A STUDY OF SENSORINEURAL HEARING LOSS IN PATIENTS OF INFLAMMATORY BOWEL DISEASE

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ABSTRACT

BACKGROUND

Inflammatory bowel disease (IBD) is an immune mediated chronic intestinal disease. It is of two major types, Ulcerative Colitis (UC) and Crohn's Disease (CD). Though IBD is primarily an intestinal disease, it involves various organ systems such as eyes, skin, musculoskeletal and hepatobiliary systems. Sensorineural hearing loss is one of such extraintestinal manifestations which is attributed to the autoimmune inner ear disease.

The objective of this study is to find the prevalence of sensorineural hearing loss in patients of inflammatory bowel disease.

MATERIALS AND METHODS

28 patients presenting to ENT and Medicine OPD of VIMSAR, Burla, from September 2016 to August 2018, clinically diagnosed to have Inflammatory Bowel Disease were selected for the study. The patients were compared with equal number of age and gender matched controls (n=28). All the patients were subjected to thorough clinical examination along with otoscopy, tympanometry and pure tone audiometric tests. All cases and controls had normal otoscopy and tympanometry findings, thus excluding conductive hearing loss. The data was tabulated in Excel sheets and statistical analysis was done by Student's 't' Test. Statistical significance was set at p value <0.05.

RESULTS

A total of 56 patients were included in the study (28 cases and 28 age and gender matched controls). 57% of the cases were females and 43% of the cases were males. Mean age of the study was 35 years.

There was significant difference between the cases and controls in terms of sensorineural hearing loss (p<0.002). Of the total 28 patients of IBD (20 cases of Ulcerative Colitis and 8 cases of Crohn's disease), 17 patients had documented SNHL, 14 of them were bilateral and 3 were unilateral. 11 patients (7 cases of UC and 4 cases of CD) had no hearing loss. SNHL was present in all frequencies but mainly affecting the higher frequencies 2 KHz, 4 KHz and 8 KHz.

CONCLUSION

Inflammatory bowel disease is a treatable cause of otherwise permanent sensorineural deafness. Almost 60% of cases present with documented sensorineural hearing loss. Early audiometric evaluation may be advised in all inflammatory bowel disease patients.

KEYWORDS

Sensorineural Hearing Loss, Inflammatory Bowel Disease, Extraintestinal Manifestation, Ulcerative Colitis, Crohn's Disease.

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BACKGROUND

Inflammatory bowel disease (IBD) in an immune mediated chronic intestinal condition. It is classified into two major types Ulcerative Colitis and Crohn's disease. The most common clinical features of IBD are abdominal pain, bloody diarrhoea, malabsorption and weight loss. Ulcerative colitis causes contiguous chronic inflammation of the alimentary tract involving the mucosa and submucosa. Crohn's disease causes non-contiguous chronic inflammation of the alimentary tract transmurally with non-caseating granuloma formation. Though IBD is primarily an intestinal disease it is frequently associated with several extraintestinal manifestations involving various organs and organ systems such as uveitis and episcleritis in the eye, pyoderma gangrenosum and erythema nodosum in skin, arthritis, enthesitis and sacroiliitis of the musculoskeletal system and primary sclerosing cholangitis involving the hepatobiliary systems.

Sensorineural hearing loss (SNHL) is another extraintestinal manifestation of IBD which is attributed to the autoimmune inner ear disease. The autoimmune basis for SNHL in IBD was first suggested by McCabe in 1979.[1] This

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is followed by Summers & Harker in 1982[2] suggesting the association of sudden sensorineural hearing loss with ulcerative colitis. SNHL also occurs in association with other autoimmune diseases such as Rheumatoid arthritis (Goodwill et al. 1972),[3] SLE, Sjogren's syndrome (Doig et al. 1978),[4] Vasculitis such as PAN (Gussen. 1978)[5] and Wegener's granulomatosis and Cogan syndrome (Buge. 1986).[6] The possible aetiologies have been suggested: autoantibodies binding to type II collagen (Yoo et al. 1983),[7] Immune mediated vasculitis of labyrinthine vessels (Jenkins et al. 1981),[8] circulating immune complexes (Kanazaki & O-Uchi. 1983)[9] and Type IV hypersensitivity mediated by T-cells against inner ear membranous elements.[10]

SNHL due to autoimmune disease is usually diagnosed based on clinical presentation.[11] Otoscopic examination, tympanometry and pure tone audiometry help in assessing the level of hearing loss. The response to treatment can also be monitored by serial audiometric testing at regular intervals. IBD patients rarely present with hearing loss at the first hospital visit. Patients complain of hearing loss only when there is significant impairment of hearing. In the recent past the association between SNHL and IBD has been put forward by several researchers but is still not well established.

The present study was conducted to find out the prevalence of clinical as well as subclinical SNHL in IBD patients.

MATERIALS AND METHODS

A hospital based cross sectional study was conducted on 56 patients presenting to ENT and Medicine OPD from September 2016 to August 2018. 28 patients who were clinically diagnosed to have inflammatory bowel disease participated in the study. Age and gender matched otherwise healthy individuals were taken as controls for comparison. Informed consent were obtained from all the participants prior to inclusion in the study.

Inclusion Criteria

The study participants were between 16 to 65 years of age. They were divided into two groups, inflammatory bowel disease cases in one group and healthy individuals in the controls group. Each group consists of equal number of males and females.

Exclusion Criteria

The following individuals were excluded from the study.
Patients of age ≤15 and ≥66 yrs.
Patients having autoimmune disease other than IBD.
Patients with associated conductive hearing loss.

The patients included in the study were subjected to thorough history taking including the time of onset of the disease and treatment history. Complete otolaryngologic examination and Otoscopy, Tympanometry and Pure Tone Audiometric tests were performed. All the patients in the study had normal otoscopic and tympanometric results. The values were tabulated on Excel Sheets based on the pure tone threshold of individual frequencies of each ear separately. Pure tone averages of each ear were calculated separately and statistical analysis were done using Student's t-Test: Two-Sample Assuming Unequal Variances. A p value of <0.05 was considered as statistically significant.

RESULTS

	Sensorineural Hearing Loss	No Hearing Loss	Mean	Standard Deviation	Standard Error Mean
No. of Cases	17	11	32.5298	18.8279	3.5581
No. of Controls	3	25	18.5119	11.0203	2.0826

Table 1. Group Statistics

The calculated Odds ratio is 12.88.

The mean age of the study was 34.4642 for the cases group and 36.0714 for the controls group.

	Ulcerative Colitis	Crohn's Disease
Sensorineural Hearing Loss	13	4
No Hearing Loss	7	4
Total	20	8

Table 2. Patients with Inflammatory Bowel Disease

Most of the patients with Ulcerative colitis (65%) had SNHL than Crohn's disease (50%).

Air Conduction Threshold (dB)	250 HZ	500 Hz	1 KHZ	2 KHz	4 KHz	8 KHz
Right Ear	31.07143	31.96429	33.57143	34.28571	35.35714	35.71429
Left Ear	29.46429	31.25000	32.14286	31.96429	33.57143	35.17857
Ulcerative Colitis	32.0000	33.2500	34.7500	34.7500	35.8750	36.5000
Crohn's Disease	25.9375	27.5000	28.1250	29.0625	30.9375	32.8125

Table 3. Frequency Specific Averages

The mean Pure tone threshold of right ear (33.25 dB) was higher than that of left ear (31.68 dB) but the difference was not statistically significant (P value = 0.068).

Ulcerative colitis involves all frequencies but mostly 1, 2, 4 and 8 KHz. Crohn's disease involves all frequencies but mostly 8 KHz.

Mean Pure Tone Threshold (AC)	Cases (dB)		Controls (dB)	
	Right Ear	Left Ear	Right Ear	Left Ear
	33.2738	31.7857	18.3929	18.6310
Total	32.5289		18.5119	

Table 4. Pure Tone Threshold Averages

The mean pure tone threshold of cases was (32.5289 dB) more than that of controls (18.5119 dB). This difference was highly statistically significant (p value = 0.000).

Sex	No. of Cases	Right Ear Threshold (AC)	Left Ear Threshold (AC)	Total
Females	16	36.0417 dB	36.8750 dB	36.4583 dB
Males	12	29.5833 dB	25.0000 dB	27.2917 dB

Table 5. Sex Distribution

The mean pure tone threshold of females (36.4583 dB) was higher than that of males (27.2916 dB). This difference was statistically significant (p value = 0.0299).

Age Group	No. of Patients	Average Threshold (dB)	Average Threshold of Left Ear (Air Conduction) (dB)	Average Threshold of Right Ear (Air Conduction) (dB)
16-25 yrs.	4	10.4166	10.4166	10.4166
26-35 yrs.	12	34.1666	35.9722	32.3611
36-45 yrs.	9	30.8333	31.6666	30.0000
46-55 yrs.	1	60.0000	56.6666	63.3333
56-65 yrs.	2	60.8333	58.3333	63.3333

Table 6. Age Distribution of Cases

Most of the cases belong to the age group of 26-35 yrs (n=12) and least number of cases in age group 46-55 yrs. (n=1).

SNHL	Normal (0-25 dB)	Mild (26-40 dB)	Moderate (41-55 dB)	Moderately Severe (56-70 dB)	Severe (71-91 dB)	Profound (>91 dB)	Total
16-25 Yrs.	4	0	0	0	0	0	4
26-35 Yrs.	3	4	4	1	0	0	12
36-45 Yrs.	4	3	1	1	0	0	9
46-55 Yrs.	0	0	0	1	0	0	1
56-65 Yrs.	0	0	1	0	1	0	2
Total	11	7	6	3	1	0	28

Table 7. Hearing Loss of Cases

The total 28 cases, 60.71% of cases (n=17) had any hearing loss whereas 39.29% cases (n=11) had no hearing loss.

7 cases had mild hearing loss (25%), 6 cases had moderate hearing loss (21.42%), 3 cases had moderately severe hearing loss (10.71%), 1 patient had severe hearing loss (3.5%) and no patients had profound hearing loss (0%).

Patients belonging to younger age groups generally had mild to moderate hearing loss and those belonging to the older age groups generally had moderate to severe hearing loss.

Total Cases with SNHL	Right Ear	Left Ear	Unilateral	Bilateral
17	16	15	3	14

Table 8. Laterality

Majority of the patients had bilateral SNHL (82.35%) (n=14) than unilateral SNHL (17.65%) (n=3).

Symptom	Hearing Loss	Vertigo	Tinnitus	Aural Fullness	Earache	Ear Discharge
	10	5	7	3	1	0

Table 9. Associated Symptoms

Out of 28 cases, 10 cases presented with hearing loss.

The most common associated symptom is tinnitus (n=7) followed by vertigo (n=5).

DISCUSSION

In a normal individual, homeostasis exists between the intestinal epithelial cells, immune cells and commensal microbiota. Whenever a soluble antigen enters the gut, the local immunity is suppressed due to this homeostasis (oral tolerance). This homeostasis is altered due to genetic and environmental factors (such as antibiotics, smoking and entero pathogens). In these susceptible individuals, an imbalance occurs between pro and anti-inflammatory mediators in favor of the former. Thus, the oral tolerance is lost for oral soluble antigens and leads to a chronic state of uncontrolled inflammation i.e. Inflammatory bowel disease. During active disease there is increased bowel permeability and the luminal antigens may enter the systemic circulation. The pro-inflammatory cytokines such as TNF-α, Interleukins IL-1 and IL-12 may cause significant inflammatory responses elsewhere in the body.[12] The inner ear can also become the target of this autoimmune attack leading to sensorineural hearing loss.

Soon after McCabe suggested the autoimmune basis of SNHL, several researchers put forward the association between inner ear disease and various autoimmune diseases such as ulcerative colitis and Crohn's disease. Though the actual mechanism of inner ear disease is not clearly known, antibodies against type II collagen, circulating immune complexes and T-cell mediated Type IV hypersensitivity have been demonstrated by a few researchers. There are no specific tests to identify except the OtoBlot test. It is a Western blot test done to detect antibodies against fresh bovine inner ear 68-kD antigen preparations (heat shock protein 70) in the serum.[13] This is one of the many cross reacting proteins against the inner ear in suspected immune-mediated hearing loss.[14]

The autoimmune inner ear disease causes mainly sensorineural hearing loss but vestibular functions are also influenced by the autoimmune process. The SNHL is usually bilateral and progressive. The hearing level fluctuates from deterioration to partial or complete remission. However the normal tendency is towards permanent hearing loss till it stabilises with some auditory function remaining.[14] Disequilibrium and postural instability are the mostly associated vestibular symptoms. Intermittent attacks of severe vertigo similar to Meniere's disease may sometimes occur.[15]

A study done by Wengrower et al. al showed that any hearing loss was found in 52% cases and moderate to severe hearing loss in 21% cases.[16] In the present study any hearing loss was found in 60.71% of cases (n=17) and moderate to severe hearing loss in 35.71% of cases (n=10). Another similar study done by Akbayir N et al. on 39 patients of inflammatory bowel disease showed that subclinical SNHL might be associated with Ulcerative colitis affecting 2, 4 and 8 KHz and Crohn's disease mainly at 8 KHz.[17] This is similar to the present study where Ulcerative colitis involves all frequencies but mostly 1, 2, 4 and 8 KHz. Crohn's disease involves all frequencies but mostly 8 KHz. The author also suggested investigations of vestibular functions in all IBD patients.

In the present study, majority of the patients presented with Ulcerative colitis (71.42%) than Crohn's disease (28.57%) of them 65% and 50% cases had sensorineural hearing loss respectively. Most of the patients had bilateral SNHL (82.35%) (n=14) than unilateral SNHL (17.65%) (n=3). This is similar to the study done by Karmody CS et al. on 38 patients with a history of IBD.[18] Most of the patients in the present study were females (57%) when compared to males (43%) and the mean threshold of hearing was significantly higher in females (36 dB) when compared to males (27 dB). This may be attributed to the higher incidence of autoimmune diseases in females. The mean age of the present study was 34 and the most common age group was 26-35 years. Most of the cases in younger age group had mild to moderate hearing loss whereas cases in the older age group had moderate to severe hearing loss. This may suggest that SNHL worsens with age and the duration of illness is a most important factor.

KuczKowski J et al. studied a 31 year old woman with Crohn's disease who developed SNHL in one ear and acute total deafness in the other. They found improvement in hearing after steroid treatment was initiated.[19] A similar study was done by Kumar BN et al. on a 12-year-old boy with ulcerative colitis. The patient initially responded well with steroid therapy but unfortunately ended up with bilateral profound SNHL.[20] This suggested further research into this area and lead to the use of anti-TNF agents. Treatment of IBD mainly consists of Anti-inflammatory agents such as Corticosteroids, 5-ASA (Amino Salicylic Acid) compounds, Immunosuppressants (Azathioprine, Methotrexate) and Anti-TNF agents (Infliximab, Adalimumab). Fousekis et al suggested initial corticosteroid therapy for SNHL, if that fails anti TNF agents and the last resort being cochlear implantation.[11] Kanzaki and O-uchi et al suggested that adequate treatment of Primary IBD causes improvement of SNHL.[9]

The present study emphasises the importance of early identification of SNHL in patients of IBD through periodic testing of pure tone thresholds before severe hearing impairment occurs. Testing for vestibular functions should also be a part of the investigations for autoimmune inner ear disease. Adequate and early initiation of treatment to which the patient responds such as ASA compounds, corticosteroids, immunosuppressants or anti TNF agents either as monotherapy or in combination. The side effects and toxicity of these drugs have to be considered thoroughly before initiation of the treatment.

CONCLUSION

Inflammatory bowel disease is a treatable cause of otherwise permanent sensorineural deafness. Most of the patients present only when hearing loss is severe and irreversible, and ignore mild hearing loss. Proper communication and inter departmental referral between Medicine and ENT of high risk patients may help in early identification of SNHL. Appropriate and timely treatment may arrest the progression of the disease and improve the quality of life.

Ethical Approval

All procedures performed in the study involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed Consent

Informed consent was obtained from all individual participants included in the study.

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