ROLE OF LYCOPENE IN PRESBYCUSIS

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ABSTRACT

Lycopene a red carotenoid found mainly in tomatoes and few other fruits and vegetables, is said to have strong antioxidant properties. This study aims to evaluate the effect of lycopene supplements in patients with age related hearing loss (Presbycusis) and any symptoms related to it like tinnitus.

MATERIALS AND METHODS

Two hundred patients with bilateral symmetrical progressive age related sensorineural hearing loss (Presbycusis) were taken up in the study; 100 patients in study group were given capsule supplement containing lycopene and multivitamins once a day after meals for 12 months. Remaining 100 patients in control group were given capsule supplement containing only multivitamins without lycopene once a day after meals for 12 months. Patients were evaluated using Pure Tone Audiometry (PTA) at first visit, after 6 months and after 12 months for degree of hearing loss, tinnitus and any side effects of capsules in both study and control groups.

RESULTS

The results showed that presbycusis mainly effects higher speech frequencies (2000 hertz and above). The results showed that there was slower progression of degree of sensorineural hearing loss in study group using lycopene containing supplement as compared to control group without lycopene. There was a marginal improvement in incidence of tinnitus in the study group. There were minimal drug related side effects like nausea, vomiting and diarrhoea with no difference in both groups with or without lycopene.

CONCLUSION

So it can be concluded that Lycopene supplements can be considered as a safe treatment to slower the progress of disease in patients with age related hearing loss.

KEYWORDS

Antioxidants, Lycopene, Presbycusis, Pure Tone Audiometry, Sensorineural Hearing Loss, Tinnitus.

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INTRODUCTION

Presbycusis or age related hearing loss is a common cause of hearing loss in adults.[1] It is characterised as bilateral symmetrical gradually progressive Sensorineural Hearing Loss (SNHL) in older age groups affecting mainly higher speech frequencies.[2] It is one of the most common illness in aged people after arthritis and hypertension.[3] It leads to social isolation, depression and frustration in aged people and among their family members and friends.[4]

In spite of various studies no successful treatment for presbycusis has been found till today.[5] The role of multivitamins and other antioxidants has been investigated in various studies but not much success achieved.[5] The patients are also not comfortable to use hearing aids due to lack of benefit, discomfort, dislike and financial reasons.[6]

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Lycopene is a red carotenoid found mainly in tomatoes and other fruits and vegetables like watermelons, apricots, guava and papaya.[7] Its role as a powerful antioxidant in preventing age related eye maculopathies, heart diseases, artherosclerosis, breast, lung, ovaries cancer has been studied in literature.[8] Studies have shown that lycopene blocks production of reactive oxygen metabolites at molecular level.[8]

These metabolites which are associated with aging cause oxidative stress which damage cochlear and neural structures leading to hearing loss.[9] Not much studies regarding role of lycopene in controlling age related hearing loss are available. The recommended daily dietary intake of lycopene cannot be met by its natural source.[10] So this study was done to highlight the role and safety of lycopene supplements in patients with presbycusis for control of progression of hearing loss and tinnitus.

MATERIALS AND METHODS

This study was conducted in Department of ENT of our medical college and hospital after taking approval of local ethics committee. The patients were enrolled for the study between December 2012 to November 2013 and followed up for 1 year after enrolment. The written consent was obtained from all the patients enrolled in the study.

All the patients underwent detailed history taking, otomicroscopic examination and Pure Tone Audiometry to

diagnose presbycusis. The inclusion criteria was adult patients with bilateral symmetrical SNHL with normal external ear and tympanic membrane where no other etiology could be identified.

The exclusion criteria was history of exposure to noise, ototoxic drugs, trauma, other otologic disorders like otitis media, unilateral or asymmetric hearing loss, conductive hearing loss or syndromic hearing loss. Patients with known allergy to tomatoes or tomato products, pregnant or nursing mothers were also excluded from the study.

The patients were randomized alternatively into study and control group. The comparatively better hearing ear was evaluated in the study; 100 patients in study group were given commercially available capsule supplement contains lycopene and multivitamins (Lycored, lyco DM, licosule plus) once a day after meals for 12 months. Remaining 100 patients in control group were given capsule supplement containing only multivitamins without lycopene (A to Z, Supradyn) once a day after meals for 12 months.

Patients were assessed using Pure Tone Audiometry (PTA) and Speech Audiometry at first visit, after 6 months and after 12 months. The assessment points were:

1. Degree of hearing loss calculated as average pure tone thresholds of all speech frequencies in better hearing ear at each visit.
2. Ability to understand speech was assessed by calculating the Speech Discrimination Score (SDS) of all the patients in both groups.
3. Median pure tone thresholds at various speech frequencies for all the patients enrolled in the study.
4. The patients were enquired about subjective complaint of tinnitus at each visit.
5. Any side effects of the capsule supplements were enquired.

RESULTS

Two hundred patients with age related hearing loss who gave consent were enrolled in this study. All the patients underwent assessment using PTA and speech audiometry. Data was collected on all patients. All the patients were adults in middle or older age groups. The majority of patients (73.5%) were above the age of 65 years. Only 6 patients (3%) were below 50 years of age. (Table 1) There was a slight male predominance among the patients (1.174:1). This predominance was more evident in middle age groups less than 65 years of age (1.41:1). (Table 1).

One hundred patients were randomized to use capsule supplement contains lycopene and multivitamins (Lycored, lyco DM, licosule plus) once a day after meals for 12 months. Remaining 100 patients in control group were given capsule supplement containing only multivitamins without lycopene (A to Z, Supradyn) once a day after meals for 12 months. Patients were assessed using Pure Tone Audiometry (PTA) and Speech Audiometry at first visit, after 6 months and after 12 months.

The pure tone audiogram plotted showed that median pure tone threshold for all the patients taken together at first visit was 20 decibel Hearing Level (HL) at 500 hertz speech frequency which increased to 65 decibel HL at 8000 hertz. There was a significant increase in pure tone thresholds with increasing speech frequencies. The hearing loss was present in majority cases for frequencies above 2000 hertz. (Table 2). This shows that hearing loss is more for higher frequencies.

The audiogram obtained for majority of patients at first visit (82%) was right sloping audiogram. Only for 36 patients (18%), it was flat audiogram. (Figure 1).

Regarding the degree of hearing loss the number of patients having severe to profound hearing loss increased from 22% at initial visit to 23% after 12 months in study group using lycopene supplements, which was much slower progress as compared to 24 % at initial visit to 28% after 12 months in control group without lycopene. (Table 3) This shows that lycopene slows the progression of hearing loss.

The ability to understand speech was evaluated using speech discrimination score (SDS). The results showed that in majority of patients (87%) speech discrimination was good. SDS was poor in 21 patients. (Figure 2).

The subjective evaluation of tinnitus was done in both groups at each visit. The results showed that more than 40% of patients of patients with presbycusis complained of tinnitus. The comparison in both groups on follow up showed that there was slow progression or marginal improvement in incidence of tinnitus in study group as compared to control group after 12 months. (Table 4).

Five patients (5%) discontinued treatment as a result of side effects of capsule containing lycopene in study group. The major side effects in these patients were nausea, vomiting and diarrhoea. But even in control group using multivitamin capsules without lycopene 6 patients (6%) had side effects leading to discontinued treatment. Here also the side effects were of vomiting and diarrhoea. The results show that lycopene is as safer as multivitamins with minimal and rare side effects. (Table 3) 7 patients were lost to follow up in study group with similar 6 patients lost in control group after 12 months. (Table 3).

DISCUSSION

The efficacy of lycopene in patients with age related hearing loss was investigated in this study. The primary aim of this study was to evaluate the role of lycopene supplements in controlling the progress of hearing loss and tinnitus and the second aim was to study its side effects, if any. We have used commercially available capsule supplement contains lycopene and multivitamins (Lycored, lyco DM, licosule plus) in our study.

Presbycusis has been recognised by ENT surgeons and societies since long back. According to studies it is more prevalent in older age groups affecting 40 to 50% patients aged above 75 years.[2] According to a study by Helzner, et al. it is found to be more common in men than women.[11] In our study also we found majority of patients of older age groups above 65 years.

There was a slight male predominance among patients in our study, especially among middle age groups. (Table 1). This could be attributed to more risk factors like smoking, alcohol being more common in males than females. The various risk factors of presbycusis according to studies are smoking, alcohol, diabetes and hypertension.[12] Some studies have shown age related hearing loss to run in families.[13]

The causes of presbycusis are loss or damage to hair cells and loss of blood supply to cochlea. There is also loss of nerve fibres and neural elements.[14]

The reduction in blood flow leads to formation of Reactive Oxygen Metabolites (ROM), which affects inner ear structure and damages mitochondrial DNA.[14] Mitochondrial DNA deletions lead to deafness. Researchers observed that diminished flow in capillaries of basal turn of cochlea correlates with higher frequency hearing loss in elderly.[15] In our study also we found that higher speech frequencies above 2000 hertz are affected the most. (Table 2) This was also evident by right sloping audiogram obtained in our study.

The flat audiogram obtained in some cases is due to strial presbycusis causing atrophy of strial vascularis leading to equal loss among frequency range. (Figure 1) According to studies tinnitus is one of the most annoying complaint associated with presbycusis.[16] In our study also we found a strong correlation between presbycusis and tinnitus. (Table 4).

In neural presbycusis due to degeneration of auditory neurons, there is poor ability to understand speech. This explains the poor speech discrimination scores for some patients in our study. (Figure 2) As in literature in majority of cases the various types of presbycusis coexist.[17]

Lycopene is a naturally occurring carotenoid that gives fruits and vegetables a red colour. Among the carotenoids lycopene is the most potent antioxidant.[8] It reduces oxidative stress by neutralizing oxygen metabolites and free radicals. It also enhances the expression of connexin gene.[18]

It also increases the activity of endogenous antioxidants like superoxide dismutase and glutathione peroxidise.[19] In our study we found lycopene slows the progression of age related hearing loss over a period of time (Table 3). Lycopene was also found to slower the progression of subjective complaint of tinnitus (Table 4).

Studies have shown that synthetic form is more bioavailable and more effective than its natural source.[20] According to a study combine effect of supplements like vitamins and lycopene have a synergistic positive effect and enhances mitochondrial function.[21] We have also used a supplement containing lycopene and multivitamins in study group which gave better results as compared to control group without lycopene.

The results of studies have demonstrated absence of significant toxicological affects of lycopene.[22] In our study also we found rare side effects of lycopene (5%) and it was found to be a safer drug. (Table 3). Patients lost to follow-up was almost same in both groups, which can be explained by longer duration of our follow up and patients belonging to far away inaccessible areas.

CONCLUSION

Lycopene being a potent antioxidant is highly effective in slowing down the progress of age related hearing loss and the associated complaint of tinnitus with it. Lycopene supplements were found to be safer drug with minimal side effects. So we can conclude that the use of lycopene supplements in patients with presbycusis probably would benefit our patients. There is scope of further studies along this line of management of presbycusis

Age (Years)	Male	Female	Total
< 50 years	4	2	6
50 – 65 years	27	20	47
66 – 75 years	36	32	68
> 75 years	41	38	79
Total	**108**	**92**	**200**

Table 1: Age and Sex distribution

Speech Frequency in Hertz	Median Pure Tone Thresholds in Decibels
500 hertz	20 decibels
1000 hertz	25 decibels
2000 hertz	35 decibels
4000 hertz	55 decibels
8000 hertz	65 decibels

Table 2: Median pure tone thresholds at various speech frequencies for all the patients at first visit

Degree of Hearing Loss	First Visit		After 6 Months		After 12 Months	
	Study group N = 100	Control group N = 100	Study group N = 100	Control group N = 100	Study group N = 100	Control group N = 100
Mild (25–40 decibel HL)	18 patients (18%)	17 patients (17%)	15 patients (17%)	13 patients (15%)	15 patients (17%)	12 patients (13%)
Moderate (41–55 decibel HL)	28 patients (28%)	29 patients (29%)	24 patients (27%)	24 patients (27%)	23 patients (26%)	22 patients (25%)
Moderately Severe (56–70 decibel HL)	32 patients (32%)	30 patients (30%)	30 patients (33%)	29 patients (32%)	30 patients (34%)	30 patients (34%)
Severe (71–90 decibel HL)	12 patients (12%)	13 patients (13%)	12 patients (13%)	12 patients (14%)	11 patients (13%)	13 patients (15%)
Profound (>90 decibel HL)	10 patients (10%)	11 patients (11%)	9 patients (10%)	11 patients (12%)	9 patients (10%)	11 patients (13%)
Discontinued treatment due to side effects	.....	.....	5 patients	6 patients	5 patients	6 patients
Lost to follow-up	.....	.....	5 patients	5 patients	7 patients	6 patients

Table 3: Degree of Hearing Loss in both groups at each visit

	First Visit	After 6 Months	After 12 Months
Study Group	41 patients (41%)	38 patients (42%)	36 patients (41%)
Control Group	40 patients (40%)	38 patients (42%)	39 patients (44%)

Table 4: Incidence of Tinnitus in both groups at each visit

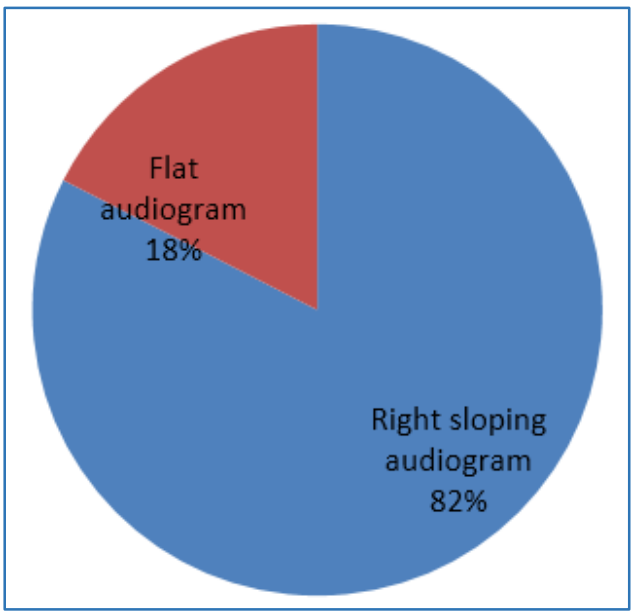

Fig. 1: Type of Audiogram obtained

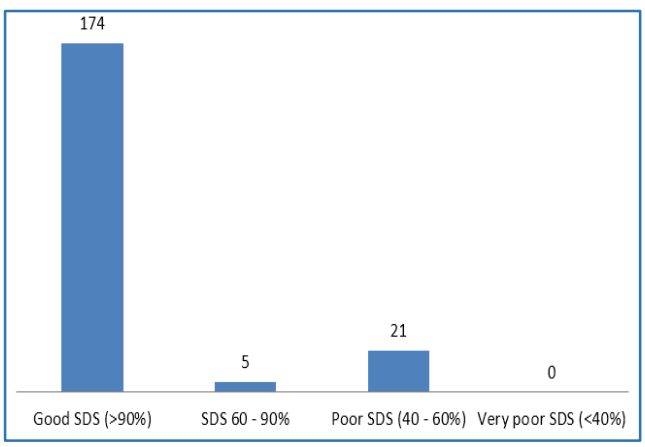

Fig. 2: Ability to understand speech (Speech Discrimination Scores)

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