
Conductive Hearing Loss In Children : A Comprehensive Literature Review

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Abstract

Conductive hearing loss (CHL) in children is a hearing disorder caused by impaired sound transmission through the external and/or middle ear, while sensorineural function is generally preserved. Although commonly associated with otitis media and external ear abnormalities, CHL in children may be underrecognized and can negatively affect speech and language development, learning, academic performance, and psychosocial functioning when left untreated. This literature review aimed to synthesize current evidence regarding the definition, epidemiology, etiology, risk factors, pathophysiology, clinical manifestations, diagnosis, management, complications, and prognosis of CHL in children. A narrative literature review was conducted through searches of PubMed, ScienceDirect, SAGE, Google Scholar, NCBI Bookshelf, and official websites of the World Health Organization and the Ministry of Health of the Republic of Indonesia. Literature published between 2016 and 2026 in English or Indonesian was considered. Of 99 identified articles, 13 duplicates were removed, 86 articles underwent title and abstract screening, 42 were assessed in full text, and 26 publications met the eligibility criteria and one additional study was identified by hand-searching, giving 27 included sources. The review indicates that otitis media with effusion is a major cause of CHL in children, followed by external ear conditions such as cerumen impaction. Important risk factors include recurrent upper respiratory tract infections, Eustachian tube dysfunction, adenoid hypertrophy, limited access to healthcare, congenital ear abnormalities, trauma, and inappropriate ear-cleaning practices. Diagnosis requires comprehensive history taking, otoscopic examination, pure-tone audiometry, and tympanometry, with imaging reserved for suspected structural abnormalities or complications. Management is primarily directed at the underlying cause and may include observation, medical treatment, tympanostomy tube placement, tympanoplasty, surgical reconstruction, hearing rehabilitation, or bone conduction systems according to the clinical condition. Persistent or recurrent CHL may result in impaired speech and language development, learning difficulties, psychosocial problems, and structural damage to the tympanic membrane and ossicles. Overall, the prognosis is generally favorable in reversible conditions, particularly nonpersistent otitis media with effusion, but is less favorable in chronic, recurrent, or structurally complicated disease. Early detection, appropriate diagnosis, hearing monitoring, and etiology-based management are essential to minimize the long-term impact of CHL on children's development and quality of life.

Keywords: Conductive Hearing Loss; Children; Otitis Media With Effusion; Diagnosis; Management; Prognosis.

INTRODUCTION

Hearing is one of the important sensory functions that support the development of children's communication, learning process, and social interaction. Impairments in hearing function can affect children's ability to receive verbal information and follow the learning process in the school environment. Children with hearing loss can have difficulty understanding speech, especially in conditions with many sound sources, such as classrooms, so they can experience obstacles in following instructions and learning activities (Patro & Mishra, 2024). Hearing loss is also related to lower academic achievement in some school-age children, both in mild unilateral and bilateral hearing loss (Collier, 2025).

The burden of hearing loss in children is relatively large. Globally, around 95.1 million children and adolescents aged 5–19 years have hearing loss, and more than 40% of hearing loss in that age group is related to otitis media (World Health Organization, 2025). One type of hearing loss that needs attention in children is Conductive Hearing Loss (CHL), which is

a decrease in hearing sensitivity due to mechanical obstacles to sound transmission in the outer ear and/or middle ear, while the inner ear function is generally still normal (Sooriyamoorthy & De Jesus, 2023). The most common cause in children is otitis media with effusion (OME) and cerumen impaction, with risk factors in the form of recurrent upper respiratory tract infections, limited access to health services, congenital ear malformations, and improper ear cleaning habits (Hamood et al., 2025; Kuschke et al., 2020).

Although it is quite common, CHL in children is often recognized late. The symptoms are not typical, for example, frequent requests for repeated conversations, high television volume, attention disturbances, or decreased academic achievement (Rosenfeld et al., 2016). Delayed diagnosis and management risk having a permanent impact on children's speech, language, and learning development (Paing et al., 2025; Silva et al., 2023).

Although clinical guidelines and recent studies on pediatric CHL have been published, the evidence on its diagnosis and management is spread across sources of differing type and quality, and Indonesian data remain limited. This narrative review therefore aims to synthesize recent evidence on the definition, epidemiology, risk factors, pathophysiology, diagnosis, management, complications, and prognosis of CHL in children, integrating guideline recommendations with recent research findings and national data, as a consolidated reference for clinicians in Indonesia.

RESEARCH METHODS

This study is a narrative literature review that synthesizes recent scientific evidence on conductive hearing loss (CHL) in children, covering its definition, epidemiology, etiology, risk factors, pathophysiology, clinical manifestations, diagnosis, management, complications, and prognosis.

Literature was searched in PubMed, ScienceDirect, SAGE, and Google Scholar, and in NCBI Bookshelf (StatPearls) for clinical reference material. The websites of the World Health Organization and the Indonesian Ministry of Health were searched for global and national epidemiological data. The search combined keywords and Boolean operators as follows: (“conductive hearing loss” OR “gangguan pendengaran konduktif”) AND (children OR pediatric OR anak) AND (“otitis media with effusion” OR “cerumen impaction” OR “tympanostomy tube” OR audiometry OR tympanometry OR prognosis). The reference lists of eligible articles were also hand-searched for additional relevant references.

Sources were included if they (1) addressed CHL or its main causes in children; (2) were systematic reviews, scoping reviews, clinical practice guidelines, cohort or cross-sectional studies, or clinical reviews; (3) were published between 2016 and 2026; (4) were written in English or Indonesian; and (5) were available in full text. In addition, authoritative reference sources (a textbook, StatPearls chapters, a WHO handbook, and an Indonesian Ministry of Health publication) were used as background for definitions, pathophysiology, and epidemiological context, and not as primary evidence on clinical effectiveness. Sources were excluded if they focused solely on sensorineural hearing loss or on adults without extrapolable pediatric data, or if they were single case reports, letters to the editor, opinion pieces without supporting evidence, duplicates, or inaccessible in full text.

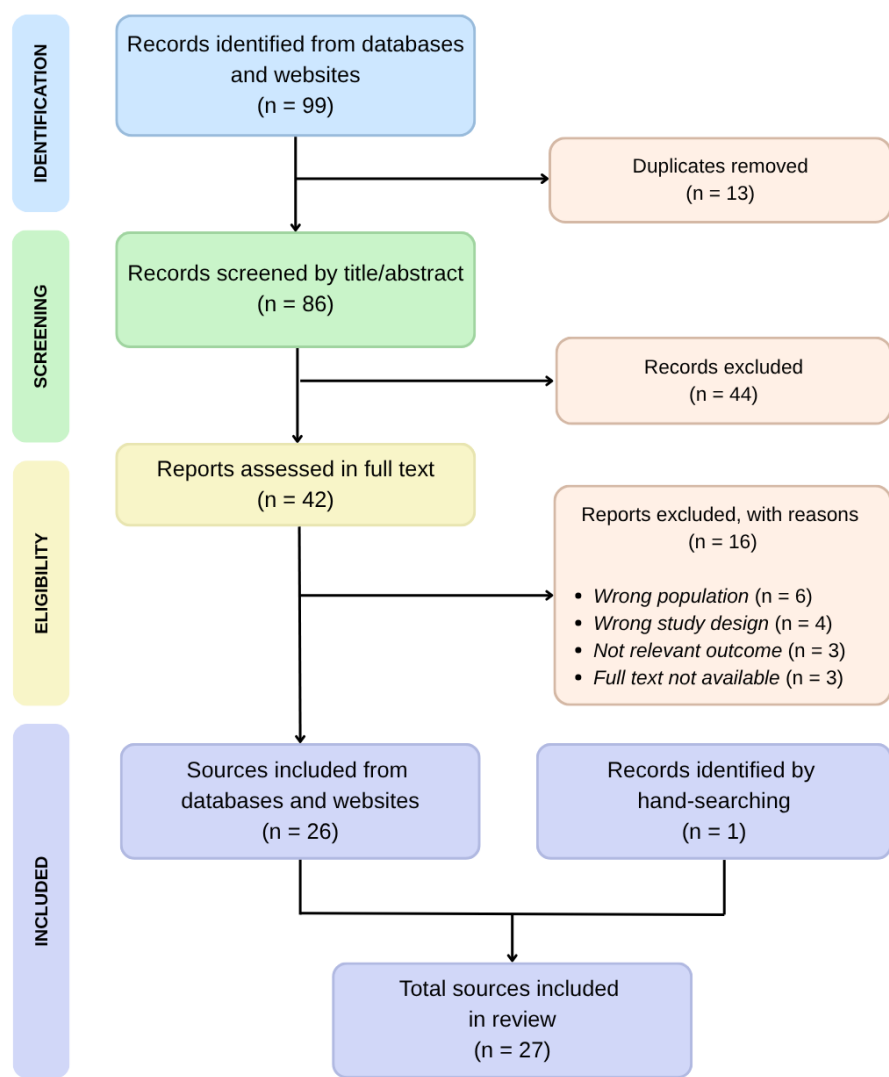


Figure 1. Flow diagram of the literature search and study selection process for the narrative review on conductive hearing loss in children (adapted from the PRISMA 2020 flow diagram)

The searches identified 99 records. After removal of 13 duplicates, 86 records were screened by title and abstract, and 44 were excluded. The remaining 42 reports were assessed in full text against the eligibility criteria, and 26 sources met the criteria. One additional primary study (Hussein et al., 2018) was identified by hand-searching and was included, giving a total of 27 sources (Figure 1). The included sources comprised 20 journal publications (7 systematic reviews, 1 scoping review, 3 clinical practice guidelines, 4 clinical reviews, and 6 observational studies) and 6 reference sources.

Extracted findings were synthesized narratively and thematically under the headings listed above. Where sources differed, particularly in management recommendations and prognosis data, the differences are described in the text and summarized in Table 1. National data were used to place the findings in the Indonesian context. No formal critical appraisal or risk-of-bias assessment was performed; the type of source (guideline, systematic review, observational study, or reference text) is therefore stated where relevant to the strength of a claim.

RESULTS AND DISCUSSION

Definition

Conductive hearing loss (CHL) in children is a reduction in hearing sensitivity caused by mechanical obstruction of sound transmission along the external ear canal and/or middle ear before sound reaches the cochlea. In contrast to sensorineural hearing loss, which involves damage to the cochlea or auditory nerve, the inner ear and sensory reception are generally normal in pure CHL. Audiometrically, CHL is diagnosed when air-conduction thresholds are elevated beyond the normal range while bone-conduction thresholds are within normal limits, with an air-bone gap (ABG) of ≥ 10 dB at two or more adjacent frequencies. In children, hearing is generally considered normal at thresholds of ≤ 15 dB HL (≤ 20 dB HL in some classifications), whereas the > 25 dB HL cutoff cited in the reference source is the adult criterion (Lieu et al., 2020; Sooriyamoorthy & De Jesus, 2023). Pure CHL is generally a mild-to-moderate hearing impairment that usually does not exceed 60 dB HL, because high-intensity sound can still reach the cochlea directly through bone conduction (Sooriyamoorthy & De Jesus, 2023).

Epidemiology

Globally, an estimated 95.1 million children and adolescents aged 5-19 years live with hearing loss, and more than 40% of cases in this age group are related to otitis media (World Health Organization, 2025). Studies summarized by Sooriyamoorthy and De Jesus (2023) report hearing loss in 15% of primary school children (88.9% conductive) and in 19% of school children in Canada (93% conductive). A study of preschool children in a low-income South African community reported hearing loss in 18.7% of children, of which 65.2% was conductive (Hussein et al., 2018). These figures come from different populations and screening methods and should not be pooled. In low- and middle-income countries, hearing loss attributable to otitis media in children has been reported to reach 26% (Sooriyamoorthy & De Jesus, 2023).

The etiology of CHL in children is dominated by otitis media with effusion (OME). In a hospital-based study from Iraq that included children, adolescents, and adults, OME accounted for 55.55% of pure CHL cases in children, and adenoid hypertrophy was found in 89.76% of the children with OME (Hamood et al., 2025). Cerumen impaction is also common: in the same South African preschool study (children aged 3-6 years), impacted cerumen was found in 9.3% of children (Hussein et al., 2018). In Indonesia, data from the Free Health Screening Programme (Cek Kesehatan Gratis, CKG) up to 31 December 2025 showed that 337,056 of 18,697,124 people who underwent hearing screening (1.8%) were found to have hearing loss. Among school-age children, the dominant conductive findings were cerumen impaction and chronic suppurative otitis media (CSOM) (Ministry of Health of the Republic of Indonesia, 2026).

Etiology

Conductive hearing loss (CHL) in children results from obstruction of sound transmission anywhere from the outer ear to the middle ear. Its etiology is highly heterogeneous, encompassing acquired inflammatory and infectious processes, structural congenital anomalies, craniofacial and syndromic disorders, and environmental and socioeconomic factors.

Inflammatory and infectious etiologies are the most common causes of CHL in children. Otitis media with effusion (OME), defined as the presence of fluid in the middle ear that impedes sound transmission, is the leading cause. OME is frequently associated with adenoid hypertrophy, as an enlarged adenoid can impair Eustachian tube function and lead to fluid accumulation in the middle ear. Hamood et al. (2025) found that OME was the most frequent cause of pure CHL in children (55.55%) and was closely linked to Eustachian tube

dysfunction and adenoid hypertrophy (found in 89.76% of cases). Besides OME, CHL may also result from chronic suppurative otitis media (CSOM) with or without cholesteatoma. Cholesteatoma is an abnormal growth of epithelial tissue in the middle ear that can destroy adjacent structures and usually requires surgical intervention. In acute otitis media with otorrhea or middle ear effusion, a systematic study by Hullegie et al. (2021) identified the principal otopathogenic bacteria as *Streptococcus pneumoniae*, non-typeable *Haemophilus influenzae*, *Moraxella catarrhalis*, and *Staphylococcus aureus*.

Non-inflammatory and congenital etiologies also play an important role, although they account for a smaller proportion of cases than OME. Congenital anomalies such as microtia and middle ear malformations are generally associated with developmental disturbances of ear structures and can cause CHL from birth, typically unilaterally. Trauma may also cause CHL, for example through tympanic membrane perforation or ossicular injury, which can result from improper ear-cleaning practices, head or ear injury, and barotrauma. Mastoiditis may likewise cause CHL in children (Hamood et al., 2025; Niu et al., 2020)

Craniofacial and syndromic disorders and neonatal risk factors significantly increase the risk of CHL. Children with cleft lip and/or palate (CLP) have impaired function of the muscles that open the Eustachian tube, making CLP a major risk factor for a higher incidence of OME. A population-based study by Collins et al. (2023) showed that preterm infants and infants with a history of prolonged mechanical ventilation have a significantly higher risk of CHL.

Risk Factors

The risk factors for conductive hearing loss (CHL) in children are multifactorial, encompassing age, environmental, socioeconomic, genetic, and behavioral factors. Children from toddler to preschool age are more susceptible to recurrent upper respiratory tract infections, which can indirectly increase the risk of Eustachian tube dysfunction and thereby lead to otitis media with effusion (OME) or chronic suppurative otitis media (Hamood et al., 2025; Kuschke et al., 2020) .

In addition, socioeconomic status and access to healthcare play a role: studies in low- and middle-income countries show that CHL is more frequently found in populations with limited access to primary healthcare, so that ear infections do not receive early treatment (Kuschke et al., 2020). From a genetic perspective, a family history of ear malformations may increase the likelihood that a child is born with a similar structural abnormality (Niu et al., 2020).

Other important factors are habits and a history of trauma, such as improper ear cleaning with non-sterile objects, a history of head or ear injury, and previous ear surgery, which may predispose to tympanic membrane perforation or ossicular disorders (Hamood et al., 2025; Lieu et al., 2020).

Pathophysiology

The conductive auditory system consists of the outer ear and middle ear that function to conduct acoustic energy from the outside air to the cochlea. Interference in this pathway reduces the intensity of the sound that reaches the sensorineural system and is known as conductive hearing loss (CHL) (Gelfand, 2016).

Under normal circumstances, sound waves enter through the external acoustic meatus which acts as a 1/4 wavelength resonator and provides a gain of 15–20 dB at a frequency of 2000–5000 Hz. Tympanic membrane vibrations are transmitted to the ossicular chain (malleus, incus, stapes). The middle ear overcomes the impedance mismatch between air and cochlear fluid. Without this mechanism, approximately 99.9% of sound energy would be reflected back. In the middle ear, mechanical reinforcement works in three ways: the area ratio (the tympanic membrane is much larger than the stapes footplate in the oval window, so pressure increases), buckling the curved-membrane effect (the movement of the

manubrium malleus is smaller but the force is greater), and the ossicular lever action (the difference in length between the malleus and incus arms acting as a lever) (Gelfand, 2016).

The primary pathophysiology of CHL occurs when a lesion or physical obstacle interferes with one or all of these mechanisms, so that the sound energy transmitted to the cochlea is weakened in proportion to the degree of damage (Gelfand, 2016).

Pathology of the external ear

Cerumen Blockage

Cerumen blockage occurs when the natural cleaning mechanism of the ear canal fails due to overproduction, anatomical obstruction (narrowing, exostosis, osteoma) or manipulation with cotton swabs and hearing aids that push the cerumen deeper, as well as inadequate epithelial migration with aging due to atrophy of the ceruminous glands, producing drier and harder cerumen. Complete blockage can reduce the intensity of sound by up to 45 dB, which causes aural fullness, tinnitus, and pain, and can raise the pH of the ear canal to alkaline, thereby facilitating otitis externa infection (Horton et al., 2020).

Otitis Externa

The inflammatory response in otitis externa is initiated by damage to the epithelium, loss of the protective wax layer and increased humidity that triggers inflammation and edema that can close the acoustic pathway, so that sound waves do not optimally reach the tympanic membrane and cause the onset of CHL (Medina-Blasini & Sharman, 2023).

Congenital Anomalies

Conditions such as aural atresia (absence of the outer ear canal) or aural stenosis (extreme narrowing of the ear canal), cause mechanical obstruction of the sound transmission pathway from birth (Gelfand, 2016).

Pathology of the Middle Ear

Tympanic Membrane Perforation

Trauma or infection causes the effective vibration surface area to be reduced, so that the area-ratio effect is weakened, the mechanical connection to the ossicles is not optimal and the sound phase relationship between the oval window and the round window is disturbed. As a result, the process of transmitting sound to the inner ear is no longer efficient, causing conductive hearing loss (Gelfand, 2016).

Otitis Media with Effusion

Ventilation failure by the Eustachian tube creates negative pressure that attracts serous and mucoid fluid to the middle ear. This fluid increases the mass and stiffness of the system so that the vibration of the tympanic membrane and ossicles is limited. In the chronic stage, the fluid can thicken into an adhesive otitis media ("glue ear") that binds the ossicles (Searight et al., 2025).

Clinical Manifestations

Conductive hearing loss gives rise to various interrelated clinical manifestations. Patients generally complain of a muffled sound, but it remains clear when the volume is turned up. Patients can also experience autophony, in which the patient's own voice is perceived as echoing or louder in the head when speaking, so patients tend to speak at a low volume. Other complaints include otalgia and otorrhea (ear pain accompanied by ear discharge), which are commonly found in acute otitis media or acute exacerbations of chronic conditions (Sooriyaamoorthy & De Jesus, 2023).

Patients may also experience aural fullness, such as a sense of blockage or abnormal pressure, due to Eustachian tube dysfunction, middle ear effusion, or cerumen plug. In addition, tinnitus in the form of low-frequency buzzing sounds can accompany mechanical abnormalities of the ossicle or obstructions in the auditory canal. In otosclerosis, patients may find that their hearing improves in a noisy environment (James et al., 2025; Sooriyaamoorthy & De Jesus, 2023).

In the child population, sound conduction disorders cause difficulties in capturing and processing speech elements in the low to moderate frequency range. Chronic conductive hearing loss triggered by Eustachian tube dysfunction or otitis media with effusion carries a high risk of articulation difficulties and speech delay (James et al., 2025).

Diagnosis

History Taking

In children, hearing loss rarely presents as a complaint of "not being able to hear". Symptoms more often take the form of requests for repeated speech, difficulty hearing in noisy environments such as classrooms, high television volume, lack of responsiveness when called, attention deficits, and decreased academic achievement. Anamnesis needs to explore the onset, duration, progressivity, as well as patterns of the disorder (unilateral or bilateral, persistent or fluctuating), accompanied by an assessment of speech and language development. To distinguish the causes, it is necessary to ask a history of otalgia, otorrhea, fever, tinnitus, vertigo, trauma, use of cotton buds or foreign objects, and barotrauma. Pain, fever, and otorrhea suggest active infection, while acute asymptomatic hearing loss, especially after an upper respiratory tract infection, suggests OME. Predisposing factors of OME, such as allergic rhinitis, adenoid hypertrophy, palatal abnormalities, and a history of recurrent OME, as well as a history of congenital abnormalities, syndromes, or hearing loss in the family, should also be asked about (Rosenfeld et al., 2016; Silva et al., 2023).

Physical Examination

The examination begins with an inspection of the auricle and ear canal using an otoscope or microscope to identify congenital abnormalities, stenosis, edema, debris, foreign bodies, or cerumen impactions that may impede sound transmission. The tympanic membrane is then systematically assessed, including color, position, integrity, light reflexes, as well as the presence or absence of retraction, protrusion, or perforation (Silva et al., 2023).

In OME, the tympanic membrane appears dull or grayish and retracted, with a lost or altered light reflex. Air bubbles or fluid boundaries (air-fluid levels) may be visible behind the tympanic membrane, and mobility is reduced on pneumatic otoscopy. In cooperative children, the tuning fork test may be used as an initial screening tool. In unilateral conductive disorders, the Weber test lateralizes to the affected ear, and the Rinne test shows bone conduction better than air conduction. However, this examination is of limited value in young children and in bilateral or mixed disorders, and cannot determine the degree of hearing loss, so the results must be confirmed by audiometry, so the results must be confirmed by audiometry (Hao et al., 2024; Silva et al., 2023).

Supporting Examinations

Pure-tone audiometry (PTA) is used to confirm the presence, type, and degree of hearing loss. In conductive disorders, the air conduction threshold decreases while bone conduction is relatively good, resulting in air-bone gap (ABG) as the main audiometric finding. To objectively assess middle ear function in suspected OME, tympanometry is performed. Type B tympanograms (flat curves) are typical for the presence of fluid in the middle ear, while type C (negative pressure) reflects Eustachian tube dysfunction which may be a predisposing factor for OME, but does not by itself prove the presence of effusion. Imaging is not required routinely in OME without complications. Temporal bone CT is considered when there is a suspicion of a structural abnormality or complication, e.g. cholesteatoma, which needs to be suspected in foul-smelling persistent otorrhea, deep tympanic membrane retraction, or atypical otoscopic imaging. If the degree of hearing loss is more severe than expected from a middle ear abnormality, or there are findings that point to a sensorineural component, further evaluation by an ENT specialist and audiologist is required to rule out mixed or sensorineural hearing loss (Hao et al., 2024; Kempfle & Remenschneider, 2024).

Management

General principles

Management of CHL in children aims to address the underlying cause, improve hearing function, and prevent lasting effects on speech, language, and learning development and on quality of life. The choice of therapy is adjusted to the etiology, degree and duration of the disorder, the condition of the outer and middle ear, and the presence or absence of structural abnormalities. Once the diagnosis is clinically and audiotologically established, the focus of therapy is not only to improve hearing thresholds, but also to treat the underlying ear disease and restore the sound conduction pathway (Silva et al., 2023).

External ear abnormalities and middle ear infections

On CHL due to reversible external ear abnormalities, such as cerumen impaction or foreign bodies, is managed by safe removal of the obstruction according to the condition of the ear canal. If the cause is inflammation or infection, therapy is directed to the underlying disease. In acute otitis media, analgesics and antipyretics are given, while antibiotics are given when there are clinical indications. Tympanostomy tube insertion is not routinely performed in acute otitis media, but can be considered for serious complications or other special indications (Silva et al., 2023).

Otitis media with effusion (OME)

OME is an important cause CHL in children and is managed in a stepwise manner. Most OMEs resolve spontaneously, so in children without specific risk factors periodic observation and evaluation is recommended, with reassessment after about 3 months to see the resolution of effusion, hearing loss, and changes in the tympanic membrane or middle ear. Antibiotics, corticosteroids (systemic and intranasal), antihistamines, and decongestants are not recommended routinely because their benefits are limited. Intranasal corticosteroids can only be considered when accompanied by allergic rhinitis (Bloom & Brodsky, 2024; Silva et al., 2023).

If OME persists and causes hearing loss or functional impact, the insertion of a tympanostomy tube (ventilation tube) may be considered to provide ventilation of the middle ear and reduce the persistence of the effusion. The main indications include bilateral OME ≥ 3 months with documented hearing loss; unilateral or bilateral OME ≥ 3 months with complaints such as balance disorders, behavioral problems, decreased school performance, or decreased quality of life; and OME in children at high risk of language development disorders. After installation, the child still needs to be monitored periodically to assess tube function and middle ear condition. Adenoidectomy can be performed concomitantly in children aged ≥ 4 years with selected cases of OME, while in children aged < 4 years it is not performed routinely unless there are other indications, such as chronic adenoiditis or nasal obstruction due to adenoid hypertrophy (Bloom & Brodsky, 2024).

Perforation of the tympanic membrane in chronic otitis media

When a perforation is established, tympanoplasty (with or without ossicular reconstruction) is one of the main options. This procedure aims to eradicate infection, close the perforation, and improve hearing whenever possible. Success in children is influenced by the condition of the ear, the function of the Eustachian tube, the state of the contralateral ear, the location of the perforation, and surgical techniques. Given the risk of damage from chronic infections and persistent hearing loss, the child's age should not be the only reason to delay the procedure (Rosenfeld et al., 2022).

Congenital malformations of the ear

The choice of therapy is determined by the degree of malformation and anatomy of the temporal bone. Surgical reconstruction aims to improve hearing while forming an open and infection-free ear canal, but there is a risk of complications so patient selection must be careful. If the anatomy does not support reconstruction, a bone conduction system can be

used that conducts vibrations through the skull bone directly to the cochlea bypassing the middle ear. In children <5 years old, a non-surgical bone conduction system is used, while after that age a bone-anchored hearing system (BAHS) or middle ear implant can be considered according to clinical conditions and specialist evaluation (Kempfle & Remenschneider, 2024; Silva et al., 2023).

Hearing rehabilitation.

In children with persistent hearing loss that has an impact on communication, rehabilitation needs to be considered, both in the form of hearing aids and implanted systems, according to the type and degree of the disorder as well as the anatomical condition of the ear. This intervention should be accompanied by audiological monitoring and evaluation of speech and language development so that the improvement of listening skills is followed by optimal communication development (James et al., 2025).

Table 1. Summary of recommended management of conductive hearing loss in children by underlying condition

Condition	Recommended approach	Indications and Cautions	Source
Cerumen impaction or foreign body	Safe removal of the blockage, appropriate to the condition of the ear canal	Reversible cause of CHL	(Silva et al., 2023)
Acute otitis media	Analgesics and antipyretics; antibiotics when clinically indicated	Tympanostomy tubes not routine; consider only for serious complications or other specific indications	(Silva et al., 2023)
OME without specific risk factors	Watchful waiting with reassessment at about 3 months (effusion, hearing loss, tympanic membrane/middle ear changes)	Antibiotics, systemic and intranasal corticosteroids, antihistamines, and decongestants not routinely recommended; intranasal corticosteroids only if allergic rhinitis is present	(Bloom & Brodsky, 2024; Silva et al., 2023)
Persistent OME with hearing loss or functional impact	Tympanostomy tube insertion	Bilateral OME ≥3 months with documented hearing loss; unilateral or bilateral OME ≥3 months with balance problems, behavioral problems, declining school performance, or reduced quality of life; OME in children at high risk of language development problems. Periodic follow-up after insertion	(Bloom & Brodsky, 2024)
OME with adenoid involvement	Adenoidectomy, concurrent with tube insertion in selected cases	Age ≥4 years in selected cases; age <4 years only with other indications (chronic adenoiditis, nasal obstruction from adenoid hypertrophy)	(Bloom & Brodsky, 2024)
Tympanic membrane perforation in	Tympanoplasty, with or without ossicular reconstruction	Aims to eradicate infection, close the perforation, and improve hearing; success	(Silva et al., 2023)

chronic otitis media		depends on ear condition, Eustachian tube function, contralateral ear, perforation location, and technique; age alone should not delay surgery	
Congenital ear malformation	Surgical reconstruction when anatomy allows	Aims to improve hearing and create an open, infection-free canal; careful patient selection due to complication risk	(Kempfle & Remenschneider, 2024; Silva et al., 2023)
Congenital malformation not suitable for reconstruction	Bone conduction system	Non-surgical device in children <5 years; bone-anchored hearing system or middle ear implant may be considered later, per clinical condition and specialist evaluation	(Kempfle & Remenschneider, 2024; Silva et al., 2023)
Persistent CHL affecting communication	Hearing rehabilitation (hearing aids or implanted systems)	Choice by type and degree of loss and ear anatomy; requires audiological monitoring and assessment of speech and language development	(James et al., 2025)

Complications

Impact on speech and language development

CHL reduces the sound that reaches the inner ear, which commonly occurs in children with otitis media with effusion or recurrent otitis media. Reduced quality of auditory input can affect speech perception through changes in sound coding, perceptual strategies, and auditory processing. Research shows that children with hearing loss due to otitis media have poorer speech perception, both in quiet and noisy conditions compared with children without otitis media (Collier, 2025; Conlon et al., 2025).

The quality of auditory signals also plays a role in the development of speech production. Degraded auditory input can affect the acoustic pattern of speech sound production in children. In addition, a study found an association between reduced auditory sensitivity and speech sound disorder (Gyawali et al., 2024). This condition can be explained through the role of auditory feedback, which is the ability of children to hear and evaluate their own speech production during the speech development process. Impaired quality of auditory input can cause children to obtain suboptimal information about speech sound characteristics so that it has the potential to affect the accuracy of sound production (Conlon et al., 2025).

Impact on development, learning, and psychosocial

Hearing loss that is not addressed early on can affect speech and language, cognitive function, behavior, and communication skills. Difficulty receiving auditory information inhibits children from following instructions and learning processes, potentially affecting academic achievement. In addition, it can cause emotional and behavioral problems, difficulty interacting, social isolation, and loneliness (Collier, 2025; de Jong et al., 2024; James et al., 2025).

Damage to the tympanic membrane and ossicles

In CHL caused by chronic or recurrent otitis media, long-lasting inflammation can cause progressive damage to the structure of the middle ear. These changes can be in the form of myringosclerosis or tympanosclerosis, tympanic membrane retraction, and tympanic

membrane perforation. Tympanosclerosis involving the ossicular chain can interfere with sound transmission and cause or aggravate conductive hearing loss. Damage or discontinuity of the ossicles can also cause more severe sound transmission disorders. Tympanic membrane perforation can also occur spontaneously in acute otitis media. About 15–20% of children with acute otitis media experience otorrhea due to spontaneous perforation of the tympanic membrane. Children with acute otitis media accompanied by otorrhea are also reported to have a higher risk of experiencing a recurrence of otitis media and hearing loss within a few months after the acute episode (Hullegie et al., 2021).

Prognosis

The prognosis of CHL in children depends on the etiology, the degree and duration of hearing loss, and the presence or absence of structural damage to the middle ear. In reversible conditions such as otitis media with effusion (OME), the hearing prognosis is generally good because spontaneous resolution is common. A systematic review of children under 12 years reported resolution of OME-related hearing loss in about 50% by 3 months, 60% by 6 months, and 61-77% by 12 months. In chronic OME present for more than 12 months before follow-up, resolution was markedly lower (7% at 1 month, 12% at 6 months, and 6% at 12 months), and only 42% of children with primary ciliary dyskinesia had resolved by 57 months. For OME of varying duration causing hearing loss, resolution ranged from 23-55% at 3 months, 20-50% at 6 months, 31% at 9 months, and 21-93% at 12 months. These figures come from a small number of heterogeneous studies (13 studies, 24-639 children) that differed in population and in the definition of resolution, and meta-analysis was not possible. Figures for different time points therefore cannot be read as a single cumulative trajectory, and the prognosis cannot be determined from one number alone; it must take each child's clinical condition into account (Paing et al., 2025).

In CHL due to structural damage to the middle ear, such as tympanic membrane perforation, tympanosclerosis, ossicular discontinuity, chronic otitis media, or cholesteatoma, the prognosis depends on the degree of damage and the success of treating the cause. Hearing loss can be permanent when the damage cannot be repaired, while appropriate cause repair and reconstruction can improve hearing function. Overall, the prognosis of CHL in children is good when it is caused by reversible conditions and treated appropriately, especially non-chronic OMEs, but more caution is needed for long-lasting, recurrent CHL, or CHL caused by chronic disease and structural damage. Timely detection and monitoring of hearing is important to prevent persistent hearing impairment and minimize its impact on the child's speech, language, learning, and social functioning (Paing et al., 2025).

Limitations

This is a narrative review in which no formal risk-of-bias assessment was performed, so selection bias cannot be excluded. Several statements rely on secondary or reference sources (StatPearls, a textbook, and a government press release), and some prevalence figures derive from single studies in specific settings, such as a hospital-based sample in Iraq and a low-income community in South Africa, which limits their generalizability to Indonesian children. Heterogeneity in the definitions of hearing loss thresholds and of resolution limits the comparison of prevalence and prognosis data across studies. The review was restricted to English- and Indonesian-language publications from 2016 to 2026 and to the databases searched, so relevant earlier or non-indexed studies may have been missed. Finally, Indonesian data on pediatric CHL were limited among the sources reviewed, and recommendations drawn from international guidelines may need adaptation to local resources.

CONCLUSION

Conductive hearing loss (CHL) in children is a sound transmission disorder involving the outer ear and/or middle ear with relatively good sensorineural function. This condition is quite often found in children, especially due to otitis media with effusion and external ear abnormalities such as cerumen impaction. Risk factors include recurrent respiratory tract infections, Eustachian tube dysfunction, adenoid hypertrophy, limited access to health services, congenital disorders, and trauma or improper ear care habits.

The diagnosis of CHL in children requires a comprehensive approach through anamnesis, otoscopic examination, audiological evaluation, and supporting examinations as indicated. Pure-tone audiometry and tympanometry play an important role in determining the type of hearing loss and assessing the function of the middle ear, while imaging is used selectively for suspected structural abnormalities or complications. Management should be adjusted to the etiology, degree and duration of the disorder, as well as the child's clinical condition, ranging from observation of conditions that have the potential to experience spontaneous resolution to medical therapy, surgery, use of hearing aids, or bone conduction systems in certain cases.

In general, the prognosis of CHL in children is quite good, especially in reversible conditions such as OME that do not last long. However, persistent, recurrent, or structural damage to the middle ear can cause persistent hearing loss and have an impact on the development of speech, language, learning, and social function of children. Therefore, early detection, proper diagnosis, hearing monitoring, and management based on etiology are important components in preventing the long-term impact of CHL on children.

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