DOI: 10.14260/jemds/2015/903

ORIGINAL ARTICLE

A CLINICAL STUDY ON INTRATYMPANIC METHYL PREDNISOLONE AS PRIMARY AND RESCUE THERAPIES VERSUS ORAL PREDNISOLONE IN THE TREATMENT OF SSNHL: A STUDY ON 90 PATIENTS

A. Sesha Prasad[1], V. Ravishankar[2], S. Muneeruddin Ahmed[3], M. Mahendra Kumar[4]

HOW TO CITE THIS ARTICLE:
A. Sesha Prasad, V. Ravishankar, S. Muneeruddin Ahmed, M. Mahendra Kumar. "A Clinical Study on Intratympanic Methyl Prednisolone as Primary and Rescue Therapies versus Oral Prednisolone in the Treatment of SSNHL: A Study on 90 Patients". Journal of Evolution of Medical and Dental Sciences 2015; Vol. 4, Issue 36, May 04; Page: 6193-6204, DOI: 10.14260/jemds/2015/903

ABSTRACT: INTRODUCTION: Sudden Hearing Loss is a real emergency requiring a fixed protocol in every hospital to help the patient recover his lost hearing ability. Diagnostic tools including pure tone and speech audiometry, Hematological tests and MRI scan will guide the physician to identify the etiology of deafness to a certain extent, but in majority of the patients it is difficult. Oral steroid therapy with Prednisolone or Methyl Prednisolone over a period of 19 days is the most common choice. It also seems to be the best treatment option. Recently intratympanic steroids have become an attractive choice either as a primary therapy or as an adjuvant therapy, in patients showing no or little improvement with oral steroids. It is also useful in patients in whom steroids are contra-indicated. **OBJECTIVE:** To observe and analyze the result of improvement in hearing following Intratympanic steroids used as a primary treatment and rescue therapy versus results in the patients on oral steroids alone taken as a control group; To evolve a treatment protocol in the management of SSNHL in our Hospital. **MATERIALS AND METHODS:** In this prospective study 90 patients are divided into three groups and the effect of Oral Prednisolone therapy on improving hearing is compared with primary and rescue therapy with Intratympanic steroid injections. Pre and post therapy audiograms of pure tone (PTA) and speech audiometry (SRT) of the three groups are analyzed to formulate a meaningful solution. **RESULTS:** Intratympanic steroids as a primary therapy showed effective recovery of hearing, observed by reduction in PTA of more than 15dB and improved SRT scoring of more than 15%. This study showed statistical significance when compared with systemic steroids therapy and failed systemic steroid therapy (less than expected P value <0.05) Intratympanic injections as a rescue therapy also showed recovery of hearing with fall in PTA to <15dB and improved SRT scoring >15%. **CONCLUSIONS:** Four injections of Steroids into the middle ear used as primary or rescue therapies, improved hearing thresholds as recorded on pure tone average and speech discrimination. The additional advantage of avoiding systemic side effects is established once again in this study.

KEYWORDS: SNHL, SSNHL, Intratympanic, Prednisolone, Methyl Prednisolone, Viral Labyrinthitis, Vestibulitis.

INTRODUCTION: Sudden Hearing Loss is defined as Reduction in Hearing up to 30dB or greater, over three contiguous frequencies, on three consecutive recordings, happening in a period of 72 hours or less. It is a true emergency as delayed treatment perpetuates the suffering in the patient. SSNHL is almost exclusively unilateral. Rare cases of bilateral involvement are seen as functional or due to encephalitis or terminal stages of malignant growths in the brain. The patients' presents with loss of hearing developed over a period of hours to days. The severity is not the same in all the

DOI: 10.14260/jemds/2015/903

patients. The prognosis is bad if associated with tinnitus and vertigo.[1] Schreiber reported loss of hearing involving both the ears.[2] SSNHL accounts to 1% of all SNHL.[3] Both sexes are equally affected and the incidence is increased with the age of the patient, the average age is 46-49 years. It occurs in 5-15 persons in 100,000 every year. The incidence is approximately the same as Meniere's syndrome and Bell's palsy (20-25 per 100,000). Tinnitus and imbalance is present in about half of these patients.[1] Among the various causes mentioned in the literature a few are: inner ear diseases like Meniere's disease, infectious, neoplastic, traumatic, metabolic, endocrinal, immunologic, toxic and idiopathic causes. It is difficult to pin point the Etio-pathology even after a thorough search in a large percentage of patients. Hence they are labelled as Idiopathic. SSNHL is diagnosed by pure tone audiogram showing a recent decline, but if the previous base line audiogram is unavailable, it is deduced from the recordings of the opposite ear. Blood tests are done to rule out systemic disease causing SSNHL.[4] Initiation of early treatment improves the chances of recovery of loss of hearing. Many patients experience spontaneous recovery of hearing though, rarely to normal status. The window period for the starting of treatment is roughly four weeks. If the treatment is started within first two weeks, there is a chance of 80% recovery in Hearing. Standard treatment is oral Prednisolone 2 weeks, later tapered over 5 days. Intra tympanic Methyl Prednisolone is tried in four successive attempts over a period of 3 months. The present study is based on the evidence in the literature about different modalities of using corticosteroids in patients with SSNHL. The present prospective study analyses results of recovery of hearing observed and analyzed in three groups of patients. The three groups are divided depending on the treatment modalities. In group A Patients are treated with Oral steroids, in group B Patients are treated with primarily intratympanic steroids and group C Intratympanic steroids in patients failing to show any recovery of hearing.

MATERIALS AND METHODS: Between May 2009 to April 2011, 90 patients attending the ENT department of Government General Hospital attached to Kurnool Medical College, for complaints of sudden loss of hearing are selected for the present study. A thorough clinical history is elicited after recording the demographic details. Patients aged above 18 years and below 61 years are included in the study.

INCLUSION CRITERIA FOR GROUP A & B PATIENTS: 1. Patients aged above 18 and aged below 60 years. 2. Unilateral Sudden hearing loss of hearing at least 30dB in three frequencies within 3 days. 3. Pure Tone Average (PTA) (500, 1000, 2000, 4000 Hz) >/= 50 dB in the affected ear, with the affected ear >/= 30 dB worse than contralateral ear in at least one of the four frequencies. 4. Patients with Symmetric hearing prior to onset of SSNHL.

SELECTION CRITERIA FOR GROUP C PATIENTS: (In addition to the above selection criteria) 1. Patient's who do not show improvement following 19 days of oral steroid therapy. 2. Patients showing less than 10dB improvement in PTA and less than 10% improvement in SRT after Oral steroid therapy.

EXCLUSION CRITERIA: 1. History or evidence of previous ear surgery in the patients. 2. History or signs of acute or chronic Otitis Media. 3. History of Meniere's disease. 4. History of Diabetes, MI, Hypertension, renal diseases. 5. Patients with history of severe vertigo. 6. Patients with fluctuating hearing loss.

DOI: 10.14260/jemds/2015/903

Clinical examination of Ear Nose and Throat is done to exclude local and focal conditions affecting Eustachian tubal function and to note the condition of the tympanic membrane. Blood tests like TC, DC, EST, ANA, coagulation profile, blood glucose levels, lipid levels, BUN, CRP, creatinine, Rh factor, syphilis serology (TIT), HIV, antibody, and urine analysis are done in all patients. MRI brain to exclude cerebellopontine (CP) angle and internal auditory canal lesions is done. Preliminary audiometry is done using pure tone audiometry and speech audiometry. In pure tone audiometry frequencies of 250, 500, 1000, 2000, 3000, 4000 and 6000 KHZ are tested for both air and bone conduction. Pure tone average (PTA) of speech frequencies 500 to 3000 KHZ is taken. The loss of hearing is graded as Mild: (26–40 dB), Moderate: (41-55 dB), moderately severe: (56–70 dB), Severe: (71–90 dB) and Profound: (> 90 dB). Speech audiometry is done to assess SRT using 25 monosyllables. The patients included are divided in to three groups. Group A patients are administered oral Prednisolone for 19 days.

These patients are administered high dose Prednisolone 60mg/day in divided doses for 14 days and followed by tapering of the drug over 5 days (40mgs, 30mgs, 20mgs, 10mgs and 5mgs/day). In group B patients Intra Tympanic Methyl Prednisolone injection 0.5 ml of (40mg/ml) injections, 2 doses in a week for two weeks is given; (Total four doses). In this study group C patients are those patients who have already received oral steroid therapy for 19 days as in group A, with no gain in hearing thresholds (<10dB) in all the test frequencies and < 5% in SRT). The patients in group C are also given Intratympanic Methyl Prednisolone injections for a period of 2 weeks as in group B. In addition to this steroid therapy all the patients received medical treatment vasodilator, low–molecular–weight dextran, and oral Ca^2 + channel blocker.

The technique of injecting intra tympanum consisted of informing the patient in advance about the procedure and taking an informed consent. Under local infiltration anesthesia with patient's head turned 45 degrees opposite to the side of involvement 0.5 ml of Methyl Prednisolone (40mg/ml) is injected into the middle ear through a puncture below the Umbo. A separate puncture in postero-superior quadrant is made to act like a vent hole. The patient is asked to remain in that position for half an Hour. A second injection may be necessary if the first one is inadequate. During the post injection period the patients are instructed to keep the ear dry for at least two weeks. A significant hearing improvement was defined as a decrease of at least 15 db in PTA and improved SRT >15%. Recovery is judged by audiograms repeated starting at 2 weeks after treatment and every month for 6 months. The arithmetic mean values of PTA all the three groups are calculated to arrive at significance of the study among the three groups. Statistical analysis is done using SPSS software (2013). The analysis of recovery of hearing varies in the literature. A 15dB recovery in PTA at 500, 1000, 2000 and 3000 KHZ or a 15% improvement in SRT is considered as improvement.

OBSERVATIONS: Demographic data of the sample: Sex incidence: Totally 90 patients attending the ENT department of GGH, Kurnool, A. P. are selected for this study based on inclusion and exclusion criteria. Out of 90 patients males are 53 (58.8%) and females are 37 (41.11%) (Table1). The incidence is more in males than in females in our study. Male preponderance is seen in the ratio of 1:1.4 (Table 1).

DOI: 10.14260/jemds/2015/903

Sex	Group A	Group B	Group C	Total
Male	17	20	16	53
Female	13	10	14	37

Table 1: Showing sex incidence (n= 3X30)

Age Incidence: Patients are divided into 6 age groups with a class interval 7.

Age	Group A	Group B	Group C	Total
18-24	02	01	03	06
25-32	05	04	03	12
33-40	06	07	08	21
41-48	07	09	11	27
49-55	04	05	03	12
56-61	06	04	02	12

Table 2: Showing age incidence. (n= 3X30)

The commonest age group involved in the present study is between 33 to 48 years (53.33%) (Table 2). The mean age in group A is 46.93. In group B it is 48.56 and in group C it is 45.67 (Table 6) Clinical evidence of Viral Labyrinthitis is seen in 22(24.44%) of the patients and in the remaining 68 (75.55%) patients investigations are normal hence labelled as idiopathic (Table 3).

Cause of Hearing Loss	Group A	Group B	Group C	Total
Idiopathic	21	23	24	68
Viral Labyrinthitis	09	07	06	22

Table 3: Showing causes of SSNHL (n= 3X30)

Co morbid condition	Group A	Group B	Group C	Total
Hypertension	07	05	06	18
Diabetes Mellitus	05	06	04	15
CAD	04	07	06	17
Glaucoma	02	01	02	05
Psoriasis	04	05	04	13

Table 4: Showing co morbid conditions (n=3X30)

In the present study SSNHL associated with co-morbid status are shown in the table 4. Hypertension and coronary artery diseases are the common co-morbid conditions associated with SSNHL 33 (36.66%) followed by Diabetes mellitus in 15 patients (16.66%) (Table 4).

DOI: 10.14260/jemds/2015/903

Other symptoms	Group A	Group B	Group C	Total
Vertigo	02	03	03	08
Tinnitus	01	02	04	07
Otalgia	03	01	03	07
URTI	00	01	02	03

Table 5: Showing associated symptoms (n=3X30)

Patients with associated symptoms are shown in table 5. Associated aural symptoms in the patients of the study are Vertigo 8 (8.88%), Tinnitus (7.77%) and Otalgia (7.77%) (Table5).

Sample	Group A	Group B	Group C
Mean Age	46.93	48.56	45.67
Mean value of days lapsed before start of treatment	12.4	14.7	23.5

Table 6: Showing the mean of samples relating to appearance of symptoms and start of the treatment (n=3X30)

The mean intervals between onset of symptoms and starting of the therapy in the three groups are A-12.4, B-14.7 and C-23.5. The large interval in group C is because these patients were already on systemic steroids for 19 days, and not showing response to systemic steroid are included in this group (Table 6).

Group A	Pure tone Average	Percentage of recovery-%
Mean PTA before OCT-dB	78.2	39.89%
Mean recovery of PTA after OCT-dB	31.2	
Group B		
Mean PTA before ITS-dB	73.2	46.72
Mean recovery of PTA after ITS-dB	34.2	
Group C		
Mean PTA before post OCT-dB	67.2	32.14
Mean recovery of PTA after post OCT-dB	21.6	

Table 7: Showing mean value of PTA before treatment and mean reduction in PTA after treatment, in the three groups (n=3X30)

At the end of 6 months the pure tone audiograms in group A showed mean value of reduction in PTA as 31.2, in group B 34.2 and in group C 21.6. The mean SRT values are 33.13, 34.93 and 17.50 respectively (Table 7).

DOI: 10.14260/jemds/2015/903

Group	Group A- data in 30 patients	Group B- data in 30 patients	Group C- data in 30 patients
Observations of Recovery of PTA	36, 38, 39, 38, 37,38, 32,23,39,41,40,32,22,22,30,35,37,36,37,35,25,25,25,26,27,19,20,31,23,29	32,34,37,38,32,31,30,29,39,41,40,32,33,33,36,35,37,36,37,35,35,34,35,36,37,34,34,35, 33,30	22,21,23,20,19,19,15,17,16,12,12,13,12,16,23,26,28,29,30,32,32,23,32,23,23,21,21,24, 17,28
Mean Median Mode S D	31.2 32 38 6.83	34.6 35 35 2.91	21.6 21.5 23 6.11
Observations of Improvement in SRT percentage	32,30,34,32,32,32,30,36,34,36,38,38,40,38,40,32,34,36,38,38,34,30,40,34,30,32,28,20, 28,18	38,20,20,38,38,36,38,40,40,37,36,35,34,32,30,34,35,36,37,34,40,42,34,34,36,37,34,35, 38,30	25,20,22,24,20,20,18,18,20,22,18,25,20,15,15,15,15, 12,10,10,12,14,12,10,18,20,20,22,24,10
Mean Median Mode	33.13 34 32	34.93 36 34	17.50 18 20

Table 8: Showing Observations, Mean, median and Mode in the three groups at the end of 6 months

The reduction in values of PTA and improvement in SRT are recorded and the Mean, Mode and the Median recorded (Table8).

Using Pearson correlation co-efficiency method the values of reduction of PTA and increase in SRT scores observed from the study are correlated among the three groups.

Correlation between the Groups	Pearson Correlation factor-R	R^2	Z value	P value	Result
PTA					
Group A & B	0.4399	0.1935	-2.725	0.00634	Significant
Group A & C	-0.0243	0.0006	-4.124	0	Significant
Group B & C	-0.0243	0.0006	-4.782	0	Significant
SRT					
Group A &B	0.0407	0.0017	-1.3897	0.16452	Not significant
Group A & C	-0.1475	0.0218	-4.7616	0	significant
Group B & C	0.0016	0	-4.6814	0	Significant

Table 9: Showing the Pearson correlation co-efficiency factor and Wicoxon signed- Rank tester used to calculate the P value in the three groups

Although there is a positive technical correlation between A & B therapies, the relation between the variables is weak (Nearer to the value to Zero weaker the correlation). The correlation

DOI: 10.14260/jemds/2015/903

between A&C and B&C groups is technically negative and the relationship between variables is weak. Calculating the correlation between the values of SRT among the three groups it is found that the correlation between Group A & B is technically positive but weak relation between variables. Between groups B & C and Group B & C there is a negative correlation and weak relation. Between Group B and C the correlation is positive, but a weak relation (Table9). These correlated values are used to know the significance by using Wicoxon signed-Ranks Test. It is observed that there is statistical significance in the therapies used in groups A and B, A&D and B&C for reduction in PTA (P value is 0 to 0.00634) which is below expected P value0.05. Similarly the improvement in SRT of group A& B is not significant (P value 0.164 which is more than 0.05). There is significance between the groups A&C and group B&C (P value is 0).

Group	Mean of time lapse prior to treatment	% of Recovery of PTA	% of Recovery of SRT
Group A	12.4	100%	100%
Group B	14.7	100%	100%
Group C	23.	86.62%	73.3%

Table 10: Showing audiological recovery related to time lapse between starting of symptoms to start of treatment. (n=3X30)

If the criteria of Wilson is taken to relate the improvement; Taking recovery of >15dB In PTA as 50% improvement then in the present study percentage of recovery in group A and B patients in relation to decrease in PTA and improvement in SRT is 100% and the time lapse is 12.4 to 14.7 days, whereas the response in group C is in relation to reduction in PTA is 86.62% and improvement in SRT is 73.33%; the time lapse is 23 days. The statistical significance value (p-value) was 5% ($p<0.05$) throughout. Blood counts, serological studies and MRI scans of the patients did not reveal any significant abnormality in the present study.

DISCUSSION: Sudden Sensorineural Hearing Loss is one of the Medical Emergencies referred to the ENT specialists is seen all over the world. SSNHL was first defined by De Kleyn in 1944. Etiology can be found only in 10- 15% of SSNHL patients. Others are labelled as Idiopathic. In the present study the incidence of idiopathic SSNHL are (75.55%).[3] The highest incidence of SSNHL is seen between 46 to 49 years in the literature. In our study the incidence was high between 38 to 43 years (53.33%).[5] SSNHL is found equally in both the sexes according to literature, but in the present study there is a male preponderance in a ratio of 1:1.4.[6] Idiopathic causes of SSNHL are seen in 85.7% and viral Labyrinthitis in 14.3% in a study by Igor. The present study shows idiopathic type of SSNHL in75.5%. Co-morbid conditions like DM in 28.6% seen in Igor' study whereas in our study it is 16.6%. Hypertension and coronary artery diseases are the common co-morbid conditions associated with SSNHL 33 (36.66%). Tinnitus is seen in 85.7% and vertigo in 14.3 % of patients in[6] Igor's study, where as it is 8.8% and 7.7% in our study. The patients in our study belonged to one end of the spectrum of cochlea- vestibular dysfunction which is purely Cochlear. Review of literature shows that use of Intra tympanic steroids is used as a rescue therapy or salvage therapy when there is no response to standard oral or intra venous steroids.

Few authors have tried it as a primary mode of treatment. In the present study group B patients are given Intratympanic Methyl Prednisolone as a primary therapy.[7] Both adrenocorticoid

DOI: 10.14260/jemds/2015/903

and glucocorticoid receptors are found in the inner ear, though the precise mechanism of action is not known.[8] The main role of steroids is to protect the cochlea from inflammatory mediators released like TNA- a and NFK b.[9] Steroids increase the blood flow to the cochlea and regulate protein synthesis in cochlea.[10] Striae vascularis which is the principal site of injury; Steroids improve its function.[5] Silverstein et al quoted that intra tympanic steroids are safe and do not produce histological changes in the cochlea.[8] The main clinical presentation is sudden hearing loss, which is also attributed to common ear fullness by the patients. The fullness in the ear can be due to wax impaction or congestion of Eustachian tube as in URTI. The patients may delay medical attention or may be delayed before being referred to an ENT specialist.

The window period before any definitive treatment is started in SSNHLS is 4 weeks, which is very small. In the present study the principal complaint for which the patients attended the hospital is Deafness.[8] Intratympanic steroids are used in 1991 by Itoh in the treatment of Meniere's disease.[9] Its use in SSNHL documented by silverstein in 1996;[10-14] this is followed by many authors who described use of Intratympanic steroids for SNNHL. The mode of action, its efficacy and consistency of this therapy is not clear, but it is widely used. Intratympanic steroids are used as a Primary Therapy- as a first line of treatment for SSHNL, without systemic corticosteroids. It is used as an Adjuvant therapy- concomitantly used with systemic steroids. It is also used as a rescue therapy- Intratympanic injections starting after the initial systemic steroids have failed to give recovery of hearing.[6,11,13] Primary therapy came in to vogue because of certain group of patients who do not tolerate systemic steroids, uncontrolled Diabetes and Hypertension.[15] Wilson et al in their double blind placebo-controlled study showed a significant benefit of systemic steroid for hearing improvement in patients with SSHL.[10,15,16,17,18,] Intratympanic steroids used as a rescue therapy is used by many authors.[19,20] Two authors studied the result of Intratympanic steroid therapy as primary therapy.

In the present study all the three types of Intratympanic steroids therapy used as well as Systemic steroid therapy is used as a control group to know the significance. Equal numbers of patients are taken in each group with identical demographic data and minimal co-morbid conditions. 39.89% of the patients of group A showed a reduction in PTA from 78.2 to 31.2 dB, in group B 46.72% of the patients showed a reduction in PTA from 73.2 to 34.2 and in group C the improvement is seen in 32.14% of patients reducing their PTA from 67.2 to 21.6. This is statistically significant improvement in all the three therapies.[8] The advantages of Intratympanic steroids are; It is an outpatient procedure, easy to administer, therapy is started soon after the diagnosis is established, relatively painless and High dose of steroids can be delivered directly into the middle ear. The disadvantages are; TM perforation, otalgia, otitis media, vertigo and hearing loss. Moreover it is very easy to convince the patients.[4] SSNHL can be viewed as a part which falls in a broader spectrum of disease like vestibule- cochlear dysfunction. At one end of it is a condition with sudden onset of pure vertigo without auditory symptoms and known as vestibular neuritis. This entity is attributed to be a peripheral viral inflammation of vestibular nerve.

The vertigo in such condition recovers in a period of 6 weeks due to central compensation, but the hearing never recovers. Labyrinthitis is believed to be a viral infection affecting the membranous labyrinth and its fluid, hence involves both the auditory and vestibular parts; clinically presenting with both vertigo and hearing loss. The difference between vestibular neuritis and Labyrinthitis is based on hearing involvement. At the auditory end of the spectrum SSNHL fits in with

DOI: 10.14260/jemds/2015/903

only hearing loss with mild, brief and transient vertiginous symptom. The Neurology literature clubs all these conditions as a single entity called as "Neurolabyrinthitis".[21] Plaza G et al in their nonrandomized control study found that in refractory cases to standard treatment with intra venous steroids, intra tympanic steroids are having statistical significant benefit, without any adverse effects.[22] Dispenza F et al in their prospective study found that intra tympanic administration of steroids act as a salvage method to recover hearing loss in patients who are earlier treated with Oral or Intravenous steroids. The earlier treatment with steroids seems to have a protective role in these patients treated with salvage treatment.[23,24] Salt et al demonstrated in their study that many substances can reach the vestibule by passing extracellular route between scalae and through spiral ligament.[5,13,25] Parnes and others have shown that there are non-linear flow and interscalar pathways for substances administered through intra tympanic route to reach the inner ear fluids.[16,23,24]

Steroids injected into middle ear reach very high concentrations in the Perilymph than when given through systemic route.[26,27] Salt and Saijo using different markers like TMPA and peroxidase respectively demonstrated that non uniform high concentrations of the substances reach close to the basal turn than apical turn of the cochlea.[18,28,29,30] Spontaneous recovery of hearing loss in SSNHL is observed from 31% to 65% of the patients, so it is difficult to confirm that the therapies used are really improving the hearing. The best method to explain this possibility is that each author measures his success in a different manner.[31,32] As there are no fixed criteria to measure the recovery from hearing loss in SSNHL patients, especially for those who are recovering from a failed systemic steroid therapy, an improvement in PTA of 10 dB or more and recovery of 10% or more in SRT is taken as 50% recovery of the initial loss; Wilson's et al criteria 1. In the present study recovery of hearing is taken when 20 dB decreases in PTA and improved SRT by more than 15%.[19] Choung et al showed better improvement with Intratympanic combined with systemic steroids in one group (38%). Using systemic steroids alone showed improvement only in 6.1%.[33] Slattery showed a 10dB improvement – PTA or 12% SRT and decrease in tinnitus in 55% of patients who are given Intratympanic steroids after failure with systemic steroids.

Treatment of group A patients with oral steroids. In the present study there is a positive correlation between the recovery results of PTA between Group A and B, A and C and B&C (Table 9). One can deduce that all the three therapies are equal in their effectiveness. In contrast there is no correlation between group A and B for the improvement mean values of SRT, but there is significant correlation between A&C and B&C (table 9).[20] Dallan et al recorded improvement of 75% in 8 patients of SSNHL treated with Intratympanic steroids.[34] Shaia and sheehy noted marked improvement in patients in whom treatment started within 1 week after the onset of symptoms. In 10% of the patients where the treatment started 12 weeks later also showed improvement.[35] Fuse et al there was complete recovery within 7 to 10 days after starting steroids. Those patients who did not show improvement initially did not recover to normal status even when the follow up is for 3 months to 2 years.

In the present study there is not much difference in the recovery of hearing related to the start of therapies from the onset of symptoms. Patients of all the three groups showed more than 70 % of recovery in spite of late start.[36] Shima Arastou et al in a combined therapy of systemic and Intratympanic steroids versus systemic steroids alone showed that the combined therapy is more effective than systemic steroids alone. Further studies are required to prove the efficacy of the combined therapy in the treatment of ISSNHL. Battaglia et al. from their study revealed that the

combination therapy of Intratympanic steroids and High dose Prednisolone therapy gives better recovery than systemic steroids alone. "Overall, Intratympanic methylprednisolone was shown to be not inferior to oral prednisone for treatment of idiopathic sudden sensorineural hearing loss. In the present study the three therapies adopted showed overall significant effect in recovering the lost hearing in the patients. A review of studies published to this date shows that the definition of success or post-therapy improvement may differ significantly between authors.

CONCLUSIONS: Use of steroids in the treatment of SSNHL, Intratympanic route, Systemic route and as rescue therapy has given overall equal recovery in the patients of the present study. There is only marginal difference in the percentage of patients recovering hearing either in the form of reduction I their PTA or improvement in SRT scores. In our study the success rate is 100% with systemic and Intratympanic route by way of observation of fall in PTA values. The success rate is 73.3% in Post systemic steroid therapy patients treated with Intratympanic steroids. The reason may be due to delay in starting rescue therapy.

REFERENCES:

1. Gerard J Gianoli, John C LI. Transtympanic steroids for Treatment of Sudden Hearing Loss. Otolaryngology-Head and Neck Surgery. 125. 3. 142-46.
2. Hughes GB, Freedman MA, Haberkamp TJ, Guay ME. 1996. Sudden sensorineural hearing loss. Otolaryngologic clinics of North America 29. 393-405.
3. Byl FM, Jr. 1984. Sudden hearing loss: eight years' experience and suggested prognostic table. The Laryngoscope 94. 647-61.
4. Plaza G, Herráiz CI, Intratympanic steroids for treatment of sudden hearing loss after failure of intravenous therapy. Otlaryngology head and Neck surgery. 2007. 137. 1. 74-78. 5.
5. Silverstein H, Choo D, Rosenberg SI, Kuhn J, Seidman M, Stein I. Intratympanic steroid treatment of inner ear disease and tinnitus (preliminary report). Ear Nose Throat J. 1996. 75. 468 - 71.
6. Igor Teixeira Raymundo, Fayez Bahmad Jr[I], Jairo Barros Filho, Thaís Gonçalves Pinheiro, Nilda Agostinho Maia, Carlos Augusto Oliveira, Intratympanic methylprednisolone as rescue therapy in sudden sensorineural aearing loss, 2010. Braz. j. otorhinolaryngol. 76.4. 499-509.
7. Rarey KE, Luttge WG. Presence of type I and type 2/IB receptors for adrenocorticosteroid hormones in the inner ear. Hear Res. 1989. 41. 217-21.
8. Stockroos RJ, Albers FW, Schirm J. The etiology of idiopathic sudden sensorineural hearing loss. Experimental herpes simplex virus infection of the inner ear. Am J Otol. 1998. 19. 447- 52.
9. Nagura M, Iwasaki S, Wu R, Mizuta K, Umemura K, Hoshino T. Effects of corticosteroid, contrast medium and ATP on focal microcirculatory disorders of the cochlea. Eur J Pharmacol. 1999. 366. 47-53.
10. Tabuchi K, Oikawa K, Uemaetomari I, Tsuji S, Wada T, Hara A. Glucocorticoids and dehydroepiandrosterone sulfate ameliorate ischemia-induced injury of the cochlea. Hear Res. 2003. 180. 51-6.
11. Itoh A, Sakata E. Treatment of vestibular disorders. Acta Otolaryngol Suppl. 1991. 481. 617- 23.

12. Silverstein H, Choo D, Rosenberg SI, Kuhn J, Seidman M, Stein I. Intratympanic steroid treatment of inner ear disease and tinnitus (preliminary report). Ear Nose Throat J. 1996. 75. 468 - 71.
13. Parnes LS, Sun AH, Freeman DJ. Corticosteroid pharmacokinetics in the inner ear fluids: an animal study followed by clinical application. Laryngoscope.1999. 109. 1-17
14. Chandrasekhar SS. Intratympanic dexamethasone for sudden sensorineural hearing loss: clinical and laboratory evaluation. Otol Neurotol. 2001. 22. 18 -23.
15. Wilson WR, Byl FM, Laird N. The efficacy of steroids in the treatment of idiopathic sudden hearing loss. A double- blind clinical study. Arch Otolaryngol. 1980. 106. 772-6.
16. Gianoli GJ, Li JC. Transtympanic steroids for treatment of sudden hearing loss. Otolaryngol Head Neck Surg. 2001. 125. 142-6.
17. Kopke RD, Hoffer ME, Wester D, O'Leary MJ, Jackson RL. Targeted topical steroid therapy in sudden sensorineural hearing loss. Otol Neurotol. 2001. 22. 475- 9.
18. Lefebvre PP, Staecker H. Steroid perfusion of the inner ear for sudden sensorineural hearing loss after failure of conventional therapy: a pilot study. Acta Otolaryngol. 2002. 122. 698 -702.
19. Choung YH, Park K, Shin YR, Cho MJ. Intratympanic dexamethasone injection for refractory sudden sensorineural hearing loss. Laryngoscope. 2006. 116. 747-52.
20. Dallan I, Bruschini P, Nacci A. Transtympanic steroids as a salvage therapy in sudden hearing loss: preliminary results. ORL J Otorhinolaryngol Relat Spec. 2006. 68. 247-52.
21. Plaza G[1], Herráiz C.Intratympanic steroids for treatment of sudden hearing loss after failure of intravenous therapy. Otolayngology and Head & Neck Surgery. 2007.137.1. 74-78.
22. Dispenza F, De Stefano A, Costantino C, Marchese D, Riggio F. Sudden sensorineural hearing loss: results of intra tympanic steroids as salvage treatment. 2013. 34. 4. 296-300.
23. Salt AN, Ohyama K, Thalmann R. Radial communication between the perilymphatic scalae of the cochlea. I, Estimation by tracer perfusion. Hear Res. 1991. 56. 29 -36.
24. Salt AN, Ohyama K, Thalmann R. Radial communication between the perilymphatic scalae of the cochlea. 2: Estimation by bolus injection of tracer into the sealed cochlea. Hear Res. 1991. 56. 37- 43.
25. Battista RA. Intratympanic dexamethasone for profound idiopathic sudden sensorineural hearing loss. Otolaryngol Head Neck Surg. 2005. 132. 902-5.
26. Plontke S, Zenner HP. Pharmacokinetic considerations in intratympanic drug delivery to the inner ear. Acta Otorhinolaryngol Belg. 2002. 56. 369 -70.
27. Chandrasekhar SS, Rubinstein RY, Kwartler JA, Gatz M, Connelly PE, Huang E, et al. Dexamethasone pharmacokinetics in the inner ear: comparison of route of administration and use of facilitating agents. Otolaryngol Head Neck Surg. 2000. 122. 521-8. 26.
28. Bachmann G, Su J, Zumegen C, Wittekindt C, Michel O. Permeabilitat derrunden Fenster membran fur Prednisolon-21-Hydrogensuccinat. Prednisolongehalt der Perilymphe nach lokaler Applikation vs. systemischer Injektion. HNO. 2001. 49. 538-42.
29. Salt AN, Ma Y. Quantification of solute entry into cochlear Perilymph through the round window membrane. Hear Res. 2001. 154. 88-97.
30. Saijo S, Kimura RS. Distribution of HRP in the inner ear after injection into the middle ear cavity. Acta Otolaryngol. 1984. 97. 593-610.

DOI: 10.14260/jemds/2015/903

31. Mattox DE, Simmons FB. Natural history of sudden sensorineural hearing loss. Ann Otol Rhinol Laryngol. 1977. 86. 463-80.
32. Cinamon U, Bendet E, Kronenberg J. Steroids, carbogen or placebo for sudden hearing loss: a prospective double-blind study. Eur Arch Otorhinolaryngol. 2001. 258. 477- 80.
33. SlatteryWH, Fisher LM, Iqbal Z, Friedman RA, Liu N. Intra-tympanic steroid for the treatment of sudden hearing loss. Otolaryngol Head Neck Surg. 2005. 133. 251-9.
34. Shaia FT, Sheehy J. Sudden sensorineural hearing impairment: a report of 1220 cases. Laryngoscope. 1976. 86. 389-98.
35. Fuse T, Aoyagi M, Funakubo T, Sakakibara A, Yoshida S. Short-term outcome and prognosis of acute low-tone sensorineural hearing loss by administration of steroid. ORL J Otorhinolaryngol Relat Spec. 2002. 64. 6-10.
36. Shima Arastou, Ardavan Tajedini, and Pedram Borghei. Combined Intratympanic and Systemic Steroid Therapy for Poor-Prognosis Sudden Sensorineural Hearing Loss. Iran J Otorhinolaryngol. 2013 Winter; 25. 70. 23–28.

AUTHORS:

1. A. Sesha Prasad
2. V. Ravishankar
3. S. Muneeruddin Ahmed
4. M. Mahendra Kumar

PARTICULARS OF CONTRIBUTORS:

1. Professor, Department of ENT, Kurnool Medical College, Kurnool, Andhra Pradesh.
2. Assistant Professor, Department of ENT, Osmania Medical College, Hyderabad, Telangana.
3. Formerly Professor, Department of ENT, Osmania Medical College, Hyderabad, Telangana.
4. Assistant Professor, Department of ENT, Kurnool Medical College, Kurnool.

NAME ADDRESS EMAIL ID OF THE CORRESPONDING AUTHOR:

Dr. S. Muneeruddin Ahmed,
44/118, 2nd Lane,
Prakash Nagar, Kurnool.
E-mail: ahmedmunirent@gmail.com

FINANCIAL OR OTHER COMPETING INTERESTS: None

Date of Submission: 03/04/2015.
Date of Peer Review: 04/04/2015.
Date of Acceptance: 24/04/2015.
Date of Publishing: 01/05/2015.