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Research Paper

Role of N-Acetylcysteine in Hearing Outcome of Patients with Idiopathic Sudden Sensorineural Hearing Loss: Our Experience

Medical Science

KEYWORDS : Sudden sensorineural hearing loss (SSNHL), N-acetylcysteine (NAC), downsloping audiogram

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ABSTRACT

We conducted a case control study of 31 adult patientsto see the effect of N-acetyl cysteine (NAC) in treatment of idiopathic sudden sensorineural hearing loss (SSNHL). Patients were divided into two treatment groups. The first group (group I) patients were treated primarily with corticosteroid in oral form; the second group (group II) patients were treated with a combination of oral corticosteroid and oral NAC. The overall hearing improvement was 35.7% in group I, whereas 64.7% in group II. Among patients with initial hearing loss of more than 90 db, group I showed no significant improvement in hearing, whereas in group II out of 8 patients 4 patients had > 15 dB improvement in hearing. This suggests that a combination of corticosteroid + NAC can improve the treatment outcome in patients of SSNHL with profound hearing loss.

Introduction:

Sudden sensorineural hearing loss (SSNHL) is an otologic emergency. It is defined as an idiopathic disorder with sensorineural hearing loss of at least 30 dB over three contiguous frequencies on pure tone audiometry occurring acutely under 72 hours from initial onset (1). It has an incidence of 5 to 20 per 1, 00,000 persons per year (2).

There are no fixed treatment protocols and gold standard treatment for SSNHL till date is oral corticosteroids.

NAC is predominantly used as a mucolytic and as antidote for paracetamol poisoning. It is believed to reduce free radical injury to inner ear and thus can have a beneficial role in management of SSHNL.

Materials& Methods:

A case control study of 31 adult patients was conducted in the Department of ENT, SGRRIMS Dehradun from the period Jan 2010 to March 2014. The study was done using two groups for comparison of results. The first group (group I) comprised of study of 14 patients of Idiopathic SSNHL from the period January 2010to March 2012. These patients were treated primarily with corticosteroid in oral form (Tab prednisolone, max 1mg/kg) in tapering dosage for 14 days.

The second group (group II) contained 17 patients of Idiopathic SSNHL treated from March 2012 to March 2014. These patients were treated with a combination of oral corticosteroid (prednisolone, max 1mg/kg in tapering dosage), and oral n-acetyl cysteine in dosage of 600mg twice daily for 14 days.

The inclusion criteria of the patients were-

- Acute hearing loss without any identifiable cause of more than 30 dB in at least 3 contiguous frequencies over a period of 3 days.
- Therapy starting within 10 days after onset of hearing loss.
- No hearing loss in the affected ear in the past.

The exclusion criteria were –

- Recurrent Sudden SNHL.
- History of CSOM, discharge or ear surgery.
- History of CVA, major vascular disease or any other identifiable cause.
- Therapy starting after 10 days.

The patients were admitted and pre therapy Pure Tone Audiogram and Tympanometry was done and used for comparison of results. Local and systemic examinations were done. Routine blood investigations and HRCT temporal bone with CP angle screening was done in every patient.

Serial audiograms were done on days 1, 2, 3 days and then on 7th day and 6th week. Pure tone average was calculated as the average of thresholds at 0.5, 1, 2 and 4 KHz.

Results and Observation:

The clinical findings of 31 cases were studied & tabulated. ENT examination was normal in all patients. Tympanometry revealed type 'A' tympanogram in all individuals and HRCT temporal bone was normal in all cases.

The criterion of improvement was set as > 15 dB improvement in PTA threshold of post treatment audiogram (at 0.5, 1, 2, 4 KHz) done at 6th week following therapy. Clinical results of Group I & Group II are shown in table1 and 2 respectively.

Table 1: Comprehensive clinical data of Group I patients

Sl. No	Age	Sex	Hearing loss	Vertigo	Tinnitus	Pre- Rx PTA Threshold dB(.5,1,2,4)	Post- Rx PTA Threshold dB(.5,1,2,4)	Improvement of > 15dB
1	44	M	U	N	N	55	45	N
2	32	M	U	N	N	66	30	Y
3	56	M	U	N	N	92	80	N
4	45	F	U	Y	Y	98	87	N
5	65	M	U	N	N	90	84	N
6	34	M	U	N	Y	67	30	Y
7	67	M	B	Y	N	72	70	N
8	58	M	U	N	N	64	58	N
9	45	F	U	N	N	56	56	N
10	56	M	U	Y	Y	70	52	Y
11	64	M	B	N	N	75	68	N
12	30	M	U	N	Y	68	36	Y
13	27	M	U	N	N	67	42	Y
14	68	F	U	N	N	58	46	N

Abbreviations: U unilateral; B bilateral

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Table 2: Comprehensive clinical data of Group II patients

Sl. No	Age	Sex	Hearing loss	Vertigo	Tinnitus	Pre- Rx PTA Threshold dB(.5,1,2,4)	Post- Rx PTA Threshold dB(.5,1,2,4)	Improvement of > 15dB
1	73	M	U	N	Y	50	25	Y
2	35	F	U	N	N	92	40	Y
3	40	M	U	N	N	90	48	Y
4	52	M	B	N	Y	98	82	Y
5	44	M	U	Y	N	88	75	N
6	55	F	U	Y	N	92	80	N
7	60	M	U	N	Y	80	60	Y
8	65	M	B	Y	N	98	90	N
9	69	M	U	N	N	95	85	N
10	24	F	U	N	N	84	56	Y
11	30	F	U	N	Y	90	52	Y
12	51	F	B	Y	Y	92	90	N
13	33	M	U	N	N	55	20	Y
14	35	F	U	N	N	68	30	Y
15	40	M	U	N	N	84	60	Y
16	50	M	U	N	Y	70	58	N
17	47	M	U	N	N	68	30	Y

The results of study of Group I can be summarized as:

- Of 14 patients in this group only 5 patients showed improvement in hearing.
- Age group of the patients ranged from 27 yrs to 68 years; 11 were male and 3 were females.
- Initial hearing loss of more than 90 db was seen in 3 patients. None showed any significant improvement in hearing.
- Bilateral disease was seen in 2 patients, none showed hearing improvement.
- Vertigo was seen in 3 patients and tinnitus was found in 4 patients; 3 patients with tinnitus showed improvement in hearing of which 1 patient had accompanying vertigo.
- The pre-therapy audiogram (table 3) showed downsloping curve in 10 patients, 3 cases had flat audiogram and 1 case had upsloping curve. All cases with flat and upsloping audiogram had improvement in hearing; 1 patient with downsloping PTA had hearing improvement.

The results of study of Group II can be summarized as-

- Of 17 cases, 11 patients showed improvement in hearing.
- The age group of the patients ranged from 24 yrs to 73 yrs; 11 were male and 6 were female patients.
- Initial hearing loss > 90dB were seen in 8 patients of which 4 patients had > 15 dB improvement in hearing.
- Unilateral disease was seen in 14 cases while bilateral in 3 cases
- Vertigo was seen in 4 patients; none of them had significant improvement in hearing
- Tinnitus was seen in 6 cases of which 4 showed improvement in hearing.
- The pre-therapy audiogram (table 3) of the patients showed that none of patients had an upsloping audiogram; majority of patients had downsloping audiogram of which 9 showed improvement in hearing; 3 patients had flat audiogram of which 2 showed significant hearing improvement.

Table 3: Depicting correlation between type of audiogram and hearing improvement in both the groups

Type of Audiogram	Group I		Group II	
	No of cases	Hearing improvement	No of cases	Hearing improvement
Upsloping	1	1	0	0
Flat	3	3	3	2
Downsloping	10	1	14	9

Discussion:

SSNHL is a challenging clinical entity in otology due to its uncertain pathogenesis and lack of fixed treatment protocols .It's etiology is mainly idiopathic; although SSNHL is commonly implicated to either vascular or viral etiology (2).

The treatment of SSHNL is mostly empirical. Majority of the treatments studied in randomized controlled trials can be divided into three different categories: 1) corticosteroid treatment; 2) specific antiviral therapy; and 3) specific treatment of vascular insufficiency (3).

In a double blind, placebo controlled study by Wilson et al, a statistically significant benefit with systemic steroids in recovery of hearing was seen in patients with SSNHL (61% vs. 32%, $p<0.05$) (4). Patients with hearing losses greater than 90 dB in all frequencies (profound hearing losses) had no response to corticosteroids and had a very limited recovery rate that was not improved by steroid therapy.

Recent studies have shown a beneficial effect of NAC on cochlea. NAC protects the cochlea from reduced hair cell loss, threshold shifts associated with acoustic trauma and decreases gentamicin ototoxicity in OC-k3 cells (5). Ralph Abi-Hachem et al studied the effect of combination of oral + intratympanic steroid + NAC on the hearing outcome of SSNHL and reported that 44% of all patients had hearing recovery at both low and high frequencies (6). In another study conducted by Angeli SI et al a combination therapy of corticosteroids plus oral NAC was given to treat SSNHL. At 6 months, the mean PTA improvements were 26.1dB and 15.1 dB for the combination and single therapy groups, respectively ($p= 0.046$). Higher gains at 4000 Hz were noted with NAC use (7). In our study the overall improvement was seen in 35.7% cases in Group I, whereas 64.7% cases showed improvement in group II. In Group I, patients with initial hearing loss of more than 90 db no significant improvement in hearing was seen. This is in correlation to the fact that advanced hearing loss has unfavorable outcome with oral steroids. However in group II out of 8 patients with >90dB initial hearing loss, 4 patients had > 15 dB improvement in hearing.

Mattox and Simmons [2] reported that a descending audiogram slope associated with vertigo is unfavorable prognostic sign. Majority of patients in both the groups in our study had a downsloping audiogram. Of the 10 patients in Group I with downsloping audiogram only 1 showed hearing improvement whereas of 14 with downsloping curve in Group II, 9 patients showed hearing improvement (figure 1). This suggests that a combination of corticosteroid + NAC can improve the treatment outcome in such patients with profound hearing loss.

Conclusion:

Summarily it would not be imperfect to state that therapy for SSHNL is still an ongoing research with the perfect regime yet to be found. However based on our study results we would like to state that addition of NAC to treatment regimen can improve hearing outcome in SSNHL patients with >90dB hearing loss.

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