. Usually surgical management is necessary for this condition.



Intracranial complications (associated meningitis or brain abscess)

Acute otitis media and chronic suppurative otitis media may lead to meningitis or inflammation of the lining of the brain or an abscess in the brain or thrombosis of one of the great blood vessels in the region (lateral sinus thrombosis).

Facial paralysis

Facial nerve paralysis can be caused by otitis media, either in its acute or chronic form as well as with cholesteatoma. The child will have an inability to move one side of the face, and this condition requires acute intervention by the otolaryngologist.

Labyrinthitis

Labyrinthitis occurs when there is spread of infection from the middle ear or mastoid into the vestibular and cochlear organs. This may cause a permanent hearing loss and dizziness and, in the presence of fever and an acute infection, is a medical emergency.

RESOURCES

ATSI EAR HEALTH

Healthinonet.ecu.edu.au This excellent website also including earInfoNet.ecu.edu.au contains a wealth of resource material including all published papers on the subject of ATSI ear health.

Recommendations for Clinical Care Guidelines on the Management of Otitis Media in Aboriginal and Torres Strait Islander Populations. Updated 2017

OMapp—A major on line Otitis Media app with easy to follow treatment guidelines based on the updated 2017 Clinical Care Guidelines. Appstore or GoogleApp.

Otitis Media. Medical Journal of Australia Supplement Vol 191 No 9, Nov 2009. S37. Though ten years old, many articles still currently relevant.

Sibthorpe, B., Agostino, A., Coates, H., Weeks, S., Lehmann, D., Wood, M., Lannigan, F and McAullay, D. (2017). Indicators for continuous quality improvement for otitis media in primary health care for Aboriginal and Torres Strait Islander children. Australian Journal of Primary Health, 23, 1-9.

Roadmap for Hearing Health-Hearing Health Sector Committee. This document contains 52 key actions recommended in ATSI Ear Health in the short to long term. Three of the Manual co-authors participated. (SH, KK, HC.)

AUDIOLOGICAL RESOURCES

Hearing Australia. <http://www.hearing.com.au>

PLUM and HATS speech resource. www.hearhappy.nal.gov.au

Online tympanometry training. <https://www.hearing.com.au/Resources-for-health-professionals/General-Practitioners/Tympanometry-training-for-primary-health-services?viewmode=0>

OTHER RESOURCES

Blow- Breathe-Cough Program. <https://www.hearing.com.au/Hearing-loss/Children-young-adults/Blow-Breathe-Cough>

Deadly Ears Program. Parents download resource
<https://www.childrens.health.qld.gov.au/service-deadly-ears-program/>

Care for Kids's Ears website.:

[http://www.careforkidsears.health.gov.au/internet/cfke/publishing.nsf/Content/NACCHO Aboriginal Ear Health](http://www.careforkidsears.health.gov.au/internet/cfke/publishing.nsf/Content/NACCHO%20Aboriginal%20Ear%20Health). <https://www.naccho.org.au/programmes/ear-and-hearing/>

Earbus Foundation of WA. <http://www.earbus.org.au/>

EON Foundation. <https://eon.org.au/>

Cholesteatoma-diagnosing the unsafe ear. Chang P, 2008, Australian Family Physician, Vol 3, (8);631-8

PACIFIC ISLANDER RESOURCE

Fijian Ear Health Guidelines and training Manual. Dr Oh Chunghyeon, 2019.

World Health Organisation. (2006) Primary ear and hearing care training resource. World Health Organisation.

Kaspar,A., Kei,J., Driscoll, C., Swanepoel, D.W., and Goulios, H. (2016). Overview of a public health approach to pediatric hearing impairment in the Pacific Islands. Int J Pediatr Otorhinol, 86.43-52.

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