

ORIGINAL ARTICLE

Oral Prednisolone Treatment of Sudden Sensory Neural Hearing Loss: A Three Year Retrospective Analysis

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Abstract:

Sudden Sensory Neural Hearing Loss (SSNHL) is a serious medical condition and requires prompt medical attention. The study was done to estimate the effect of different protocols of oral Prednisolone plus high dose vitamin B-complex and vitamin B₁, B₂, B₆ in patients with unilateral SSNHL who have failed to respond to treatment. A retrospective study was done from January 2015 to January 2018 at the outdoor patient department of Holy Family Red Crescent Medical College Hospital, Dhaka among 75 randomly selected patients with a mean age of 46.32 years (range 25-69 years), with the preselected criteria. Each of the patient received one of the four standard oral Prednisolone dosing protocols along with high dose of vitamin B-complex and B₁, B₂, B₆ orally 20mg four times for a total dose of 80mg daily for one week, Group A, n=18; orally 20 mg three times, for a total dose of 60mg daily for one week, Group B, n=18; orally 20mg two times for a total dose of 40mg daily for one week, Group C, n=18; orally 10mg three times for a total dose of 30mg daily for one week, Group D, n=18. All the doses were then tapered for next 5 days. Patient characteristics and pharmacological effects were compared among the 4 groups. The mean age, average duration of symptoms from onset to treatment, and degree of hearing loss were analyzed by means of t-test. Treatment effects were analyzed by means of Chi-square test. P<0.05 was considered significant. Improvement of hearing was assessed by pure tone audiogram. The total effective rate was 88.89%, 83.33%, 77.78%, 66.67% for each treatment protocol, respectively, with no significant statistical difference between them (p>0.05). The results suggest that a total dose of 80 mg is the most appropriate protocol. Prednisolone significantly improves the prognosis of SSNHL. Further multicenter studies are needed to determine the more standard treatment protocol

Keywords: Sudden Sensorineural Hearing Loss; Prednisolone, Pure tone audiometry.

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Introduction:

Sudden sensory neural hearing loss (SSNHL) is a frequent presentation in otologic and audiology practices. SSNHL is a syndrome overlaying

various heterogeneous entities resulting from different pathogenesis, mostly defined as sensory neural hearing loss of 30 dB or greater over at least

three contiguous audiometric frequencies developing within 72 hours¹. There is virtually always some degree of associated aural fullness and tinnitus, imbalance or vertigo. Idiopathic SSNHL has an estimated incidence of 5 to 20 per 100,000 persons per year². Patients recovering quickly never comes to health facilities thus causing an underestimated incidence rate³. Most of them make the appointment at the otologic OPD after being delayed for several weeks even months misinterpreting the aural fullness as common sensation, rather a symptom of emergency. Even, some of the patients already were found to use an over-the-counter decongestant during their delayed times, further delaying appropriate treatment⁴.

SSNHL was first described in 1944⁵. Most of the time, up to 90% specific cause for unilateral SSNHL cannot be found despite adequate investigation and are classified as "idiopathic". Some authors urged that viral infection, microcirculation disturbance, and autoimmune disorder are the main reasons for such hearing loss. Apparently, SSNHL is presumptively attributed to vascular, viral, or multiple etiologies⁶. though debate remains in the etiology, hearing level improvement following SSNHL can be zero, partial, or complete. Recovery of hearing depends on age at onset, severity and frequencies of hearing loss, presence of vertigo, and time between onset of hearing loss and visit to the physician^{7,8}. Early, as soon as possible after onset of symptoms introduction of steroids could effectively reverse this process.

Once the cause of the SSNHL is recognized, the appropriate treatment for that condition is administered. Some authors reported a very few conditions, such as vestibular schwannoma, mumps, and secondary syphilis that may improve hearing potentially after appropriate therapy⁹. But for those with diabetes, hypertension, peptic ulcer diseases, malignancy, tuberculosis, and other systemic disorders, only steroid therapy may not be undoubted. Disease-specific therapy does not return hearing to previous physiological levels in the majority of idiopathic SSNHL cases¹⁰⁻¹³.

Despite wide research, the necessity and options for appropriate care of patients with idiopathic SSNHL remains arguable. There is a controversial bases that idiopathic SSNHL spontaneously resolves in 45% to 65% of patients¹⁴. Multiple drugs were tried to rationalize the definitive treatment of idiopathic SSNHL including anti-inflammatory agents, antimicrobials, calcium channel blockers, vitamins, microminerals, vasodilators, plasma expanders,

fibrinolytics, diuretics, hyperbaric oxygen¹⁵. The etiological debate on the idiopathic SSNHL, a lack of superiority of therapy with rarity of the disease influenced such number and variety of treatments¹⁶.

Intra-tympanic (IT) steroid injection is a new choice of treatment and is being increasingly applied for management of idiopathic SSNHL. It serves as an alternative to typical medicine treatments that have failed to respond, also in persons with contraindications to steroid therapy through systemic route. Approximately, 8% of the otolaryngologists disclosed the use of IT steroids that causes higher levels of steroids in perilymph than blood circulation after oral administration in Guinea pigs¹⁷. Some researcher commented that IT steroids is somewhat superior to systemic steroids for idiopathic SSNHL with low impact (less than 70 dB)¹⁸.

In a survey, 50% of 104 practicing otolaryngologists responded about their use of antiviral therapy (acyclovir, famciclovir, etc.) in conjunct to corticosteroids for the treatment of idiopathic SSNHL, though evidence of efficacy was lacked.

One usually accepted treatment for SSNHL is systemic corticosteroids, which can be started before magnetic resonance imaging (MRI) and autoantibodies testing. In a survey at U.S., 98% of the otolaryngologists preferred treating idiopathic SSNHL with oral corticosteroids¹⁹. Corticosteroids are believed to improve idiopathic SSNHL by diminishing inner ear inflammation and auto immune response and to be helpful for recovery of nerve function,^{20,21} even as a sequel of autolytic changes surrounding an area of ischemia or infarction. Steroid receptors are situated in the inner ear and describe why steroid therapy is effective. Recently, several publications have suggested improvement in hearing recovery with the use of oral corticosteroids in cases of severe-to-profound SSNHL which was not evident when moderate cases (< 60 dB PTA) were included. Previously, Wilson et al. stated about two different double-blinded RCTs who found 78% steroid vs 38% placebo of improved hearing in 67 patients using different steroid regimens. These findings were negated by the researchers afterwards due to the dissimilarities and many controversies that were found²².

Lack of clear specification of clinical endpoints, lead the authors to conduct a study to evaluate therapeutic effects of different protocols of oral Prednisolone plus high dose vitamin B-complex and vitamin B₁, B₂, B₆ in patients with unilateral SSNHL who have failed to respond to typical medical treatment, in an attempt to standardize an appropriate regimen to improve the approach to sudden deafness.

Materials and method:

A retrospective clinical study was conducted in 75 patients diagnosed with unilateral SSNHL of idiopathic etiology from January 2015 to January 2018, including 26 males and 49 females. All subjects fulfilled the preset criteria: i) idiopathic unilateral sensory-neural hearing loss, SSNHL that developed within 72 hours, all had 25 dB hearing loss at three consecutive frequencies, ii) no preexisting central nervous system disorders, iii) visiting OPD within 1-7 days after the onset of impaired hearing, iv) previously not treated, v) no impairment of hearing in the opposite ear for age, and vi) poor or no response to a 10-14 days course of typical systemic medicine treatment including intra-tympanic steroids, vasodilator, low-molecular-weight heparin, calcium channel blocker, or hyperbaric oxygen. All selected patients were detailed a complete clinical history, physical and otologic examination, and tested for syphilis and autoimmune antibodies. Magnetic resonance imaging (MRI) report was found to be negative in these patients. Informed consent was obtained from each patient for participation in the study. A Pure tone average (PTA) of thresholds at 0.25, 0.5, 1, 2 and 4KHz was used to categorize the losses as mild (26-40 dB), moderate (41-70 dB), severe (71-90 dB), profound (>90 dB), or total. The hearing involvement was monitored by successive audiometric examinations: before and after oral Prednisolone therapy. Steroid treatment was administered within one month of SSNHL onset. The extent of hearing recovery was reported as 'complete recovery' - PTA at pre-onset level; marked recovery (MR - PTA improvement ≥ 30 dB); partial recovery (PR-PTA improvement 15 to 30 dB); and unchanged (PR-PTA improvement ≤ 15 dB). A total of 75 cases were randomly selected to receive oral Prednisolone in different dosing schedule as Group A (n=18): 20 mg four times for a total dose of 80 mg daily for one week, Group B (n=18): 20 mg three times, for a total dose of 60 mg daily for one week, Group C (n=18): 20 mg two times for a total dose of 40 mg daily for one week,

Group D (n=18): 10mg three times for a total dose of 30 mg daily for one week, Patient profiles and therapeutic effects were compared among the 4 groups. Prednisolone was given in tapering doses for next 5 days of each treatment course. Throughout the course of study all the patients were supplemented with the combination of vitamin B_1 , B_2 , B_6 as a precaution to deal with the possible long-term adverse effects, if any. The mean age, average duration of symptoms from onset to treatment, and degree of hearing loss were analyzed by means of t-test. Treatment effects were analyzed by means of Chi-square test. $p < 0.05$ was considered significant.

Results:

Between January 2015 and January 2018, 377 patients were diagnosed with SSNHL and treated in OPD of the hospital. However, only 75 subjects fulfilled the inclusion criteria and were included in the study. In patients who didn't met the criteria, were excluded. Either the audiological follow-up or other file data were missing of the excluded patient. The study groups were scrutinized for a history of upper respiratory tract infection (URTI) before SSNHL, a previous history of ear surgery. 28 patients (37.33%) gave a recent history of URTI and 13 patients (17.33%) had a history of ear surgery for various reasons.

The climatic conditions were found to be variants for SSNHL across weeks, months, or quarters of the year. At the time of diagnosis, we found 11 patients (14.67%) were admitted in winter, 16 patients (21.3%) in spring, 19 patients (25.3%) in summer and 29 patients (38.67%) in autumn. On statistical comparison, there was no significant difference between the seasons or time of the year in which diagnosis of SSNHL was made ($p > 0.05$).

The SSNHL was found in 83 patients (45.9%) and 98 patients (54.1%) in right and left sides respectively. Most of the patients (95.71%) were admitted at their first attack.

Table-I: Characteristics of the four groups

Characteristics	Group A n=18	Group B n=18	Group C n=18	Group D n=18
Gender (M/F)	7/11	6/12	8/10	5/13
Mean age (years)	42.73	44.29	49.36	48.90
Impaired hearing (L/R)	10/6	8/10	6/12	5/13
Degree of hearing loss (PTA)				
Mild	3	5	2	5
Moderate	4	3	5	5
Moderately severe	7	8	7	8
Severe	2	1	2	1
Profound	0	1	2	2
Cases of moderately severe and severe-profound hearing loss (n, %)	9 (52.25%)	10 (55.56%)	11 (61.11%)	11 (57.89%)
Interval from the onset (days)	4.02	3.53	3.17	4.98

Table-II: Therapeutic effect of four groups

Groups	Recovery(n)	Marked recovery (n)	Partial recovery (n)	Unchanged	Cure rate (%)
A	5	9	2	2	88.89*
B	4	8	3	3	83.33*
C	4	8	2	4	77.78*
D	2	6	4	6	66.67*
Total	15	31	11	14	79.17

*The effective rate was not statistically different between the four groups. ($p>0.05$)

The mean age, average time from onset to treatment, and degree of hearing loss were not statistically different between the groups ($p>0.05$). The cure rate was 88.89%, 83.33%, 77.78% and 66.67%, respectively, and not statistically different between the study groups. Four patients didn't follow up in OPD. The average effective rate was 79.17%. Other than the expected peptic ulceration or weight gain, there were no other severe adverse effects were observed after administration of medications.

Discussion:

The duration of hearing loss before seeking treatment, and the extent of hearing loss – are the two important factors that influence the prognosis. In this study, patient age, interval of hearing loss from onset to treatment and intensity of hearing loss were not statistically different between the four groups ($p>0.05$). Therefore, a straight forward relationship is being established through this steroid dosage regimen in this study.

Treatment of SSNHL remains arguable. Different curing protocols such as intra-tympanic steroids, vasodilator, antiviral agents, diuretics, and low-salt diets have been in consideration. As a result of its anti-inflammatory and immunosuppressive effects, high-dose systemic steroid therapy is currently is the mainstay of treatment²³⁻²⁵. Recurrent SSNHL is sensitive systemic steroid treatment. Some animal studies demanded that steroid through there is chances of systemic toxicity; possess a higher level of cure rate. Past researchers had focused on the efficacy of oral steroid compared with the other approaches. Few controlled studies have been published regarding the appropriateness of protocols of such therapy²⁶.

In the present study, there were no significant

difference in the success rate between the four tested treatment protocols, suggesting that different combination of dose, therapeutic frequency and duration do not influence treatment efficacy in SSNHL. A total dose of 80mg/day for one week followed by 05 days tapering may be satisfactory. Prednisolone is thought to improve idiopathic SSNHL by reducing inflammation and edema in the inner ear.

An important factor of therapy is to initiate systemic steroids as early as possible. The highest rate of recovery has been found in patients who started within 2 - 4 weeks of onset of hearing loss.

Conclusion:

SSNHL is a frequent case in audiological and otolaryngologic practice. A few curable underlying conditions act as the etiology of the SSNHL though most cases are idiopathic origin. Diagnosis should be emphasized on treating these ailments. Several factors affecting prognosis for hearing recovery includes number of days and level of deafness, age, and vertigo. Although spontaneous improvement of SSNHL is often without treatment, specified therapy against visible causes of SSNHL and corticosteroid therapy for idiopathic SSNHL are centerpieces of the treatment.

References:

1. Wilson WR, Byl FM, Laird N. The efficacy of steroids in the treatment of idiopathic sudden hearing loss: a double-blind clinical study. Archives of otolaryngology. 1980 Dec 1; 106(12):772-6.
2. Shaia FT, Sheehy JL. Sudden sensori-neural hearing impairment: a report of 1,220 cases. Laryngoscope 1976; 86:389-98.
3. Simmons FB. Sudden idiopathic sensori-neural hearing loss: some observations. Laryngoscope 1973; 83: 1221-1227.
4. Chen CY, Halpin C, Rauch SD. Oral steroid treatment of sudden sensorineural hearing loss: a ten-year retrospective analysis. Otolaryngology & neurotology. 2003 Sep 1;24(5):728-33.
5. DeKleyn A. Sudden complete or partial loss of function of the octavus-system in apparently normal persons. Acta Otolaryngol 1944; 32: 407-29.
6. Rauch SD. Clinical practice: idiopathic sudden sensorineural hearing loss. N Engl J Med. 2008; 359(8):833-840.

7. Fetterman BL, Saunders JE, Luxford WM. Prognosis and treatment of sudden sensorineural hearing loss. *Am J Otol.* 1996; 17(4):529-536.
8. Haynes DS, O'Malley M, Cohen S, Watford K, Labadie RF. Intratympanic dexamethasone for sudden sensorineural hearing loss after failure of systemic therapy. *Laryngoscope.* 2007;117(1):3-15.
9. Jeans AR, Wilkins EG, Bonington A. Sensorineural hearing loss due to secondary syphilis. *International journal of STD & AIDS.* 2008 May; 19(5): 355-6.
10. Berrocal JG, Vargas JA, Vaquero M, y Cajal SR, Ramírez-Camacho RA. Cogan's syndrome: an oculo-audiovestibular disease. *Postgraduate medical journal.* 1999 May 1; 75(883):262-4.
11. Lorenzi MC, Bittar RS, Pedalini ME, Zerati F, Yoshinari NH, Bento RF. Sudden deafness and Lyme disease. *The Laryngoscope.* 2003 Feb; 113(2):312-5.
12. Nosrati-Zarenoe R, Hansson M, Hultcrantz E. Assessment of diagnostic approaches to idiopathic sudden sensorineural hearing loss and their influence on treatment and outcome. *Actaoto-laryngologica.* 2010 Mar 1; 130(3):384-91.
13. Yimtae K, Srirompotong S, Lertsukprasert K. Otosyphilis: a review of 85 cases. *Otolaryngology—Head and Neck Surgery.* 2007 Jan; 136(1):67-71.
14. Mattox DE, Simmons FB. Natural history of sudden sensorineural hearing loss. *Ann Otol Rhinol Laryngol.* 1977; 86 (4, Pt 1):463-480.
15. Conlin AE, Parnes LS. Treatment of sudden sensorineural hearing loss, II: a meta-analysis. *Arch Otolaryngol Head Neck Surg.* 2007; 133(6): 582-586.
16. Byl FM Jr. Sudden hearing loss: eight years' experience and suggested prognostic table. *Laryngoscope* 1984; 94:647-61.
17. Chandrasekhar SS, Rubinstein RY, Kwartler JA, et al. Dexamethasone pharmacokinetics in the inner ear: Comparison of route of administration and use of facilitating agents. *Otolaryngology—Head and Neck Surgery.* 2000; 122(4):521-528. doi:10.1067/mhn.2000.102578.
18. Rauch SD, Halpin CF, Antonelli PJ, Babu S, Carey JP, Gantz BJ, Goebel JA, Hammerschlag PE, Harris JP, Isaacson B, Lee D. Oral vs intratympanic corticosteroid therapy for idiopathic sudden sensorineural hearing loss: a randomized trial. *Jama.* 2011 May 25; 305(20):2071-9.
19. Shemirani NL, Schmidt M, Friedland DR. Sudden sensorineural hearing loss: an evaluation of treatment and management approaches by referring physicians. *Otolaryngology—Head and Neck Surgery.* 2009 Jan; 140(1):86-91.
20. Merchant SN, Rosowski JJ. Conductive hearing loss caused by third-window lesions of the inner ear. *Otology & neurotology: official publication of the American Otological Society, American Neurotology Society [and] European Academy of Otolology and Neurotology.* 2008 Apr; 29(3): 282.
21. Wei BP, Stathopoulos D, O'Leary S. Steroids for idiopathic sudden sensorineural hearing loss. *Cochrane Database of Systematic Reviews.* 2013(7).
22. Cinamon U, Bendet E, Kronenberg J. Steroids, carbogen or placebo for sudden hearing loss: a prospective double-blind study. *European archives of oto-rhino-laryngology.* 2001 Nov 1; 258(9):477-80.
23. Zernotti ME, Paoletti OA, Zernotti M, et al. Intratympanic dexamethasone as therapeutic option in sudden sensorineural hearing loss. *ActaOtorrinolaringolEsp,* 2009, 60(2): 99—103.
24. Plontke SK, Lowenheim H, Mertens J. Randomized, double blind, placebo-controlled trial on the safety and efficacy of continuous intratympanic dexamethasone delivered via a round window catheter for severe to profound sudden idiopathic sensorineural hearing loss after failure of systemic therapy. *Laryngoscope,* 2009, 119(2): 359-369.
25. Lee HS, Kim JM, Kim YJ. Results of intratympanic dexamethasone injection as salvage treatment in idiopathic sudden hearing loss. *J Otolaryngol Head Neck Surg,* 2008, 37(2): 263-268.
26. Hamid M, Trune D. Issues, indications, and controversies regarding intratympanic steroid perfusion. *Curr Opin Otolaryngol Head Neck Surg,* 2008, 16(5): 434-440.