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Impact of environmental hazards on sense of hearing - A conceptual study

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ABSTRACT

The high burden of deafness globally and in India is largely preventable and avoidable. The prevalence of deafness in Southeast Asia ranges from 4.6% to 8.8%. In India, 63 million people (6.3%) suffer from significant auditory loss. In Ayurveda we get many references of *Karna*, *Karna* is one among *Pancha Jnanendriya* and predominance of *Akasha Mahabhuta*, perceives *Shabda*. *Asatmyendriyartha Samyoga* of *Indriya* i.e. *Ayoga*, *Atiyoga* and *Mithya Yoga* of *Srotrendriya* causes *Roga*. *Karna Shoola*, *Karna Nada*, *Karna Kshweda*, *Badhiryam* are some diseases caused by *Asatmyendriyartha Samyoga*. Ayurvedic system of medicine gives more importance to preventive measures. Identifying (early screening) the *Nidana* and *Nidana Parivarjana* plays the key role in preventing most of the *Karna Rogas*. In all *Karna Rogas Vata Prakopa* to be the chief cause, hence *Ghrutapana* is told as *Rasayana*.

Key words: *Karna, Pancha Jnanendriya, Asatmyendriyartha Samyoga, Karna Roga.*

INTRODUCTION

Ear is the organ of hearing and balance. Ears are the organs that process sounds, enabling the brain to interpret what individual is hearing. The ear is divided into three parts mainly - Outer ear, middle ear, inner ear. Each of these has unique function in the process of hearing. In Simple terms, the outer and middle ear amplify the sound signals and inner ear converts this sound signals into an electrical impulse that is transmitted to the brain. This process also produces a frequency, pitch and intensity analysis of the sound signals. Sound is complex mixture of pressure variations and travel invisible waves through air. When these sound waves travel down the canal to the eardrum, causes it to vibrate. The vibrations are transmitted by the ossicles (malleus, incus and stapes) with in ear to cochlea, causing movement of fluid and sensory cells (hair cells) within cochlea. The sensory cells convert the vibrations into electrical nerve signals that travel along the auditory nerve to the brain. The brain then interprets these signals as sounds that can be recognized and understood.[1]

Environmental pollution which can cause hearing impairment.

1. Air pollution
2. Water pollution
3. Noise pollution
4. Radiation pollution

Effect of air pollution on sense of hearing

Air pollution is defined as presence of toxic chemicals or compounds (ammonia, carbon monoxide, sulfur dioxide, nitrous oxides, methane, chlorofluorocarbons etc.) in the air, at levels that pose a health risk. Some of the important sources of air pollution:

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- Combustion: Burning of gas, coal, oil, fuel etc.
- Decomposition: Decomposition or organic matter.
- Automobile and industries: Traffic, manufacture process which produce dust, fumes, vapor and gases.

URI (upper respiratory infection) is usually caused by air pollution.

Acute otitis media arises as a complication of a preceding URI. The secretions and inflammation due to URI causes relative occlusion of eustachian tubes leading to negative pressure in middle ear, which accelerates microbial growth leading to acute otitis media to hearing loss.

Effect of water pollution on sense of hearing

Water pollutants include contamination due to domestic waste, insecticides, herbicides, food processing waste, volatile organic compounds, heavy metals, chemical waste etc. Commonly seen ear diseases due to water pollution include otitis externa (swimmer's ear) - swimming in the contaminated water with elevated bacteria levels causes outer ear infection. Symptoms of otitis external are Pain in the ear, itching sensation inside ear, feeling that ear is blocked, reduced level of hearing, fever, fluid or pus draining from ear.

Effect of noise pollution on sense of hearing

A sound, especially one that is loud or unpleasant or that causes disturbance. Noise is typically measured with a sound pressure meter in decibel dB (A) units of A scale. A sound begins to stress the auditory system when the sound level exceeds 75-85dB range. Noise pollution impacts millions of people can cause noise induced hearing loss or permanent hearing loss, when there is an impulse noise at very high level of around 130-140 dB or at chronic exposure equal to an average of 85 dB or high level for an 8 hrs period.

Source of noise pollution:

1. Indoor cause - Watching TV in high volume, listening music in loud sound, playing computer games with intense sound, using mobile for longer time etc.
2. Outdoor cause - Traffic, trains, airplane, loud speakers, industrial sounds, explosives- crackers, gun shoot etc.

Effects of noise on ears

- Excessive exposure to noise i.e. for long term, repeated exposure and a single exposure to extremely intense sound cause damage to the auditory system and resulting in hearing loss. The hearing loss is usually slow in onset but progresses relentlessly for as long as the exposure continues. Indeed the harmful effects may continue long after noise exposure has ceased and they are irreversible.
- The damage caused to the cochlea by loud sounds occurs by two means - Mechanical destruction: regular exposure to the loud sound causes the hair cells to lose their rigidity and thus their ability to work effectively. These changes occur over time until the sensory cells are eventually destroyed and are no longer able to carry out their function. Intense metabolic activity at cellular level - A higher level of energy is required by hair cells during periods of intense exposure to loud sounds. The consequent increased consumption of oxygen generates raised levels of free radicals in cochlea. The ear's anti oxidant defense mechanism is unable to cope with these levels and the free radicals causes' cell death.
- The physiological changes in the ear are reflected in the change in hearing sensitivity. Thus leading to hearing loss that can be temporary or permanent and usually bilateral.
- Noise induced hearing loss (NIHL): It is of three types Temporary threshold shift (TTS)- exposure to loud sounds for any length of time causes fatigue of ears sensory cells, resulting in hearing loss or tinnitus(ringing sensation in ear), Permanent threshold shift(PTS) - regular or prolonged noise exposure can cause gradual irreversible damage to sensory cells, leading to permanent threshold shift, Acoustic trauma- permanent damage to hearing can be caused by a

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single brief exposure to very intense sound (140-170 dB).

- Common features of Noise induced hearing loss (NIHL) : It is always sensorineural, it is nearly always bilateral and symmetric, it will not progress once noise exposure is stopped, the rate of hearing loss decreases as the threshold increases, higher frequencies(6000-3000Hz) are more affected then the lower frequencies(500-2000Hz), continuous noise is more dangerous than intermittent noise, maximum loss typically occur after 10-15 years of chronic exposure.[2]

Effect of radiation on sense of hearing

- Mobile phones transmit and receive signals using electromagnetic fields in the radiofrequency band. The global system for mobile communications (GSM) is currently the most widely used digital phone service operating at 900-1800 MHz frequency bands. Although the EMR emitted is with the accepted range causes cellular damage. The ear especially the inner ear, being the closest to the mobile phone, is the direct recipient of the EMR thus making it the most likely effected organ. The delicate hair cells in the organ of corti doesn't have regeneration property, thus damage are often permanent hearing loss. Therefore the ear is at risk of exposure of noise from mobile phone as well as the EMR emitted by the phone.
- Radiation induced hearing impairment - Repeated long or regular exposure to loud sounds causes permanent stiffness of inner ear muscle, thereby leading to temporary or permanent hearing loss. Prolonged use of mobile phone causes battery to heat up and this heat is transferred to inner ear and damages hair cells. Continuous exposure to radiations which are emitted by mobile has proven to damage hair cells leading to hearing loss.

Ayurvedic approach

- Ayurveda is the ancient science of life, and gives at most importance to sense organs (*Indriyas*). *Indriyas* are the medium through which we can sense the whole creation, and gives a wonderful explanation of perception of knowledge through *Indriya* or sense organs. We get many references of diseases that are caused due improper usage of sense organs (*Ayoga*, *Atiyoga* and *Mithya Yoga* of *Indriya*). All *Jnanendriya* i.e. sense organs are *Panchabhautika* in composition. *Karna* is originated from *Akasha Mahabhuta* and perceives *Shabda* i.e. sound perception.
- According to *Acharyas, Satmya Indriyartha Sannikarsha* (proper bondage of sense organs with its objects) is required for correct perception of knowledge. *Asatmyendriyartha Samyoga* or improper use of sense organs is one of the reasons for *Tridosha* imbalance leading to diseases. A thing which is not conducive to body is regarded as *Asatmya* (unwholesome). *Indriya* include both *Jnanendriya* and *Karmendriya*. *Artha* implies objects of senses. Therefore the *Asatmya* (imbalance) occurring due to the improper bondage of sense organs with its objects can be termed as *Asatmyendriyartha Samyoga*.
- *Asatmyendriyartha Samyoga* of *Indriya* and its significance in *Srotrendriya*. *Shabda* which is predominant of *Akasha Mahabhuta* is perceived through its *Adhishtana Karna* and it is interpreted by *Srotrobudhi*. This is the normal *Samyoga* of *Indriya* with *Indriyartha*.
  - *Ayoga* of *Srotrendriya* - improper exposure to sound media or reluctant to *Shabda* and its applicants.
  - *Atiyoga* of *Srotrendriya* - exposure to loud sounds for longer duration (ex - workers at call centers, using ear phones for longer duration, listening to loud speakers etc).
  - *Mithyayoga* of *Srotrendriya* - untimely, uncircumstantial, improper reception and exposure to sound, exposure to *Avashyaya* and *Pragvata Sevana*.[3]
- *Karna Shoola*, *Karna Nada*, *Karna Kshweda*, *Badhiryam* are the diseases caused by *Asatmyendriyartha Samyoga*.

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- *Pragnyaparada*: Excessive use of mobile phone, listening to loud music, excessive indulging in *Sheeta Vihara* like bike riding for long distance without any ear protection, exposure to *Avashyaya* and *Pragvata*.

Preventive measures

- Prevention is better than cure - *Acharya Susruta* tells first line of treatment is *Nidana Parivarjana*.[4]
- *Acharya Charaka* describes - Those who practice *Nasya Karma* according to proper *Kala* and method are not affected with diseases of eye, ear and throat.
- *Acharya Susruta* describes regular practice of *Kavala* and *Gandusha* has *Indriya Prasadanam*.
- By regular practice of *Dhumapana* - *Vata Kapha* disorders of *Urdhwajatru* can be prevented, does *Indriya Prasadana* by regular practice of *Dhumapana*.
- *Pathya* in *Karna Rogas* - Adopting treatments like *Sweda, Vamana, Virechana, Nasya, Dhumapana,* intake of food grains like *Godhuma, Mudga, Shali, Yava, Purana Ghritha* are beneficial, intake of *Mamsa* of *Lava Pakshi, Mayura, Harina, Thithira, Vanakukkuta* etc. are conductive. Vegetables like *Patola, Shigru, Varthaka, Karavellaka* are advised.

Treatment

- In all *Karna Rogas, Vata Prakopa* seems to be the chief cause, hence *Ghrutapana*, *Rasayana Sevana*, *Brahmacharyapalana* along with avoiding *Vyayama* and *Shirasnana* is advised.[5]
- *Pramarjana* - secretions in the external auditory canal should be cleaned regularly.
- *Karnaprakshalana* - is performed with decoction of *Aragvadhadi Gana* or *Surasadi Gana.*
- *Karna Dhupana* - ear is exposed to fumes either of *Guggulu, Yava, Agaru,* added with *Ghruta*.
- *Karnapurana* - filling the external canal with medicated oils like *Priyangvadi Taila* / decoction of *Tinduka, Haritaki, Lodra, Manjista* and *Amalaki / Madhu / Amra Kapittadi Rasa.*
- *Karna Pichu* - Inserting the *Pichu* dipped in medicated oils like *Bilwa Taila, Kshara Taila, Dashamula Taila.*

Music therapy for hearing loss

Music is a very useful tool, as it helps patients work on distinguishing sounds and pitches. It also increases a patient's attention to sound and recognizing differences in sound, which is important if you have hearing loss. This therapy can be beneficial for people who are getting used to hearing aids or cochlear implants.

DISCUSSION

Karna is one among the *Panchendriyas*, thus importance should be given to *Karna* and *Karna Rogas*.[6] Impact of environmental hazards on ear finally leads to hearing impairment which can be permanent or temporary, it is a growing problem in developing and under developed countries. Owing to human activities, pollution is increasing day by day. And to overcome this, all the measures advised in Ayurveda can be adopted for both preventive and curative purpose. Environmental hazard is an important risk factor of hearing loss around the world. While multiple factors contribute to the occurrence of hearing loss due to environmental hazard, lack of prevention is the major contribution. Noise is produced by almost everything we humans do. It makes sense that we would get used to it.

Exposure to noise more then 75-80dB causes hearing loss. Reduced hearing is primarily seen due to aging, unfortunately due to the lifestyles adopted and environmental changes, it is seen commonly even in the young age group. In modern medical science, Hearing aids and implants are the devices most commonly used for rehabilitation of the impaired hearing. Hearing aid will not suit to all persons and such types of many disadvantages of conventional hearing aids and many complications of cochlear implants are seen. Ayurveda has discussed principles for both preventive and curative purpose.

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CONCLUSION

The high burden of deafness globally and in India is largely preventable and avoidable. According to the 2005 estimates of WHO, 278 million people have disabling hearing impairment. The prevalence of deafness in Southeast Asia ranges from 4.6% to 8.8%. In India, 63 million people (6.3%) suffer from significant auditory loss. Ayurvedic system of medicine gives more importance to preventive measures which are lacking in contemporary science. *Nidanas* like *Avashyaya, Jalakreeda, Mithya Yoga* of *Shabda* can be correlated as environmental pollution leading to hearing loss and our *Acharyas* explained preventive and curative aspects for the same in the classics. Identifying (early screening) the *Nidana* and *Nidana Parivarjana* plays the key role in preventing most of the *Karna Rogas*. Complete hearing loss prevention programs that include control of air pollution, water pollution, noise pollution and control of radiational hazards, record keeping and program evaluation are need to effectively reduce the global burden of hearing loss caused due to environmental hazard.

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