Original Article

Effects of Oral Steroids Combined with Postauricular Steroid Injection on Patients with Sudden Sensorineural Hearing Loss with Delaying Intervention: A Retrospective Analysis

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Received: 29-Sep-2022;
Revision: 07-Mar-2023;
Accepted: 19-May-2023;
Published: 14-Jul-2023

Abstract

Background: In the otology clinic, we often receive some sudden sensorineural hearing loss (SSNHL) patients accompanied by annoying tinnitus, who usually visited over three weeks after the onset. Nevertheless, due to the high treatment cost and relatively low cure rate, there are still great disputes about hospitalization or not for these patients. **Aim:** This study aimed to perform a retrospective analysis for analyzing the efficacy of treatment with oral steroids combined with postauricular steroid injection in patients with delaying effective treatment. **Material/Methods:** A total of 157 eligible SSNHL patients with delaying effective treatment over three weeks were enrolled in this study. According to different treatment methods of oral steroids with or without postauricular steroid injection, these patients were divided into three groups: PO (prednisone oral) group, PSI (prednisone oral and postauricular steroid injection) group, and PII (prednisone oral and postauricular lidocaine injection) group. The changes in level of hearing, mean subjective tinnitus loudness, and side effects were analyzed in the three groups. **Results:** Hearing improvement and tinnitus remission were all observed in three groups after treatment. Compared with PO and PII groups, those patients in PSI groups had more improvement in level of hearing and mean subjective tinnitus. The level of tinnitus loudness was statistically significantly correlated with the level of PTA both before treatment and after treatment. **Conclusion:** Oral steroids combined with postauricular steroid injection should be employed for treatment of SSNHL patients with delaying effective treatment over three weeks.

Keywords: *Injection, prednisone, steroids, sudden sensorineural hearing loss*

Background

Sudden sensorineural hearing loss (SSNHL) is a common emergency in otolaryngology.[1] Glucocorticoids therapy, including systemic and topical glucocorticoids, had become the primary mode of SSNHL treatment.[2,3]

Timely treatment is considered as an important positive prognostic factor for SSNHL.[1] However, in practice, some patients still cannot receive effective and timely treatment. Some patients simply present with intolerable tinnitus, which often results in missing the optimal time for the treatment. Tinnitus is a common ear condition that is associated with many physical and mental illnesses and can be persistent, annoying, and costly.[4,5] Chen *et al*.[6] found that some patients who presented more than three weeks after the onset of SSNHL experienced significant improvement in their symptoms during treatment. Therefore, the treatment of these patients is still very necessary.

Due to the relatively low cure rate of patients with an onset of more than three weeks, outpatient treatment

Access this article online

Quick Response Code:

Website: www.njcponline.com

DOI: 10.4103/njcp.njcp_661_22

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How to cite this article: Liu ZB, Zhu WY, Fei B, Lv LY. Effects of oral steroids combined with postauricular steroid injection on patients with sudden sensorineural hearing loss with delaying intervention: A retrospective analysis. Niger J Clin Pract 2023;26:760-4.

obviously has better cost performance. The use of tympanic injection (IT) in outpatient department was limited because of the cost, discomfort, and the complexity of operation. In addition to tympanic injection, the postauricular steroid injection has been recommended to treat SSNHL patients in Chinese Guideline of Diagnosis and Treatment of Sudden Deafness.[7] The operation of postauricular injection is simple to perform and can be completed by outpatient nurses. At the same time, lidocaine injection could be used to reduce the pain during postauricular steroid injection. Previously, in the treatment of refractory SSNHL, we found that postauricular steroid injection achieved the same therapeutic effect as tympanic steroid injection, and no obvious complications and discomfort of postauricular steroid injection were observed.[8] Therefore, we tried to use postauricular steroid injection in the initial intervention of delaying treatment for SSNHL patient with tinnitus.

Materials and Methods

Recruitment and grouping of SSNHL Patients

This study was approved by the Ethics Committee of The Affiliated Huaian No. 1 People's Hospital of Nanjing Medical University (Protocol No. YX-2019-041-55). A total of 157 eligible SSNHL patients were recruited from March 2019 to March 2021 in Otorhinolaryngology-Head and Neck Surgery, The Affiliated Huaian No. 1 People's Hospital of Nanjing Medical University. All patients met the SSNHL criteria.[1] Inclusion criteria were as follows: sensorineural hearing loss occurs within 72 hours and hearing loss of more than 30 dB affecting at least three consecutive frequencies; unilateral hearing loss; age above 18 years; patients accompanied by tinnitus with admission 21 days or more after the onset of symptoms. Exclude patients with hereditary deafness, acoustic neuroma, diabetes, severe hypertension, and voluntary withdrawal from the study or loss to follow-up. The patients were divided into three groups: PO (prednisone oral) group, PSI (prednisone oral and postauricular steroid injection) group, and PII (prednisone oral and postauricular lidocaine injection) group based on the medication used for the patients. The patients in PO group received a 10-day course of oral prednisone 60 mg/day. The patients in PSI group received a 10-day course of oral prednisone, 60 mg/day; concurrently, post auricular injection of 40 mg methylprednisolone (Huapont Pharm Co., Ltd, Chongqing, China) and 0.5 ml lidocaine were performed once two days for a total of five doses. The patients in PII group received a 10-day course of oral prednisone 60 mg/day along with postauricular injections of 0.5 mL lidocaine once two days for a total of five doses. The scheme of administration of steroids is shown in Figure 1. Patients were followed up for more than 2 months after discharge. The efficacy was analyzed according to the pretreatment hearing threshold and the final post-treatment hearing levels. For the purpose of the study, the hearing levels measured at 3 months after onset were considered as the final post-treatment hearing levels. Pure-tone averages (PTA) were calculated as the average of the thresholds measured at 0.5–4.0 kHz. The overall rate of hearing improvement (PTA improvement ≥15 dB) based on Siegel's criteria.[9]

Tinnitus loudness was recorded on a numerical scale from 0 to 10 (0 = no tinnitus, 10 = extremely loud) to compare the change in tinnitus loudness between the different groups before treatment and three months after treatment.[10]

Statistical analysis

All data were summarized as mean ± standard deviation. Statistical analyses were performed using SPSS 20.0 software (IBM, Armonk, NY, USA). T test was used to compare the values of means between groups. General clinical data between groups were studied by Chi-square and one-way ANOVA test. A value of $P < 0.05$ was considered a statistically significant difference.

Results

A total of 157 eligible patients with SSNHL participated in the study and completed the follow-up. There were no significant differences between the PO, PSI, and PII group in terms of gender, age, the course of disease, pretreatment PTA, duration from onset to the treatment, and audiogram type. The demographic data for the SSNHL patients are summarized in Table 1.

The hearing levels of all SSNHL patients in the PO, PSI, and PII groups were assessed before and after treatment.

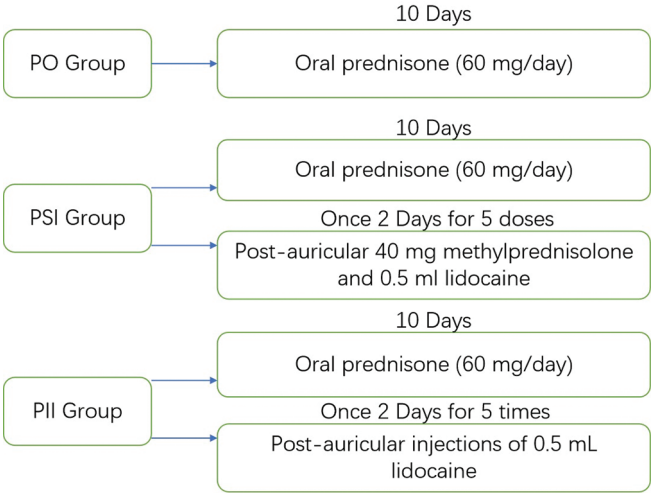

Figure 1: Scheme of administration of steroids

Table 1: Demographic data for SSNHL patients and the control group (n, $\bar{X}$±SD)

	The PO group	The PSI group	The PII group	$\chi^2/F/t$	*P*
Gender (M/F)	28/24	27/25	28/25	0.039	0.981
Average age (y)	43.5±8.4	44.6±8.7	45.6±8.9	0.771	0.464
Duration from onset to treatment (d)	23.8±2.9	24.1±2.9	23.8±2.8	0.165	0.848
PTA before treatment (dB, 0.5-4 kHz)	59.7±12.5	58.1±11.3	56.7±10.8	0.928	0.398
Number of patients with hearing loss (mild to moderate/severe to profound)	12/40	14/38	16/37	0.679	0.712
Number of patients with different audiogram type (ascending/descending/flat/total deafness)	5/25/15/7	6/24/13/9	4/25/14/10	1.095	0.982
Tinnitus loudness (0–10)	6.2±1.8	6.3±1.7	6.3±1.7	0.154	0.857

SSNHL, sudden sensorineural hearing loss; PTA, pure-tone average

Hearing improvement were all observed in three groups after treatment. Compared with PO and PII groups, those patients in PSI groups had more improvement in PTA after treatment (PSI vs PO: 33.9 ± 9.9 vs 39.7 ± 8.8, PSI groups vs PII groups: 33.9 ± 9.9 vs 38.7 ± 8.8, both $P < 0.05$). There was no significant difference in effective rate among the three groups (PO vs PSI vs PII: 36.5% vs 44.2% vs 35.8%, $P = 0.621$) and PTA improvement (39.7 ± 8.8 vs 38.7 ± 8.8, $P = 0.582$) between the PO and PII group.

The mean subjective tinnitus volume of all SSNHL patients in the PO, PSI, and PII groups was also assessed before and after treatment. Compared with pretreatment, tinnitus remission was all observed in three groups after treatment (6.2 ± 1.8 vs 3.4 ± 1.2 for the PO group, 6.3 ± 1.7 vs 2.2 ± 1.1 for the PSI group, 6.3 ± 1.7 vs 3.5 ± 1.0 for the PII group, all $P < 0.001$), while those patients in PSI groups had significantly lower tinnitus volume than in PO and PII groups (PSI vs PO: 2.2 ± 1.1 vs 3.4 ± 1.2, $P < 0.001$; PSI vs PII: 2.2 ± 1.1 vs 3.5 ± 1.0, both $P < 0.001$). Tinnitus volume in the PII group has more improved compared to the PO group, but no statistically significant difference was observed between two groups (PO groups vs PII groups: 3.4 ± 1.2 vs 3.5 ± 1.0, $P = 0.15$). The pattern of tinnitus remissions hearing recovery was similar to those observed for hearing recovery in three groups. The level of tinnitus loudness was statistically significantly correlated with the level of PTA both before treatment ($r = 0.440$, $P < 0.001$) and after treatment ($r = 0.403$, $P < 0.001$).

In this study, adverse effects include pain, infection during injection, and subcutaneous congestion, which were observed in PSI and PII group. Pain was very mild due to the use of lidocaine. One case of skin redness and swelling at the injection site was noted, and hyperglycemia was found in two patients at 10 days in PSI group and one patient at 7 days in PII group after treatment, respectively. In addition, it must be considered that patients in the PSI group required multiple visits to the clinic.

Discussion

In the otology clinic, we often receive some SSNHL patients who present more than three weeks after the onset of hearing loss. These patients are often accompanied by annoying tinnitus. Hearing loss was ignored because of obvious tinnitus and is only identified after consultation of the medical history. Usually, improvement rate is negatively correlated with later treatment time, but Chen *et al*.[6] showed SSNHL patients who presented late for treatment had probably benefited from the treatment. However, the high cost of treatment and relatively low cure rate remain highly controversial for inpatient treatment. For these patients, we usually recommend outpatient treatment.

The use of systemic steroids or topic steroids in patients with SSNHL remains controversial.[11,12] A meta-analysis compared the efficacy of systemic steroids against topic steroids as an initial treatment and did not show an overall advantage of topical steroids over systemic steroids.[13] Recently, some data supported the use of systemic steroids combined with tympanic injection (IT) steroids as initial therapy for SSNHL.[14,15] However, several disadvantages, such as complexity of operation, high treatment cost, and unavoidable adverse effects (pain, transient dizziness, infection, persistent tympanic membrane perforation), limit the application of topic steroids in the treatment of SSNHL.[1,16] In recent years, postauricular injections have been shown to have the same therapeutic effect as IT steroids and are widely used in China.[17,18] In the Chinese SSNHL guidelines, the local use of postauricular injections of steroids is recommended in addition to IT steroids.[7] Compared to systemic administration, intra- and postauricular injections of steroids may have higher drug concentrations in the auricular organs.[8] The operation of postauricular injection is simple, and all five times of injections in the course of treatment were performed by a nurse practitioner at the Otology Clinic. All patients received

an injection of 0.2 mL of 2% lidocaine with or without 40 mg methylprednisolone into the postauricular in PSI and PII group and no obvious pain or side effects were noted.

Our previous study demonstrated no significant different between IT steroid and the postauricular injection in the prognosis for treating refractory SSNHL.[8] Therefore, we attempted to combine systemic steroids with postauricular steroids injection for the initial treatment of SSNHL after 3 weeks of symptom onset. In the present study, all patients have a hearing improvement rate of more than 1/3 after steroid treatment, which was higher than the study by Chen *et al*.[6] and lower than the study by Ganesan *et al*.[19] Although the specific data of these studies were differences because of different evaluation criteria and treatment schemes, all of these result, suggesting that steroids treatment is very necessary for patients with delaying effective intervention. Our study showed an overall advantage of postauricular steroids injection combined with systemic steroids over systemic steroids alone, which is due to the higher drug concentration in internal ear.[8]

Tinnitus is a common concomitant symptom of SSNHL.[20] In this study, we found that postauricular steroids injection combined with oral glucocorticoid can improve tinnitus, and its efficacy was better than post-auricular lidocaine injection combined with oral glucocorticoid and oral glucocorticoid alone. Moreover, the purpose of lidocaine injection in this study is to reduce the pain during and after injection. Lidocaine has a certain therapeutic effect on tinnitus, but lidocaine has no long-term effect on tinnitus in this study.

The present study has limitations. First, we did not design a placebo control group in this study for ethical reasons. Also, another limitation of this study is a relatively small number of participants were included in this study. Therefore, further analysis in a larger sample was needed.

Conclusions

The aim of this study was to assess the efficacy of delayed effective intervention in patients with SSNHL after treatment with oral steroids combined with postauricular steroid injections. The results suggest that postauricular steroid injection should be employed for treatment of SSNHL.

Acknowledgments

The authors would like to thank Prof. Wan-Dong She (Nanjing Drum Tower Hospital Clinical College of Nanjing Medical University, Nanjing, China) for his instruction in our manuscript writing.

Financial support and sponsorship

This study was funded by a Grant (HAB202024) from the Natural science research plan of Huai'an City, Jiangsu Province, China.

The research was supported by health research project of Huai'an City, Jiangsu Province (HAWJ202026).

Conflicts of interest

There are no conflicts of interest.

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