



# Chronic otitis media and subsequent hearing loss in children from the Himalayan region residing in Buddhist Monastic schools of Nepal

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## ABSTRACT

**Objectives:** The main objective of the study was to ascertain the prevalence of chronic otitis media and determine the corresponding hearing loss in children from Nepal's Himalayan region now residing in Buddhist Monastic schools of Nepal.

**Methods:** The study was conducted among children at Buddhist monastic school in different parts of Nepal. A total of 3174 children aged between 5 and 15 years, who were originally from the Himalayan region of Nepal and were currently residing in monastic schools, were screened for ear problems and hearing loss. They were examined by otoscope to diagnose chronic otitis media. Hearing was evaluated by pure tone audiometer, and 0.5–4 kHz air conduction hearing threshold was measured and documented.

**Results:** Of the total of 3174 children who were screened for ear diseases and hearing loss, monks constituted 76.21% (n = 2419) and Nuns 23.78% (n = 755). Chronic otitis media was the most common otoscopic finding during the screening, and it affected a total of 344 (10.83%) children. Out of these 344, hearing loss of varying degrees was observed in 5.42% (n = 172) children.

**Conclusion:** There is high prevalence of chronic otitis media in children belonging to the Himalayan region of Nepal, and it is the main cause of avoidable hearing loss. Timely diagnosis and treatment of chronic otitis media could prevent unnecessary hearing loss in these children.

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## 1. Introduction

Chronic otitis media (COM) is a permanent abnormality of the tympanic membrane following a long-standing middle ear infection as a result of acute otitis media (AOM), otitis media with effusion (OME), or persistent negative pressure of the middle ear for a long time (Browning et al., 2008). Tympanic perforations that continue to discharge for periods between 6 weeks and 3 months (Goycoolea et al., 1991), despite medical treatment, have been recognized as chronic otitis media, whereas the World Health Organization (WHO) definition requires only 2 weeks of continuous ear discharge (World Health Organization, 2004).

Hearing loss (HL) is one of the main sequelae of chronic otitis media, but potentially life threatening complications such as brain abscess and facial nerve paralysis still exist (Sharma et al., 2015). A particular problem in developing countries is that patients with the disease often present at a late stage, and this leads to higher morbidity and mortality (Dubey and Larawin, 2007). The size and site of tympanic membrane perforation and the duration of ear discharge affect the magnitude of hearing loss (Maharjan et al., 2009).

Otitis media is common in developing countries, especially within populations that fall in the low socio-economic strata. According to WHO, 60% of hearing loss in children below 15 years of age is due to otitis media. The prevalence of otitis media is much higher in developing countries (75%) than in developed countries (49%). COM accounts for hearing loss in 31% of cases (World Health Organization, 2020a). 466 million people (6.1% of the world's population) are estimated to be suffering from hearing loss, of which 34 million are children (World Health Organization, 2020b). In Nepal, 16.6% of the population suffers from hearing loss and 7.4%

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have been found to have middle ear pathology. In children, however, 55.2% of the hearing loss has been found to be due to otitis media (Little et al., 1993).

Buddhist monastic schools are traditional schools that have been set up in Buddhist monasteries in Nepal and India since around the middle of the first millennium BC (Tinley and Sangye, 1993). There are many monastic schools in Nepal today, and these are spread all over the country. Children who attend these monastic schools are predominantly of Tibetan origin, and they hail either from the Himalayan region of Nepal or from the neighboring regions of Tibet. The high altitude of the sparsely populated Himalayan region of Nepal renders it very remote. There are hardly any roads in the region, and accessibility is largely restricted to walking trails through difficult terrain. Access to medical care for children from this mountainous region is limited. In addition to the remote geographical location, very limited health-care facilities, a general lack of awareness about diseases, and the deprived socio-economic status of the inhabitants, all contribute to this. Discharging ears are very often neglected or regarded as normal amongst children of rural Nepal. Crowded living quarters, inadequate nutrition and poor hygiene are associated with the high prevalence of otitis media (Booth, 1997). The runny ear is the heritage of the poor, and poverty is an important risk factor (Bluestone and Klein, 2001). The main objective of this study is to find out the prevalence of chronic otitis media and the corresponding hearing loss in children hailing from the remote, mountainous Himalayan region of Nepal who reside presently in Buddhist monastic schools.

**2. Materials and methods**

This is a cross-sectional study conducted at 53 Buddhist monastic schools in different parts of Nepal over a three year period from 2017 to 2019. A total of 3174 young monks and nuns aged 5–15 years were included in the study, of which 755 were nuns and 2419 monks. All these children were of Tibetan origin, came from the Himalayan region of Nepal, and were studying in Buddhist monastic schools.

Monasteries that consented in writing to conduct the program were included in the study. The written consents were usually provided by the chief monk or nun of the monastery. Only children diagnosed with chronic otitis media were included in the study. Children with acute otitis media and otitis media with effusion were excluded.

The pathological definition specified in Browning's classification is used to define and classify chronic otitis media (Browning and Kerr, 2008). Active mucosal COM is defined as the presence of permanent defect of the pars tensa with inflamed and edematous middle ear mucosa and active ear discharge. Inactive mucosal COM is characterized by permanent defect of the pars tensa but no evidence of inflammation of middle ear mucosa. Active squamous COM is defined when in addition to active mucosal chronic otitis media there is a squamous epithelially lined pocket full of squamous epithelial and inflammatory debris. Inactive squamous COM is characterized by retraction of the pars tensa or pars flaccid where part of the retraction pocket is out of vision giving a chance to retain squamous epithelial debris. In healed COM, pars tensa and pars flaccid are intact and in normal position but abnormal in appearance due to scarring, thickening, chalk patches, tympanosclerotic plaques or healed perforations.

Two class rooms in each of the monastic schools were used for carrying out the study. Ear examination was carried out in one of the classrooms, and hearing evaluation was done in the other. After taking a brief history of the ear and hearing problems of each child, their ears were examined by a physician or an Ear Nose and Throat surgeon using Heine Mini 3000 otoscope. The otoscopic findings

were determined and documented. If wax was detected, it was removed only in those children who had a history of ear and hearing problems. In children who did not have a previous history of ear and hearing problems, wax was not removed and a four frequency pure tone audiometric test was carried out.

Hearing was evaluated in a separate quiet room by an audio-technician using Arphi Proton SX3 pure tone audiometer. The noise level in the room was calculated by the examiners themselves, who had normal hearing. The room was considered a quiet room if the examiner could hear 10 dB HL sound at 1000 Hz, 2000 Hz and 4000 Hz frequency. A pure tone air-conduction threshold of 0.5–4 kHz frequency was determined and documented. Pure tone average of four frequencies of 0.5, 1, 2, and 4 kHz were recorded. Hearing loss was defined as a pure tone average of greater than 25 dB HL of the four frequencies in one or both ears. In children with average loss of greater than 25 dB HL, a complete audiogram of both the air conduction and the bone conduction was carried out and recorded. Hearing loss was classified according to the WHO classification: Mild HL 26–40 dB HL, Moderate HL 41–60 dB HL, Severe HL 61–80 dB HL and Profound HL ≥ 81 dB HL. All the data was documented and analyzed.

**3. Results**

A total of 3174 young monks and nuns living in 53 Buddhist monastic schools in different parts of Nepal were screened for ear and hearing problems. Of the children screened, 2391 were in the 11–15 age group and 783 in the 5–10 age group. 2419 (76.21%) of those screened were male, and 755 (23.79%) female.

Chronic otitis media was diagnosed in 344 (10.83%) children, with consequent hearing loss observed in 172 children with COM. The type of chronic otitis media most common found was healed COM, which was observed in 135 (39.25%) children. This was followed by active mucosal COM that was documented in 126 (36.63%) children. The breakup of the different types of COM found in the study is summarized in Table 1.

Chronic otitis media was observed more frequently in male children aged 11–15 years. Male children constituted 83.72% of those diagnosed with COM, and 77.04% of them were older children aged between 11 and 15 years.

All the children with COM had similar socio-economic backgrounds. They all belonged to minority ethnic groups that resided in remote high-altitude villages. The primary source of livelihood of these communities was agriculture. The rate and level of literacy was low, as was the level of income. Other relevant socio-demographic and associated factors have been summarized in Table 2.

Hearing loss was observed in 221 (6.96%) children. The main cause of hearing loss was COM, which was found in 172 (5.42%) children. Other causes were OME, which was found in 9 (0.28%), wax in 30 (0.95%) and sensori-neural hearing loss (SNHL) in 10 (0.31%) children. Hearing loss was most commonly associated with active mucosal COM and least commonly with healed COM. Out of

**Table 1**  
Types of chronic otitis media and the number of children affected.

Chronic Otitis Media (COM)	Number of Children Affected (%)
Active Mucosal	126 (36.63%)
Inactive Mucosal	64 (18.60%)
Active Squamous	4 (1.16%)
Inactive Squamous	15 (4.36%)
Healed	135 (39.25%)
Total	344

Browning's Classification (Browning et al., 2008).

**Table 2**  
Socio-demographic characteristics and other associated factors of children with chronic otitis media.

Characteristics	Category	Number (n)	Percentage (%)
Sex	Male	288	83.72
	Female	56	16.28
Age	5–10 year old	79	22.96
	11–15 year old	265	77.04
Side	Right ear	127	36.92
	Left ear	114	33.14
	Both ears	103	29.94
Family size	1-5 members	93	27.03
	6-10 members	238	69.19
	>10 members	13	3.78
Visit to health worker for ear and hearing problem	Yes	101	29.36
	No	243	70.64
History of instillation of oil/other homemade liquids in ears	Yes	151	43.90
	No	193	56.10
Habit of ear picking	Yes	336	97.68
	No	8	2.32
Exposure to passive smoke	Yes	168	48.83
	No	176	51.17
Duration of ear and hearing problems	1–5 years	157	45.63
	6–10 years	33	9.6
	>10 years	100	29.06
	Not known	54	15.69
Family history of ear and hearing problem	Yes	60	17.44
	No	284	82.55

the 126 children with active mucosal COM, as many as 120 had hearing loss. In contrast, only 8 children out of the 135 observed with healed COM were found to have associated hearing loss. A majority of the children with COM (n = 169) were suffering from conductive hearing loss (CHL). Only three children with active mucosal COM had mixed hearing loss. Bilateral hearing loss was found in 46 children, right side hearing loss in 72 children and left side in 54 children. A detailed break-up of the associated degree of hearing loss with each type of otitis media is at [Table 3](#).

#### 4. Discussion

Several studies on ear and hearing problems in children of different races, ethnic groups and socio-economic strata have been published. However, very few studies on the ear-related problems of children from the Himalayan regions have been conducted. This is one of the first studies of its kind done among ethnic Tibetan children of Nepal. The Tibetan children included in this study hail from the Himalayan region of Nepal and are now living in residential Buddhist monastic schools. The Tibetan people are an East

**Table 3**  
Different types of chronic otitis media and subsequent hearing loss.

Age Distribution	Number of Children with COM (%)	Type of COM	Number of children with Different Type of COM	Type and Degree of Hearing Loss	Total Number of Children	Number of Children with Hearing Loss >25 dB HL	
5–10 years old	79 (22.96%)	Active Mucosal	35	Mild CHL	28	28	
				Moderate CHL	2	2	
					<25 dB HL	5	
		Inactive Mucosal	9	Mild CHL	5	5	
				<25 dB HL	4		
		Active Squamous	1	Mild CHL	1	1	
		Inactive Squamous	3	Mild CHL	2	2	
				<25 dB HL	1		
		Healed	31	Mild CHL	3	3	
	<25 dB HL		28				
11–15 years old	265 (77.04%)	Active Mucosal	91	Mild CHL	66	66	
				Moderate CHL	20	20	
					Severe CHL	1	1
					Moderate Mixed HL	2	2
					Severe Mixed HL	1	1
					<25 dB HL	1	
		Inactive Mucosal	55	Mild CHL	27	27	
				Moderate CHL	1	1	
					<25 dB HL	27	
		Active Squamous	3	Mild CHL	3	3	
		Inactive Squamous	12	Mild CHL	3	3	
				Moderate CHL	2	2	
					<25 dB HL	7	
		Healed	104	Mild CHL	5	5	
				<25 dB HL	99		
Total	344		344		172		

Asian ethnic group native to the Himalayan regions of Nepal, India and China.

The rugged and mountainous geographical terrain of the Himalayan region has resulted in severe limits to road access, especially in Nepal. This has led to the relative isolation of the Himalayan region from the rest of Nepal. It is primarily due to this reason that till date only one study, that of Bagshaw et al. who studied the prevalence of OME in Tibetan refugee children living in refugee camps, has been published. This study, however, did not delve specifically into COM (Bagshaw et al., 2011).

In our study, the overall prevalence of chronic otitis media was found to be 10.83% (n = 344), with male subjects accounting for 83.72% (n = 288) and female subjects 16.27% (n = 56) of the cases. The larger number of monasteries as compared to nunneries in Nepal meant that more monks than nuns were examined and this found reflection in the results of the study.

Among other similar studies done in Nepal, Mishra et al. reported a otitis media prevalence rate of 12.13% in a study carried out on school-aged Bhutanese refugees in Nepal (Mishra et al., 2002). A similar prevalence of otitis media was also reported by Maharjan et al. 13.2% (Maharjan et al., 2006). The higher prevalence rate in these studies could be because they included all types of otitis media and not just COM. Other studies by Adhikari et al. reported lower prevalence rates of 5.0% and 5.7% (Adhikari et al., 2009) (Adhikari et al., 2008). These lower prevalence rates could be on account of the fact that the studies were conducted in children studying in private schools in urban areas of Nepal. These children constitute the most privileged group in Nepal, whereas children attending government schools and Buddhist monastic schools are largely from economically deprived backgrounds. Other studies in Nepalese populations have reported prevalence rates of 8.18% (Thakur et al., 2017) and 9.8% (Byanju and Saha, 2017).

Studies done in other Asian countries have reported COM prevalence rates between 6% and 7.59% (Rupa et al., 1999) (Kamal et al., 2004) (Mahfuz et al., 2016). A review article by De Antonio et al. reported that otitis media was prevalent and was a burden across 90 developing countries, including Nigeria 9.2%, Egypt 10%, China 6.7%, India 9.2% and Iran 9.1% (Deantonio et al., 2016).

Chronic otitis media is considered to be one of the main causes of hearing loss in developing countries. Our study found that COM alone was responsible for 77.82% of all the cases of hearing loss. Conductive hearing loss, which was the most commonly observed, was seen in 169 children, and mixed hearing loss was seen in only 3 children. Muftah reported a COM prevalence rate of 7.4%, and the association of COM with hearing loss in 66.7% of cases (Muftah et al., 2015). Similar results were reported by Gupta et al. (Gupta and Mittal, 2016). The literature review article by Leach et al. concluded that otitis media and CHL were common amongst disadvantaged populations (Leach et al., 2020). Godinho et al. found statistically significant associations between COM and hearing loss (Godinho et al., 2001). Adoga et al. found that the entire 100% of children with otitis media had hearing loss, and that due to the costs involved in treatment, it had a higher prevalence in people from economically weaker sections of society (Adoga et al., 2010).

The children included in our study share some common socio-demographic characteristics such as belonging to rural, agricultural, ethnic minority communities that had lower socio-economic status, poor literacy rates and limited access to health care facilities. These children also have other risk factors associated with otitis media such as overcrowded living quarters, large family size, ignorance about diseases, poor nutrition and low rates of immunization. Studies done in other underprivileged communities have demonstrated a strong association between increased prevalence of otitis media and these risk factors.

Baerg et al. in their review of literature on the disparity in the

prevalence of otitis media amongst children of different ethnic groups such as African Americans and Aboriginal Australians mentioned that other than shared risk factors, race/ethnicity could also be a risk factor for developing otitis media (Baerg et al., 2017). Similar findings were reported by Vakharia (Vakharia et al., 2010) and Coleman et al. (Coleman et al., 1186).

Studies done on the Greenlandic population found that otitis media and hearing loss were more prevalent in Greenlandic children (Pedersen and Zachau-Christiansen, 1986) (Jensen et al., 1530) (Anvstorp et al., 2016). Bowd (2004) and Ayukawa et al., 2004 reported that among the Inuit in northern Quebec, COM was the chief cause of hearing loss at 28% and 16.9% respectively. The associated factors they mentioned included genetics, environment and socio-economic status. In addition, they also pointed out the remoteness of this ethnic group when compared with the rest of the Canadian population.

Given the high prevalence of COM that our study found, the susceptibility to COM of the ethnic Tibetan population living in the Himalayan region of Nepal requires further investigation. This population, just like the Greenlandic and Inuit populations, is largely isolated in a remote geographical space. It would, therefore, be worthwhile to expand on the findings of our study in future studies that include and examine the association of genetic and other factors to COM in the Tibetan population of Nepal.

## 5. Conclusion

In Nepal there is a high prevalence of chronic otitis media among children of the Himalayan region. The main cause of hearing loss among these children is chronic otitis media. Timely diagnosis and treatment of chronic otitis media and awareness about the disease could prevent avoidable hearing loss in these children.

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## Declaration of competing interest

None.

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