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Original Research Article

Effect of intratympanic dexamethasone injection in sudden idiopathic sensorineural hearing loss

K. Mallikarjuna Swamy[1]*, Arati Ganiger[2]

[1]Department of ENT, [2]Department of Biochemistry, Koppal Institute of Medical Sciences (KIMS), Koppal, Karnataka, India

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***Correspondence:**
Dr. K. Mallikarjuna Swamy,
E-mail: drkmallikarjuna1980@gmail.com

ABSTRACT

Background: The aim of this study is to assess the effect of intratympanic dexamethasone injection (ITDI) in patients with idiopathic sudden sensorineural hearing loss (ISSNHL).
Methods: A prospective study was conducted on 40 patients refractory to intravenous steroid therapy between May 2012 to March 2014. Intratympanic dexamethasone injection was given every week for 3 consecutive weeks. Hearing was assessed by performing pure tone audiogram before every ITDI and also 1 week after the completion of treatment.
Results: Hearing improvement was seen in 27 out of the 40 cases (68%).
Conclusions: Intratympanic dexamethasone significantly improves the prognosis of ISSNHL and is a safe, inexpensive and effective treatment in ISSNHL.

Keywords: Intratympanic dexamethasone, Sudden sensorineural hearing loss

INTRODUCTION

Sudden sensorineural hearing loss（SSNHL）is a syndrome covering several heterogenous entities resulting from different pathogenic mechanisms. It is a devastating disease for patients and represents a true otologic emergency. The etiologies of sudden hearing loss are many, but only about 10–15% of cases have an identifiable cause.[1] Oral steroids have been effective in many patients and currently represent the standard treatment for idiopathic sudden sensorineural hearing loss (ISSNHL).[2-4]

Steroids are believed to reduce inner ear inflammation and autoimmune response and to be beneficial for recovery of nerve function. Steroid receptors have been found in the inner ear and may explain why steroid therapy is effective. But for patients with diabetes, tumors, peptic-ulcers, tuberculosis, hypertension and other systemic disorders, steroid therapy may not be appropriate. Intratympanic steroids injection is a new treatment choice for these patients, and may also offer alternatives for cases that have failed to respond to typical medicine treatments. Intratympanic steroids (ITSs) may treat ISSNHL more effectively than oral steroids.[5-12] Data to support this hypothesis are limited almost exclusively to case series, which differ in the type of steroid used, the steroid dose, the dose frequency, the method of injection, the existence of previous treatment with oral steroids, and the outcome measurements. Most cases of sudden hearing loss are idiopathic not because they do not have a cause but because we are unable to identify it.

Studies have been already done in other areas but very few in our locality. Hence the present study was conducted to determine therapeutic effects of different intratympanic dexamethasone injection protocols on

sudden hearing loss in an attempt to determine an appropriate protocol to improve our approach to SD.

METHODS

It was a prospective study. It was conducted on 40 patients in the age group of 25 to 50 years, diagnosed with unilateral SNHL of unknown causes attending the out-patient department of ear, nose and throat at JJM Medical College, Davangere. The study was conducted over a period of 2 years from May 2012 to March 2014. Ethical clearance was obtained from the institute's ethical clearance committee. Informed consent was taken from the cases after explaining the procedure. Inclusion and exclusion criteria are mentioned below in Table 1. Table 2 shows the grading of severity of hearing loss.

Table 1: Inclusion and exclusion criteria.

Inclusion criteria :
• Patients who had a sensorineural hearing loss of atleast 30 dB in 3 contiguous frequencies occurring in less than 72 hours, idiopathic SNHL
• Those who presented after 1- 7 days of onset of hearing loss, previously untreated, with normal hearing in contralateral ear
• Unresponsive to a 10 day course of systemic medications
• Those with negative serological studies for infective and inflammatory diseases (syphilis, autoimmune antibodies, rheumatoid factor)
• Those with normal magnetic resonance imaging (MRI) with contrast of the brain and internal auditory canals were included in the study
Exclusion criteria:
• Those patients who presented with h/o chronic otitis media, Meningitis, Meniers disease
• Those with fluctuating hearing loss
• Those who had previous ear surgeries
• Those with h/o trauma (head, acoustic, bariatric)
• With h/o exposure to radiation
• Intake of ototoxic medications were excluded from the study.

Table 2: Grading of severity of hearing loss.

Grading of severity of hearing loss
• Mild: 26-40dB
• Moderate: 41-55 dB
• Moderately severe: 56-70 dB
• Severe: 71-90 dB
• Profound : > 90 dB

Conventional treatment

All the patients received a combination of complamina (xantinol nicotinate) and steroid (methyl prednisolone) intravenously. Complamina was given as an intravenous infusion in a dose of 1500 mg (5 ampoules) diluted in 500 cc of 5% dextrose over a period of 20 to 30 minutes with constant blood pressure monitoring. This infusion was given once a day for a period of 5 days. Injection methyl prednisolone (1 gm) was diluted in 100 cc of normal saline and given intravenously over a period of 30 minutes once a day for 3 consecutive days. Daily audiograms were done during hospitalisation to look for any improvement in hearing. Those patients with partial or no response to conventional therapy were enrolled in the study for intratympanic dexamethasone injection on an outpatient basis.

Audiometric measurements

Patients were evaluated for pure-tone thresholds and speech intelligibility both before and after steroid injection. The pure-tone average (PTA) was calculated as an average of thresholds measured at 0.5, 1.0 and 2.0 KHz. Speech-discrimination scores (SDSs) were calculated as the percent of phonetically balanced, monosyllabic words pronounced correctly.

Method of intratympanic injection

The patient is positioned in the supine position. With a 25 gauge $1^1/_2$ inch long needle and Tuberculin syringe, a puncture was made in the anterosuperior quadrant for air perfusion and then another puncture was made just anterior to it for ventilation. 0.3-0.5 ml of dexamethasone injection (4 mg/ml) was injected through this site. Intratympanic dexamethasone injection was given once a week for 3 consecutive weeks.

Patient should avoid the swallowing reflex and patient should remain in the same position with head tilted 45 degrees to the opposite side for 15 to 20 minutes. Audiograms were performed at the completion of conventional steroid therapy, prior to every dose of ITDI and at the completion of ITDI.

Statistical analysis

Data was analyzed by statistical tests by using SPSS package version number 19. Data was expressed in terms of mean±SD. Chi-square tests were used to determine the association between patient characteristics and improvement. The mean age, average time from onset to treatment and degree of hearing loss were analysed using t-tests. P value <0.05 was taken as statistically significant. Improvement was defined as an improved pure-tone average ≥20 dB or speech-discrimination score ≥20%. The variables evaluated included time to post-treatment audiogram, age, gender, sidedness of hearing loss, days from onset to ITS treatment (>14days), prior treatment with oral steroids, presence of vertigo and presence of tinnitus.

RESULTS

This was a comparative study conducted on 40 diagnosed cases of SSNHL. Demographic characteristics of the subjects were shown in Table 3. The mean age (in years) of cases was 49.5±11.7 years and was not significant (p >0.005). The average number of days from the onset of hearing loss to the initiation of ITS was 22.7 days. The overall response rate was 50% (20/40) as presented in Figure 1.

Table 3: Demographic characteristics of the subjects.

Characterstics	
Age (in years)	
Mean	48
Range	25-50
Ear	
Right	14
Left	26
Oral steroids prior to ITS	24
Days to treatment with ITS	22.7
Mean	1-120

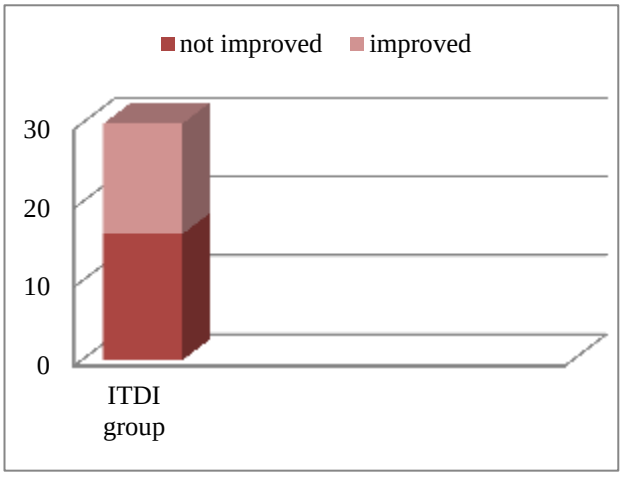

Figure 1: Overall response rate in cases (50%).

DISCUSSION

Sudden SNHL is an otologic emergency. If treated at correct time, it can be potentially reversed. Currently, steroids are the most potent medication used in treating sudden SNHL. The main purpose of using steroids in sudden SNHL is activation of all the glucocorticoid receptors in the cochlea.

A very little is known currently about the receptor binding functions, or the cellular or molecular processes that are activated by receptor binding. Intratympanic steroid therapy can be used as an additional or alternative treatment for the management of sudden SNHL. When applied intratympanically, steroids enter the perilymphatic space through the round window membrane and result in higher concentration in endolymph and perilymph than when given intravenously. There is no significant elevation in plasma steroids after intratympanic instillation of steroids. The higher concentration and the longer duration of steroids in the inner ear after intratympanic instillation make them effective in cases that are refractory to systemic steroids or in cases with late presentation.[10-12]

In our study, nearly fifty percent patients (46.2%) showed improvement in hearing with IT administration of dexamethasone after unsuccessful intravenous steroids administration. Our data are similar to other reviews of ITS with regard to demographics of ISSNHL and response rate to ITS; however, our review differs in that it specially addresses the timing of post-treatment audiograms when assessing treatment response.

A few studies have reported the use of serial audiograms during or immediately after the completion of treatment with ITS. These studies have found that the greatest treatment response is after the first injection.

Guan-Min et al performed serial audiograms in patients who received intratympanic dexamethaxone after failure with oral steroids. Audiograms were performed after each of 3 injections.[5] The greatest response to treatment was 7 days after the first injection with a steadily decreasing steroid effect there-after. There were significant differences between the PTA after the first and third injection, corresponding to 7 and 21 days after treatment began. Choung et al also performed serial audiograms after intratympanic dexamethasone was administered twice a week for 2 weeks.[13] Audiograms were performed after each injection and found similar response early, with the greatest response in 35.8% of ears after the first injection, 14.7% after the second, and 11.8% after the third; however, Choung also performed an audiogram 1week after the final injection. There was an increased response rate from 11.8% on day 14 to 20.6% on day 21. The studies of Guan Min and Choung provide valuable information regarding the early response to treatment with ITS but do not address the response to treatment that

may occur several weeks after the completion of treatment.

By definition, ISSNHL is from an unknown etiology and is a result of multiple unknown causes. Within this heterogeneous group, there are likely to be early, late, and non-responders to steroid treatment. There may also be a number of patients who are recovering spontaneously, regardless of steroid therapy. This has been reported to be somewhere between 31% and 65%.[14,15]

Nevertheless, the timing of the audiogram will determine the observed response; therefore, when reporting results of idiopathic hearing loss, studies should, atleast, report when the audiograms were performed. Ideally, a series of audiograms should be administered during and after treatment to document the timing of treatment response. This will identify early versus late responders and may provide important clues to the etiology of hearing loss. It may also have implications with regard to the determination of the length of treatment.

Another possibility to explain the late effect of ITS is how long it may affect inner ear cells. Intratympanic methyl prednisolone has been detected in the perilymph and endolymph in guinea pigs for a fairly short duration; it achieves its highest concentration at 1-2 hours and is present for atleast 6 hours, but it is no longer detectable at 24 hours.[16] Despite the brief existence of steroids within the inner ear fluid, the effect may be more durable and has not yet been determined. Steroids effect gene expression in cochlear cells to alter both inflammatory processes and ion homeostasis.[17-19] A delayed effect of treatment may well be via a mechanism that takes greater than 3 weeks to demonstrate a measurable response.

CONCLUSION

Intratympanic steroid therapy is a safe, inexpensive and effective treatment in refractory cases of sudden SNHL.

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