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Hearing Loss and the Elderly - A Primer

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Abstract
Hearing impairment, is very common among the elderly. In many of them it can be so disabling that it affects normal day to day activities, impairs communication and puts them at risk of social isolation and psychological problems. Fortunately, while it cannot be reversed most times, hearing loss in the elderly can be so well managed that the elderly can enjoy a good quality of life. This article is a review on presbycusis (age-related hearing loss), the physiology and management as a means of sensitizing medical personnel and those working with the elderly.

1. Introduction

Hearing impairment affects one in five adults worldwide(Koester et al 2002) and it is one of the most prevalent chronic conditions among the elderly. Clinically significant hearing loss is the third most common condition among older adults. It is present in about 25%–40% of people over 65 years of age, 50% of those over 75, and 80% of those over 85 years (Gussekloo et al) [3]. According to the World Health Organization , there are 164.5 million persons of above 65 years with disabling hearing loss. This is approximately one-third of persons above 65 years. Also, it is estimated that the population of persons above 65 is growing at a faster rate than the general world population. World population will grow from 6,853 million people to 7,770 million in the period 2010-2020 (growth 11%) while the population of people aged 65 years or more will grow from 626 million in 2010 to 855 million in 2019, representing a growth of 37% (WHO, 2012). Thus it is expected that the overall proportion of people aged over 65 years with hearing loss will increase over time.

Hearing loss is invisible and almost always painless. There are no physical warning signs, except in some cases whereby there may be tinnitus. But, the real reason hearing loss "sneaks" up on elderly people is that the change is so gradual. Most hearing loss in the elderly develops over a period of 25 to 30 years. By age 50 or 60, there can be enough deterioration to interfere with conversation. Loss of hearing can damage one's mental processing, emotional and mental health, educational and occupational prospects. Thus hearing loss, especially in older adults, tends to lead to cognitive decline, social isolation, depression, loss of self-esteem, withdrawal from daily activities, and strained interpersonal relationships. It has negative effects on the day to day functioning and socializing.

Hearing loss could be a consequence of sensorineural and or conductive malfunctions of the ear. The impairment may be congenital (from birth) or acquired (from disease). Hearing loss may be pre-lingual (occurring prior to speech and language acquisition) or post-lingual(occurring after the acquisition of speech and language(ASHA ,2004). Hearing loss can also be classified based on which portions of the hearing system (auditory system) are affected. When the nervous system is affected, it is referred to as sensorineural hearing loss. When the portions of the ear that are responsible for transmitting the sound to the nerves are affected, it is referred to as conductive hearing loss. Conditions affecting the cochlea, eighth cranial nerve, or brain are the causes of sensorineural hearing loss. Examples of these are Meniere's disease, nerve injury from syphilis, nerve tumors, noise exposure, head injuries and drug toxicity. Conditions that affect the ear canal, eardrum (tympanic membrane), and middle ear could lead to conductive hearing loss. These include: ear wax impaction, otitis media, otitis externa, tympanic membrane perforation, eustachian tube dysfunction, otosclerosis, middle ear barotrauma and foreign body impaction (William, 2012).

The management of hearing loss depends on its cause. Usually, conductive hearing loss can be effectively treated and cured by treating the disease of the outer or middle ear that is causing it. For example, ear wax can be syringed and ear infection can be treated with medications. Occasionally surgical procedures are necessary to treat conductive hearing loss. Sensorineural hearing loss, on the other hand, is not as easily remedied. Being as a result of damage to the nervous system, much sensorineural hearing loss cannot be cured. However, much sensorineural hearing loss can be effectively managed. Even when hearing cannot be restored, an individual with hearing loss can be adequately rehabilitated for a maximally productive life. The vast majority of elderly people with hearing loss suffer from presbyacusis which causes sensorineural hearing loss. Fortunately, excellent results can be achieved with rehabilitation using available hearing aid technology.

2. Old Age and the Elderly

Ageing is a universal phenomenon and old age (generally determined by the chronological age), is a challenge to everyone who reaches it irrespective of occupation, skill or learning (Tungdim et al, 2002). According to World Health Organization, age 65 is regarded as the margin between older people and middle age and about 5% of the

population falls in this category in Nigeria (Ogungbo et al, 2003). An elderly person is someone of chronological age of 65 and above. Those from 65 years to 74 years old are referred to "early elderly" while those over 75 years old are referred to as "late elderly" (Hajimeet al, 2006) . In sub-Saharan Africa, the elderly constitute 4.7% of the population while in developed countries, people of this age group constitute 11% - 18% of the population(Victoria et al, 2007).

3. Auditory Degeneration with Ageing

The human auditory system channels and transduces the sound waves into electrophysiological signals which are then localized and interpreted by the brain. Degenerative changes due to ageing can affect almost any stage of this process of conversion of sound stimuli to brain perception. The site of degeneration in this pathway decides the impact on the type and severity of hearing loss (Chisolm et al, 2003). With ageing, various changes in the conductive hearing apparatus have been described. These changes include collapse of the cartilaginous external auditory canal (Chandler, 1964), and stiffening of the tympanic membrane (Rosenwasser, 1964) and ossicular chain (Belal,1975). The net effect of these alterations on the auditory threshold is however minor and does not contribute significantly to the hearing deficit in the aged (Chisolm et al, 2003).

The cochlea is the site of conversion of mechanical energy into electrophysiological signal. The hair cells within the cochlea are generated within the first trimester of development and are expected to survive for the lifetime of the person. Regeneration does not occur after the loss of hair cells, and as there is little redundancy with the cochlea, with each region transducing a particular frequency of sound, it follows that the loss of any of this small population of cells will have a noticeable effect on hearing (Howarth & Shone, 2006). The number of functional neurons in the cochlea nuclei and auditory brain centres decrease with ageing due to the reduction in the neuronal size and certain neurochemical alterations. This loss of neural input from the impaired peripheral auditory system contributes partly to the decline in the functioning of the central auditory system.

A variety of cochlea lesions have been described as part of age related hearing loss. When considered separately, each of these lesions gives a different clinical and audiological picture. However, a combination of these lesions in the ageing ears result in bilateral sensorineural hearing loss (Schuknecht & Gacek, 1993). It is this clinical picture of a gradually, progressive, bilaterally and symmetrical hearing loss associated with age that has been termed presbyacusis.

4. Assessment

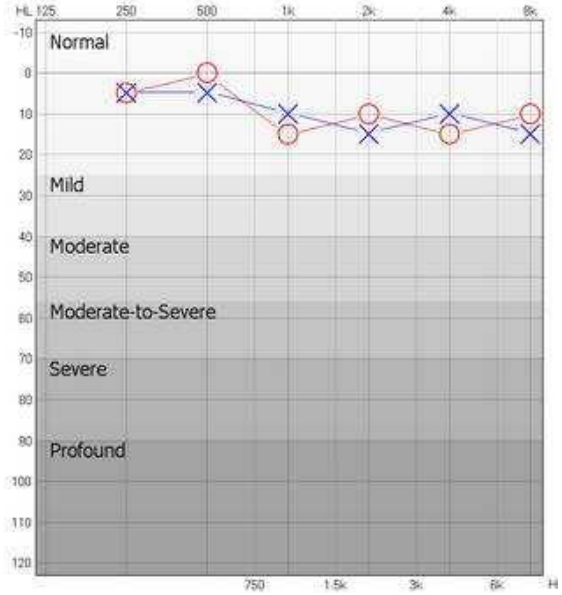
Assessment of hearing can be done in a variety of ways but the most commonly used test when the subject can cooperate is Pure tone audiometry. This is a method of measuring hearing sensitivity across a range of frequencies. The test is used to assess the degree, type and pattern of hearing loss for each ear separately. The test is done using an electronic device called audiometer which produces pure tones. The intensity of these tones or frequencies can be adjusted according to the threshold of sound perception of the patient. For each frequency, a pure tone signal is presented to the ear and the intensity of the signal is varied until the level at which the participant is just able to perceive the tone is identified. This is the pure tone threshold for that frequency. A higher threshold indicates that more intense signal is needed to perceive the tone and signifies greater hearing impairment. In age related hearing loss the threshold for the higher frequencies is usually increased.

The amount of intensity (measured in decibels) that has to be raised above the normal level is a measure of the degree of hearing impairment at the frequency. Pure tone test results are recorded on a graph commonly referred to as audiogram. The audiogram is simply a graph of frequency charted against intensity. The frequency scale along the abscissa is measured in hertz (Hz) while the intensity scale which is on the ordinate of the graph is measured in decibels (dB). Even though young normal adults can hear frequencies as low as 20 Hz to as high as 20,000 Hz, the frequencies used in clinical measurement include only those from 250 Hz to 8000 Hz (Miller et al, 1993).

Normal Audiogram

A normal audiogram indicates that a person needs the same amount of loudness to hear at low, middle, or high frequencies. An audiogram with a normal configuration is an audiogram that displays thresholds lower than or equal to 25dB

Figure 1: Normal Audiogram (Chime Social Enterprise, 2013)



Sloping Audiogram

A sloping audiogram indicates that a patient has better hearing in the low frequencies. An audiogram with a sloping configuration displays a generally downward trend in thresholds. That is, thresholds are low in the low frequencies but become higher in the high frequencies. This is the type of audiogram found in presbyacusis, although it can also be found in other conditions including noise-induced hearing loss and sudden hearing loss

Figure 2 : Sloping Audiogram (chimehealth.co,uk, 2013)

Degree of Hearing Loss

The World Health Organization in 1980 recommends the following classification on the basis of pure tone audiogram taking the average of the thresholds of hearing for frequencies of 500Hz, 1000Hz and 2000Hz (Dhingra, 2004).

Degree of Hearing Loss

Degree of Hearing Loss	**Pure tone Average**
Normal Hearing	0-25dB
Mild hearing loss	26-40dB
Moderate hearing loss	41-55dB
Moderately-severe hearing loss	56-70dB
Severe hearing loss	71-91dB
Profound hearing loss	91dB and above

5. Management Of Hearing Loss among the Elderly

The management of hearing loss in the elderly is multidisciplinary. After ear and systemic pathologies that may cause or contribute to hearing loss are ruled out, a diagnosis of presbyacusis is made with the audiometric demonstration of the classical downward-sloping high frequency sensorineural hearing loss (See Figure 2). Subsequently, depending on the degree of hearing loss and the perceived need for amplification by the patient, the patient is counseled and may be fitted with a hearing aid after an assessment has proven the aid useful. It is also important to note the following in approaching and managing the patient.

Communication Courtesy - Those communicating with older patients should take care to speak face-to-face in a clear and unhurried manner. The older people themselves should be encouraged to voice difficulties with misheard phrases and ask for clarification. If possible, there should be a clear explanation of the problem to family and friends.

The following table shows the difficulty with speech associated with the various degrees of hearing loss

Table 1 - Hearing Loss and Difficulty in Hearing Speech

Degree of Loss	**Difficulty with Perception of** Speech
None	No significant difficulty with faint speech
Mild	Difficulty with faint speech
Moderate	Frequent difficulty with normal speech
Moderately-severe	Frequent difficulty even with loud speech
Severe	Can perceive only shouted or amplified speech
Profound	Usually cannot perceive even amplified speech

Reassurance and Education - Patients often find it very reassuring to know that they will not go completely deaf. It has been shown that proactive communication education programmes have an important role to play in the management of these patients.

Amplification- Although modern hearing aids are excellent, they cannot make hearing fully normal. Modern hearing aids are a lot better in quality and also a lot smaller than the older ones and they are available in different styles. The first wearable electronic hearing aids were body-worn hearing aids which are now seldomly dispensed. Others styles include Behind The Ear (good for moderate to profound hearing loss), In The Ear (for mild to severe hearing loss), In The Canal (for mild to moderate hearing loss) and Completely In The Canal (for mild to moderate hearing loss). It must however be stressed that it takes time to get used to wearing a hearing aid. After several years of dulled hearing it may take a while to become used to the amplified sound. with time however, most people get used to hearing aids and find them of great benefit.

Speech Reading - Use of facial visual cues and study of lip movements aids understanding of speech.

Auditory training - Structured learning helps to recognize speech sounds and key words with amplification. Auditory training means the cultivation of sound perception and the training of the brain to associate language ideas with the arbitrary sequences of sound, known as words (Dhingra, 2004) .

Follow up: Follow up is necessary to ensure appropriateness and adequacy of interventions and to provide support to the patient

6. Conclusion

Presbyacusis is a condition that can be disabling and distressing. There is a need for all who have a part to play in the care of the elderly to have a good understanding of the condition and its management in order to be able to deliver care of the highest quality to these older people who may also be suffering from other conditions that are also due to ageing. There is also a need for continuous public health education on the need for early presentation and the need to support the elderly who suffer from presbyacusis and also a need for continuing medical education for the general practitioner to facilitate early referral of patients.

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