Intratympanic Injections of steroids For Treatment of sudden sensorineural hearing loss: Does the frequency of injections affect the outcome?

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Abstract:

Background: Sudden sensory neural hearing loss (SSNHL) is an ENT emergency which is defined as a loss of hearing of 30 dB or more, over at least 3 successive frequencies, that develops within 3 days in most cases it is unilateral and the most age group to be affected are 40s and 50s in most cases the cause is not known and called idiopathic sensory neural hearing loss. pure tone audiometry is done to confirm the hearing loss, history, examination, MRI and blood tests to exclude serious underlying causes .

Objective: to compare between the efficacy of four versus two intra tympanic injection of steroid for treatment of sudden idiopathic sensory neural hearing loss.

Patients and Methods. During the time frame from February 2020 to January 2021 a thirty patients (15 males and 15 females) with ISSNHL who visited our otorhinolaryngology department, Qena university hospital. were merged with intra tympanic steroid injection for treatment of sudden sensory neural hearing loss. The ages rang was from 40 to 69.

Results: According to our statistical analysis and data, hearing improvement after 4 intra tympanic injection is better than 2 injections with a p value is 0.000.

Conclusion: Injection of 4 times intra tympanic injection of steroid appears to be more effective than two times of injection.

Keywords: SSNHL, intra tympanic , corticosteroids.

Introduction

Idiopathic sudden sensory neural hearing loss (ISSNHL) is not considered an isolated disease by itself but it is may be one symptoms of a lot of diseases . There are a lot of management techniques one of them is , systemic corticosteroids which is the commonest to be used. despite of this , the effect and the outcome of systemic steroids is doubtful by many trials **(Nosrati-Zarenoe and Hultcrantz, 2012).**

For a long time , intra tympanic steroid was found as one of management of a diversity of inner ear conditions ,such as ISSNHL **(Lavigne et al., 2016)**.

Administration of Intra tympanic steroid was done in a study that listed that intra tympanic injection of dexamethasone at a higher dose found to have a better outcome than the outcome with a little dose ten versus four mg/mL for the treatment of ISSNHL.

(Yasser and Samir , 2020.)

Local steroid therapy was found to make a high rate of complete hearing recovery than systemic steroids usage as a treatment of SSNHL, which is particularly good for cases who are contraindicated to have systemic

steroids.(**Dan Zhao,a,1 Busheng Tong et al 2016)**

the two main benefits of Trans tympanic route: (1) it allow more deposition of steroids in the cochlea than systemic administration either by iv or per oral administration; (2) it has no side effects like the systemic use of steroid .

Many authors reported the effectiveness of topical administration of steroid in SSNHL, Meniere's disease, and a lot of internal pathologies **(Gianoli and Li, 2001)**.

Patients and Methods

During a time frame from February 2020 to January 2021 a thirty patients (15 males and 15 females) with ISSNHL who visited our otorhinolaryngology department, Qena University were planned for intra tympanic steroid injection for treatment of sudden sensory neural hearing loss inclusion and exclusion criteria were set for our treatment protocol and enrollment in the analysis. The inclusion criteria were Patients with sudden idiopathic sensory neural hearing loss, and with the duration from the beginning of complaining of hearing loss to the beginning of intervention is less than or equally one month, Cases should have Normal otoscopic examination.

Exclusion criteria Were cases who have diabetes mellitus with complications like severe kidney disease ,retinal pathology and neural affection, cases who have history of chronic otitis media. history of meningeal inflammation , history of Meniere's disease, or hearing loss in relapsing manner , history of having drugs that considered as ototoxic, history of irradiation exposure , history of past ear surgery. History of trauma to the ear or to the head .

. and cases do not agree with our treatment strategy .

All procedures were done at ENT department, Qena University Hospital. cases who met the inclusion criteria were treated with intra tympanic methylprednisolone injections 4 times. At day 1,2.4 and 7 Informed consent was obtained from participants .

Injection technique: Patient rest on supine position with the head directed to the normal side .

Lidocaine solution is applied in a cotton to the external ear canal till it reach the tympanic membrane for topical anesthesia left for 15 minutes in the ear canal before injection.

Spinal syringe is introduced on to lower postero inferior quadrent of the tympanic membrane to deliver the drug through it.

Patient received 0.2ml to 0.4 ml Methyl prednisolone which is injected slowly. Patients were directed to maintain a supine position with their heads turned 45° to the opposite side for 30 minutes after injection.

Post injection evaluation audiometry was done after the second and after the fourth injection.

no prophylactic antibiotic is needed before or after injection

Assessment Parameters: To compare between hearing improvement through hearing threshold audiogram at 500, 1000, 2000 and 4000 Hz of pre injection, post 2 injections and post 4 injections of intra tympanic steroid.

Results

There was a statistical great difference between the 4 and 2 intra tympanic methylprednisolone injection.

Table 1. Comparison between audiogram pre and post 2 injections

Variable	Pre	Post 2	P-value	Percent change
At 500 HZ	70.3±19.9	56.8±18.4	.000	19.2% improvement
At 1000 HZ	73.7±23.7	61 ± 20.5	0.000	17.3%
At 2000 HZ	82.7±22.4	70.7±22.7	0.000	14.5%
At 4000 HZ	91.8±22.7	79 ± 24.4	0.000	13.9%
Total average	79.6±21.2	66.7±20.7	0.000	16.2%

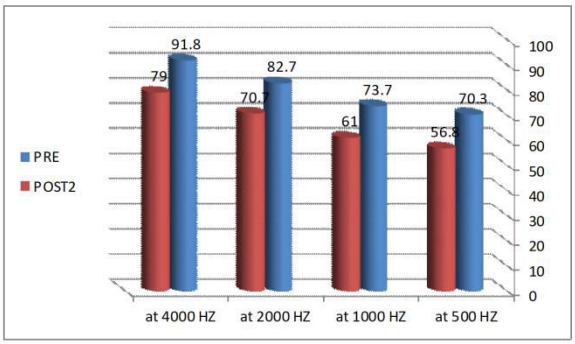

Fig.1. Histogram showing difference between pre and post 2 injections mean value audiogram.

The mean value at 500 Hz pre injection was 70.3 and post 2 injections became 56.8 so there is significant difference and the p value is 0.000.

+At 1000 Hz the mean value was 73.7 and post 2 injections became 61 so there is +significant difference and the p value is 0.000.

At 2000 Hz the mean value was 82.7 and post 2 injections became 70.7 so there is significant difference and the p value is 0.000.

At 4000Hz the mean value was 91.8 and post 2 injections became 79 so there is significant difference and the p value is 0.000, as shown in Table 1.

After the patient underwent the fourth intra tympanic injection audiogram was done and the result was: the mean value at 500 Hz pre injection was 70.3 and post 4 injections became 42.8 so there is significant difference and the p value is 0.000.

At 1000 Hz the mean value was 73.7 and post 4 injections became 47 so there is significant difference and the p value is 0.000.

At 2000 Hz the mean value was82.7 and post 4 injections became 59.3 so there is significant difference and the p value is 0.000. At 4000Hz the mean value was 91.8 and post 4 injections became 66.8 so there is significant difference and the p value is 0.000 as shown in table 2.

Table 2. Comparison between audiogram pre and post 4 injections

Variable	Pre	Post 4	P value	Percent change
At 500 HZ	70.3 ±19.9	42.8±19.6	0.000	39.1% improvement
At 1000 HZ	73.7 ±23.7	47 ± 20.1	0.000	36.2%
At 2000 HZ	82.7 ±22.4	59.3 ± 22	0.000	28.3%
At 4000 HZ	91.8 ±22.7	66.8±22.5	0.000	27.2%
Total average	79.6 ±21.2	54 ± 20	0.000	32.2%

The mean value at 500 Hz post 2 injections was 56.8 and post 4 injections became 42.8 so there is significant difference and the p value is 0.000. At 1000 Hz the mean value was 61 and post injections became 47so there is significant difference and the p value is 0.000. At 2000 Hz the mean value was 70.7and post 4 injections became59.3 so there is significant difference and the p value is 0.000. At 4000 Hz the mean value was79 and post 4 injections became 66.8 so there is significant difference and the p value is 0.000, As shown in table 3.

Table 3. Comparison between audiogram post 2 and post 4 injections

Variable	Post 2	Post 4	P value	Percent change
At 500 HZ	56.8±18.4	42.8±19.6	0.000	24.6% improvement
At 1000 HZ	61 ± 20.5	47 ± 20.1	0.000	23%
At 2000 HZ	70.7±22.7	59.3 ± 22	0.000	16.1%
At 4000 HZ	79 ± 24.4	66.8±22.5	0.000	15.4%
Total average	66.7±20.7	54 ± 20	.000	19%

Discussion

Intra tympanic corticosteroids are now the main line of treatment of SSNHL. As the Intra tympanic (IT)steroids introduction results in more perilymph level of steroid than systemic use of steroids, also IT steroid could not reach the general circulation **(Chandrasekhar et al., 2000)**. Intra tympanic steroids were indicated for cases of SSNHL who are contraindicated to have systemic steroids and also for cases that not responding of the systemic use of steroids **(Dallan et al., 2010)**.

There are a lot of benefits of Intra tympanic steroids use. The most important benefit is that it is possibility of giving treatment to all cases complaining of SSNHL without making side effects of systemic use of steroid and so manage this cases who are contraindicated to have systemic steroid like immune compromised patient, diabetic, tuberculosis, HIV. Patients especially old age have more liability for developing complications related to systemic steroids such as glucose disorder , hip joint avascular necrosis of the hip, diminished ability to sleep , general discomfort , stomach upset , and osteoporosis. these side effects could be avoided by it steroid therapy Different benefits are : It is an office based technique , it is possible to treat only the diseased ear and it is possible to give IT steroid in combination with avoidance of serious pharmacological interaction.

Topical introduction of steroid through the ear drum to the middle ear cavity is thought to act on a direct way on the internal ear at a high dose reaching the cochlea. At many trials many different techniques were tested for management of SSNHL one of them listed that forty five % to sixty five % of cases with I SSNHL are thought to have recovery even without treatment with about thirty five DB gain of hearing ***Harris (1984)***

Outcome of idiopathic SSNHL is affected by many risk factors such as personal history of the cases , how long the hearing loss was , related complains and the shape of audiogram of the personal history the most influencing factor is the age as it was noticed that age above sixty showed less recovery of hearing threshold , listed a poorer outcome in cases less than fifteen years old at complaining to have SSNHL **(Chandrasekhar et al., 2000)**. Also SSNHL accompanied with abnormality of the vestibular system or past

history of hearing loss also found to have a bad outcome.(**Daniel Weiss, Armin Julius Böcker 2017)**

Our study showed that the number of intra tympanic injection of methylprednisolone influence the outcome and hearing recovery our study showed that 4 injections is better than 2 injections.

We agree with **Amani et al. (2018)** that listed that intra tympanic introduction of dexamethasone results in progress of pure tone audio about eighteen dB and also in speech discrimination is improved about eighteen to twenty four . These result was statistically significant.

We also agree with **Conlin and Parnes (2007)**, who announced that The percent of cases to have recovered was forty five %. They also listed that the mean gain of pure tone audio about sixty two dB and the percent of cases to have recovered was forty six. **Banerjee and Parnes (2005)** in another examination announced that pure tone audio recovery was about twenty three dB and the percent of cases to be improved was fifty % **Battista et al. (2005**) announced that the mean improvement of pure tone audio about seventeen dB and the percent of cases to have recovery was twelve %..

We disagree with **Ermutlu et al. (2017)** that recorded that the hearing outcome between the fourth and the second injections group are not variable to a strong point. There result showed also that showed that hearing outcome following intervention not related to the number of intra tympanic steroids infusion .listed.

We also disagree with **Suzuki et al. (2018)** that recorded that the hearing outcome between the fourth and the second injections group are not variable to a strong point at any hearing thresholds. There result listed that less number of intra tympanic steroids infusions give equivalent outcome as well as more number in the management of ISSNHL. The treatment with only two intra tympanic infusions would be of great benefit to make the body and mentally stresses of cases

A lot of trials were done to investigate the benefits versus regressions of introducing steroids into the ear drum for treatment of sudden idiopathic sensory neural hearing loss. Our study was done to compare between different number of injections to compare between hearing outcome after two and after four injections.

Our outcome show better hearing after 2 injections and further improvement after 4 injections.

The percent change of hearing threshold after2 injections was 19.2% improvement at 500 Hz, 17.3 % at 1000 Hz, 14.5 % at 2000 Hz and 13.9% at 4000 Hz and the percent change of hearing threshold after4 injections was 39.1 % improvement at 500 Hz, 36.2 % at 1000Hz, 28.3 % at 2000Hz and 27.2% at 4000Hz.

Conclusion

As regard to our statistical results and data, demonstrates distinct advantages in hearing recovery for four versus the two injections. The improvements in recovery are most evident after the fourth injection.

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