

Short-term Intravenous Methylprednisolone Treatment of Abrupt Sensorineural Hearing Loss: An Observational Research

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Abstract

Aim: The aim of this study to evaluate the role of short course intravenous methylprednisolone in the management of sudden sensorineural hearing loss.

Methods: This study encompassed the variables like pre-treatment hearing loss level, time of presentation since the onset of the symptoms, duration of therapy, post-treatment hearing level, and associated comorbid factors. We consider intravenous methylprednisolone in cases that present with SSNHL within seven days of its onset. Intravenous methylprednisolone is not considered in cases with uncontrolled DM, hypertension, and any other medical conditions where systemic steroids are contraindicated. These patients receive steroids via the intratympanic route. On admission, the patients receive injection methylprednisolone 1 gm IV stat followed by 500 mg IV once daily for two consecutive days.

Results: At presentation, 6(12%) patients had mild hearing loss, 9(18%) had moderate, and 35 (70%) had severe hearing loss. Vertigo was present in 11(22%) patients and tinnitus in 42(84%) patients. Out of the 50 patients, 20(40%) patients had comorbidities, with 22% having hypertension, 12% having diabetes mellitus, and 6% having hypothyroidism. Collectively 10% of patients showed complete recovery, 52 % showed partial recovery, 38% of cases showed no recovery. Pre-steroid PTA and post-steroid PTA values were compared by using paired t-test, which showed a statistically significant difference when applied for the entire sample together (p value<0.05). But when we compared the pre-steroid PTA and post-steroid PTA values separately for each category using Wilcoxon sign rank test, only those with severe SSNHL showed statistically significant improvement following methylprednisolone injection (p value<0.05), whereas mild and moderate SSNHL, didn't show statistically significant improvement (p>0.05).

Conclusion: Comparing hearing loss, there was significant improvement after a short course of Methylprednisolone therapy. Short course Methylprednisolone can be an effective choice in a patient with SSNHL. Hearing outcomes are better in patients who do not have co-morbidities. Treatment must be of short duration to avoid complications although an adequate dose has to be provided.

Keywords: Sudden sensorineural hearing loss, Methylprednisolone, Steroids

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Introduction

Sudden sensorineural hearing loss (SSNHL) is relatively uncommon but may pose a significant problem for patients and a challenge for otolaryngologists. The sudden loss of hearing can be quite devastating to patients and may affect the quality of life. It was first described in 1944 by DeKleyn[1] SSNHL is defined as a decline in hearing over 3 days or less affecting 3 or more contiguous frequencies by 30 dB or greater with no identifiable etiology[2] The estimated incidence is 5–20 cases per 100,000, with viral infection being the most common etiological factor[3] Other etiologies include vascular occlusion and inner ear membrane breaks, acoustic neuroma, autoimmune inner ear disease[4,5]

The hearing loss (HL) is nearly always unilateral and is commonly associated with tinnitus and aural fullness. It was also noticed that the severe sudden onset of hearing loss associated with other inner ear symptoms like vertigo, has poorer chance of recovery. SSNHL is an ontological emergency and an early therapy is critical to recovery. High dose systemic steroids have been used and proved to be an effective method of treatment and are by far the most agreed upon line of treatment for SSNHL[2] Although proven to be effective in randomized, double-blind, placebo-controlled trials[2,6] other studies have questioned the efficacy of systemic steroids in the treatment of SSNHL[3,7,8] Other proposed lines of treatment include vasodilators, antiviral agents, hyperbaric oxygen, and plasma pheresis. It had been noticed in many studies that the earlier the onset of treatment, the better the chance of recovery the patient has.

Methods and Materials

This observational study was carried out in the Department of ENT, Nalanda Medical College and Hospital, Patna, Bihar, India for 1 year, after taking the approval of the protocol review committee and institutional ethics committee.

Methodology

This study encompassed the variables like pre-treatment hearing loss level, time of presentation since the onset of the symptoms, duration of therapy, post-treatment hearing level, and associated comorbid factors. Record data with incomplete documentation of the aforementioned variables were excluded from the analysis. As per our departmental protocol, we consider intravenous methylprednisolone in cases that present with SSNHL within seven days of its onset. Intravenous methylprednisolone is not considered in cases with uncontrolled DM, hypertension, and any other medical conditions where systemic steroids are contraindicated. These patients receive steroids via the intratympanic route. On admission, the patients receive injection methylprednisolone 1 gm IV stat followed by 500 mg IV once daily for two consecutive days. Cases that do not recover completely are prescribed with 1 mg/kg/day of oral prednisolone for 11 days. In this study, we have however assessed the hearing improvement after completion of methylprednisolone therapy only. The criteria for audiological recovery were further classified as: (i) complete recovery if the hearing level is within 10 dB of the normal hearing ear, (ii) partial recovery if improvement of >10 dB pure tone threshold, and (iii) no recovery if no improvement or improvement of <10 dB in pure tone threshold. Statistical analysis was done using the paired-t test, chi-square, and Wilcoxon signed-rank test. SPSS version 21.0 was used for the analysis.

Results

Record data of 50 patients who met the inclusion criteria were included in the study. There were 30 males (60 %) and 20 females (40%). The age of the patients ranged from 18 to 69 years, with the mean age being 41.49 years. In the age group 0-20 years there were 5(10%) patients, in 20-40 years there were 25(50%) patients, in

40-60 years there were 15(30%) patients, and in >60 years there were 5(10%) patients. 31 (62%) were admitted within three days of presentation and 19 (38%) were after three days. At presentation, 6(12%) patients had mild hearing loss, 9(18%) had moderate, and 35 (70%) had severe hearing loss. Vertigo was present in 11(22%) patients and tinnitus in 42(84%) patients. Out of the 50 patients, 20(40%) patients had comorbidities, with 22% having hypertension, 12% having diabetes mellitus, and 6% having hypothyroidism. The presence of vertigo, tinnitus or comorbidities didn't have any significant bearing on hearing recovery (Table 1).

Cases with mild SSNHL showed complete recovery in most of the cases, whereas most of the cases with severe SSNHL had no significant improvement at all. Collectively 10% of patients showed complete recovery, 52 % showed partial recovery, 38% of cases

showed no recovery. Response to treatment according to the severity of the hearing loss is shown in (Table 2) and the hearing outcome in patients after intravenous steroids is shown in (Table 3).

Pre-steroid PTA and post-steroid PTA values were compared by using paired t-test, which showed a statistically significant difference when applied for the entire sample together ($p < 0.05$). But when we compared the pre-steroid PTA and post-steroid PTA values separately for each category using Wilcoxon sign rank test, only those with severe SSNHL showed statistically significant improvement following methylprednisolone injection ($p < 0.05$), whereas mild and moderate SSNHL, didn't show statistically significant improvement ($p > 0.05$). Pre- and post- steroid PTA paired sample statistics and correlations are shown in (Table 4)

Table 1: Hearing improvement in patients with and without vertigo, tinnitus, and comorbidities.

Vertigo/tinnitus/ Co-morbidity	Hearing improvement			P value
	Complete recovery	Partial recovery	No recovery	
Vertigo present	2	3	6	
Vertigo absent	4	24	11	0.44
Tinnitus present	5	22	15	
Tinnitus absent	0	5	3	0.73
Co-morbidities absent	5	17	8	
Co-morbidities present	2	6	12	0.46

Table 2: Response to treatment according to severity of hearing loss

Patient category	Average hearing loss prior to treatment (db)	Average hearing loss post treatment (db)
Mild SSNHL	33.25	31.25
Moderate SSNHL	52.83	48.33
Severe SSNHL	94.22	83.54

Table 3: Hearing outcomes in patients after intravenous steroids

Hearing loss at presentation	Hearing at discharge		
	Complete recovery (5)	Partial recovery (26)	No recovery (19)
Mild SSNHL	5	0	2
Moderate SSNHL	0	8	4
Severe SSNHL	0	18	13

Table 4: Pre and post steroid PTA paired sample statistics and correlations

Variables	Mean	N	SD	Std. Error mean	Correlation	Sig. p value paired t test
Pre-steroid PTA	78.84	50	27.64	4.81	0.86	0.000
Post-steroid PTA	70.41	50	30.31	5.12		

Discussion

Despite many treatment regimens tried in the past, only steroids have been proven as the most beneficial in the management of SSNHL. Steroids act as a potent inflammatory agent and are known to cause vasodilation with increased microvascular blood flow in the cochlea[9] However, no consensus has yet been established regarding the dose, mode of delivery and duration of therapy. Having a greater possibility of increased concentration of the drug in the inner ear, either intratympanic or intravenous route is often considered. However, intratympanic route of delivery is often associated with pain, vertigo, and perforation of the tympanic membrane. Moreover, various studies have shown no difference in the efficacy of systemic and intratympanic steroids. A study done by Baysal et al comparing the effectiveness of systemic steroid versus combined systemic and intratympanic steroid treatment for SSNHL showed both had the same effect on the restoration of hearing.[10] Similarly, RCT done by Rauch et al which compared systemic and intratympanic steroids in 16 centres enrolling 250 patients showed the hearing outcome did not differ between patients who received prednisolone and those who received four doses of intratympanic methylprednisolone over 14 days[11] Based on these results, we considered the use of steroids systemically. This study aimed to assess the efficacy of a short course methylprednisolone given intravenously in cases with SSNHL presenting earlier i.e., within one week of the disease onset.

Our study showed the disease was more common in males than in females with a ratio of 1.5:1, mostly presenting at second

to fourth decades of life. A systemic review and meta-analysis done by Lin et al showed hypertension was found in 13.6% of SSNHL patients, whereas only 0.5% of the control populations were hypertensive. Diabetes was found in 6.5% of SSNHL patients compared to 0.15% of the control subjects[12]

In our study out of 50 patients, 5 patients had a complete recovery, 26 had partial recovery and 19 had no recovery at all. Among the 30 patients who had no comorbidities, 5 had a complete recovery, 26 had partial recovery and 19 had no recovery at all. Similarly, out of 13 patients with comorbidities, one had complete, five had partial and seven had no recovery. All patients with mild, moderate, and severe hearing loss showed improvement during the course of treatment. The majority of mild SSNHL cases had a complete recovery and the majority of the moderate, and severe SSNHL cases had a partial recovery. Cases presenting within less than 72 hours and those with mild to moderate hearing loss had better recovery rates.

A study done by Wilson et al in 1980 brought steroids as a treatment for SSNHL showing a recovery rate of 61%.[4] Eftekharian et al showed there was a significant improvement in hearing while using pulse methylprednisolone although it showed no superiority over oral conventional steroid therapy. In their study, out of 29 patients receiving the steroids, seven had complete, 10 had partial and 12 had no recovery[13] Veldmann et al showed an effective response to glucocorticoid treatment in six (50%) of 12 patients, whereas only six (32%) of 19 non-treated patients showed similar results[14] In another study by Narozny et al the group

receiving pulse methylprednisolone showed significant improvement in hearing when compared to a group receiving oral prednisolone.[15]

In our study mean hearing level before treatment was 78.84 dB (HL) and after treatment was 70.41 dB (HL), showing significant improvement in PTA, with a mean improvement of 8.43 dB. Similar to our study, Raghunandan et al using intravenous steroids also showed significant improvement in hearing loss with mean hearing level improving from an average of 79.53 dB (HL) before treatment to 42.33 dB (HL) after treatment[16]

A large sample size study is needed to draw a definite conclusion. Also, as the natural course of this disease is not known, further studies are required to compare the disease progression naturally and with the use of steroids.

Conclusion

Comparing hearing loss, there was significant improvement after a short course of Methylprednisolone therapy. Short course Methylprednisolone can be an effective choice in a patient with SSNHL. Hearing outcomes are better in patients who do not have co-morbidities. Treatment must be of short duration to avoid complications although an adequate dose has to be provided.

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