Steroid Use for Sudden Sensorineural Hearing Loss: A CHEER Network Study

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Abstract

Objective. The objective of this study was to describe patterns of corticosteroid treatment for sudden sensorineural hearing loss and to evaluate effectiveness based on delivery mode (oral vs intratympanic vs both).

Study Design. Cross-sectional repeated measures.

Setting. Patients were recruited from practices within the Creating Healthcare Excellence through Education and Research (CHEER) Network. CHEER is a National Institutes of Health-funded nationwide network of 30 community and academic otolaryngology practice sites.

Subjects and Methods. A subset of 117 patients who had been treated with steroids for sudden sensorineural hearing loss were recruited from within a larger initial CHEER Network study on clinical practice guideline compliance. Outcomes included audiometric and speech scores and patient-perceived improvement. Descriptive analyses, Wilcoxon rank-sum tests, and Fisher exact tests were run.

Results. Two categories (oral and simultaneous oral + intratympanic) had adequate sample sizes to support statistical comparison of treatment results. Improvements were seen in both audiometry and speech testing scores; 57% of patients self-reported improvement perceived as either minor or major. There were no significant differences in degree of improvement between these treatment groups.

Conclusions. We observed that a majority of steroid-treated patients demonstrated hearing improvement, but this improvement did not meet criteria for statistical significance. As in other studies on this topic, the relatively small sample size may have prevented differentiation of effectiveness among steroid treatments. We propose that the use of alternative approaches, such as pragmatic clinical trials and multidisciplinary electronic health record systems and megadatabases, may hold the most promise for an approach to best practice development.

Keywords

sudden sensorineural hearing loss, steroids, practice guidelines, CHEER Network

Although sudden sensorineural hearing loss (SSNHL) is considered a medical emergency, there is no clear consensus on either pathogenesis or effective treatments. As noted by Fetterman et al in 1996, despite the urgency associated with an unexpected sudden sensory deficit and the often dramatic presentation, the pathophysiology has yet to be defined—in as many as 88% of patients, a comprehensive diagnostic assessment failed to identify a cause. The cochlea’s complex microscopic anatomy and physiology are encased in the dense temporal bone and not readily accessible for direct evaluation. Therefore, the etiology of SSNHL remains elusive and confounds our understanding of incidence as well as recommendations for and effectiveness of diagnostic and treatment regimens.

The 2012 American Academy of Otolaryngology—Head and Neck Surgery Foundation (AAO-HNSF) clinical practice guideline (CPG) on SSNHL references Byl and Mattox and Simmons to provide incidence estimates of 5 to 20 per 100,000 population and 4000 new cases each year in the United States. A more recent study utilized a medical and pharmaceutical claims database to perform a broad population-based assessment. It found the incidence of SSNHL to be 27 per 100,000 population in the United States with variations by age—11 per 100,000 for patients <18 years old to 77 per 100,000 for patients ≥65 years. Approximately 66,000 new cases of SSNHL are seen each year, with the disorder more common in men and the elderly.

This article describes patterns of corticosteroid administration (oral, intratympanic [IT], or both) and their
associated outcomes for treatment of SSNHL. The 2012 AAO-HNSF CPG on SSNHL3,7 includes 2 evidence-based statements and associated treatment recommendations that address steroid use. Statement 8 indicates that it is an option for clinicians to offer corticosteroids as initial therapy to patients with idiopathic SSNHL, supporting flexibility in provider decision making. Statement 11 indicates that clinicians are recommended to offer IT steroid perfusion when patients have incomplete recovery from idiopathic SSNHL after failure of initial management. Statement 11 can be interpreted such that providers should generally follow the recommendation yet remain alert to new information and patient preferences. The present study was undertaken to see if current clinical practice follows these recommendations and if the treatment outcomes support the CPG statements.

Methods
Between July 11, 2013, and January 17, 2015, the Creating Healthcare Excellence through Education and Research (CHEER) Network8 conducted a study at 16 participating academic and community otolaryngology practices assessing compliance with the AAO-HNSF CPG on SSNHL, the results of which were published.9 The present study is based on data and participants at a subset of 12 sites (5 academic, 7 community) from the larger study (Figure 1). A cross-sectional repeated measures design was used.

Eligible patients for the larger initial study met the 3 following criteria: (1) symmetrical hearing prior to the incident of hearing loss, whether patient perceived (subjective) or provider determined; (2) hearing loss determined to be in only 1 ear; and (3) subject had a nonaffected ear that could be used as a baseline comparator. Patients were excluded if they presented with bilateral sudden hearing loss (SHL), a history of recurrent episodes of SHL, or focal neurologic findings. These criteria reflect the definition in the AAO-HNSF's CPG on SHL. The present study represents the subset of patients who were treated with corticosteroids for their SSNHL, as extracted from the previously published study on compliance for treatment of SHL.9

The objective of the present study was to describe patterns of corticosteroid treatment for SSNHL and evaluate their effectiveness as a function of delivery mode (oral, IT, or both). Power analysis scenarios were generated to set recruitment volume with a minimum goal to support comparison of 2 treatment groups. Data were analyzed in Microsoft Excel and SAS 9.4 (SAS Institute Inc, Cary, North Carolina) and included descriptive analyses, Wilcoxon rank-sum test, and Fisher exact test between key variables. Change scores for pure tone averages were calculated. Self-reported benefit from treatment questions included the following options: worsened after treatment, no improvement after treatment, mild improvement, major improvement, major improvement, not applicable.

The present study utilized CHEER Network research coordinators to follow up with patients who had received steroid treatment. Data and steroid treatment information were collected from the follow-up visit with outcome data, including speech testing and audiometric results and patients’ self-reported perceived improvement. The data were subsequently recorded in REDCap, a secure and appropriate online platform for clinical research.10

The present study was approved by the Duke University School of Medicine Institutional Review Board. Community-based sites without their own Institutional Review Boards were covered under the Duke University board approval. Other community and academic sites received approval from their own boards.

Results
The present substudy data set included 117 of the 175 enrolled patients evaluated for SHL (Figure 1). Of these 117 patients, 75 (64%) received steroid treatment during the visit with the CHEER participating site, and 42 (36%) received the treatment at a prior visit with a different provider. The patients who received steroid treatment prior to the visit with the CHEER participating site had seen the following provider types: a non-CHEER otolaryngologist (61.9%), primary care (38.1%), and emergency or urgent care (14.2%). The majority (72.6%) of patients in the present study were treated in the community setting. The average age of the patient was 56.3 (SD = 17.1). More than half of the patients were female (56.3%).

The median (25th percentile, 75th percentile) number of days between onset of SSNHL and study enrollment overall
was 19 (8, 34). Those seen initially at a CHEER participating site were enrolled 14 (7, 30) days after onset of SSNHL versus 26 (14, 52) days when treated prior to study visit at a different provider (\(P = .004\)). Right and left ears were affected equally.

Differences were noted in corticosteroid treatment patterns between CHEER and non-CHEER sites. We determined that the corresponding steroid use patterns were as follows: 52.0% versus 38.8% received oral alone; 36.0% versus 20.4% received oral + IT simultaneously; 10.7% versus 8.2% received IT alone; and 1.3% versus 32.7% received oral followed by IT. The majority (87.1%, 81 of 93) of patients across all providers (ear, nose, and throat and otherwise) reported a starting dose of 60 mg. The number of days treated ranged from 3 to 34, with the median days of treatment as follows: oral alone (12), oral + IT simultaneously (14), and oral followed by IT (10). Dosing of IT corticosteroid varied from 1 to 3 injections, with 3 being the most common. Three injections was the most common dose for oral + IT treatments (simultaneous or sequential), and 1 or 2 injections were most common for IT alone.

On average, improvements were seen in all audiometry and speech testing scores from pre- to poststeroid treatment. Despite this, analyses comparing improvement overall and between oral alone (n = 30) and oral + IT simultaneous (n = 26) did not reveal significant differences (Figure 2). The other 2 steroid categories could not be included due to inadequate sample size. Subjective hearing improvement, either minor or major, was reported by 57.5% of participants.

**Discussion**

In this study, we found that most patients with SSNHL who were treated with corticosteroids showed or reported hearing improvement. As in existing literature on this topic, we did not show an advantage of any 1 steroid treatment approach over the others. Our data were gathered from a variety of treatment sites, physicians, and treatment approaches. We can only conclude that the general patient with SSNHL may benefit from steroid treatment if she or he seeks prompt care, regardless of provider type.

Study of SSNHL is difficult for several reasons. First, the incidence is low, and there is only a brief window of opportunity for treatment after diagnosis. Second, the opportunity for optimal treatment of SSNHL is often narrowed or lost due to misdiagnosis as well as the nonspecific presentation of SHL. While a general otolaryngologist or otologist is less likely to confuse sensorineural and conductive hearing loss, less experienced practitioners may make this initial diagnostic error due to a knowledge gap and/or lack of easy access to audiometric testing. As noted in our prior study, composed of the larger number of patients presenting with SSNHL, the majority of patients present first to a nonotolaryngologist before referral to an otolaryngologist or audiologist. Third, despite the best intentions of investigators to perform a rigorous study, acceptance of treatment equipoise among practitioners and patients and acceptance of possible placebo assignment by study participants are not methodologically practical. A definitive study on treatment efficacy would require the rigor of a randomized controlled trial with numerous study sites and/or a prolonged period of enrollment to fulfill study subject sample size and power requirements. While the review of evidence does support treatment equipoise, there is a prevailing perception among otolaryngology practitioners as well as some general physicians and patients that steroids do offer benefit for treatment of SSNHL. Due to the aforementioned concerns, randomized trials assessing treatment effects of a steroid intervention have been challenging.

The treatment of SSNHL could be better studied by an alternative clinical trial methodology. A clinical effectiveness research approach, such as a pragmatic clinical trial (PCT), might be the best alternative to evaluating treatment effectiveness of steroid administration for patients with SSNHL. A PCT study design could evaluate the "package" of care surrounding diagnosis and treatment of SSNHL by evaluating the best therapeutic pathways leading to improved objective and subjective patient outcomes. A PCT design allows the evaluation of effectiveness of \( \geq 2 \) interventions believed to have therapeutic benefit within a real practice setting.

The SHL study completed by the CHEER Network can be treated as pilot data for considering the viability of a large PCT. There are a number of resources and guidelines for development of a PCT. The CONSORT statement (Consolidated Standards of Reporting Trials) can help guide design by providing a checklist of study attributes for reporting pragmatic research. Use of this checklist can facilitate the development of a design structure for deployment into a practice-based research network such as CHEER. Furthermore, criteria for evaluating the "pragmaticness" of research completed through a practice-based research network are available through the PRECIS evaluation (pragmatic-explanatory continuum indicator summary). The 10 domains evaluated in PRECIS are as follows:

- Eligibility criteria for trial participants
- Flexibility with which the experimental intervention is applied
• Degree of practitioner expertise in applying and monitoring the experimental intervention
• Flexibility with which the comparison intervention is applied
• Degree of practitioner expertise in applying and monitoring the comparison intervention
• Intensity of follow-up of trial participants
• Nature of the trial’s primary outcome
• Intensity of measuring participants’ compliance with the prescribed intervention and whether compliance-improving strategies are used
• Intensity of measuring practitioners’ adherence to the study protocol and whether adherence-improving strategies are used
• Specification and scope of the analysis of the primary outcome

The process, or “package,” of care was measured within a population of patients as defined by the SHL guideline; data were collected systematically on the different interventions that were considered therapeutic by the health care provider. Simple objective and patient-oriented outcomes were also collected. Our SSNHL study provides key information that can be used to inform the design of a PCT on SSNHL. The gap in our clinical guidelines for treatment of SHL can be filled only by a commitment of the otolaryngology research community to embrace the PCT design for SHL and other conditions of the ear, nose, and throat where the package of care is well beyond our direct control (eg, otitis media, Ménière’s disease, laryngopharyngeal reflux).

There are several obvious limitations of the present study. This was a voluntary study; therefore, patients could opt out of responses. Some audiograms did not report thresholds at all frequencies, so those patients with missing audiometric data at their follow-up visit were considered to have a change of 0; missing values were replaced by initial visit values. This increased the sample size used for the analysis but led to possible underestimates of the effects of the steroid regimen. Additionally, as the present study was a subcomponent of the larger initial study on guideline compliance, recruitment ceased once a minimum adequate sample was achieved to support the larger study and the present study (in the interest of timely reporting of results and ensuring nominal disruption to practice-based research settings).

While this study did not elucidate a best approach to steroid treatment practices for patients with SSNHL, the results did demonstrate that oral alone and oral + 1T are associated with hearing improvement in a majority of patients. At a minimum, it supports the AAO-HNSF’s CPG statements on corticosteroid use in treatment of SSNHL. Furthermore, given that improvement is seen, it supports the need to continue to explore treatment optimization, perhaps by turning to PCT methodology via multidisciplinary electronic health record systems and/or large megadatabases that contain medical and pharmaceutical data, to help overcome the challenges associated with randomized clinical trials.

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David L. Witsell, conception/design, manuscript editing with final approval, accountability for all aspects of the work; Hillary Mulder, statistics lead/analysis, manuscript editing with final approval, accountability for all aspects of the work; Steven Rauch, interpretation of data, manuscript editing with final approval, accountability for all aspects of the work; Kristine A. Schulz, conception/design, manuscript editing with final approval, accountability for all aspects of the work; Debara L. Tucci, interpretation of data, manuscript editing with final approval, accountability for all aspects of the work.

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References


