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Sudden sensorineural hearing loss during pregnancy: etiology, treatment, and outcome

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Abstract

Objective: To analyze the etiologies, treatments, and outcomes of sensorineural hearing loss (SSNHL) during pregnancy.

Study design: Retrospective chart review of 25 pregnant patients treated for SSNHL between January 2012 and September 2019. Forty-nine age matched non-pregnant women with severe and profound hearing loss diagnosed with SSNHL during the same period served as controls. Data were recorded on age, symptoms, onset of hearing loss, audiometric results, treatments, and outcomes.

Results: The mean age was 29.6 years (range 23–38 years). Intratympanic steroids (ITS) were administered in 15 (60.0%) pregnant women with SSNHL. Three women were treated with postauricular steroids only, while another woman was treated with intravenous ginkgo leaf extract and dipyridamole. The remaining six women received no medications. More than half (8/15, 53.3%) of pregnant women with SSNHL receiving ITS experienced hearing improvement. Pregnant women with profound hearing loss who received no medication had no hearing improvement. Most pregnant women with SSNHL (12/15, 80.0%) had higher fibrinogen levels than controls (mean values 3.77±0.71 g/L and 2.54±0.48 g/L, respectively).

Conclusion: Fibrinogen could be a risk factor for SSNHL during pregnancy. ITS may benefit pregnant women with severe and profound SSNHL.

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Pregnancy, sudden sensorineural hearing loss, intratympanic steroids, fibrinogen, retrospective analysis, drug therapy

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Introduction

Sudden sensorineural hearing loss (SSNHL) is defined as a rapid decline of hearing (> 30 dB) in at least three continuous frequencies within 3 days without identifiable cause. The etiology of SSNHL remains poorly understood but has been postulated to relate to viral infections, vascular insults, immune-mediated mechanisms, and labyrinthine membrane rupture.[1,2]

SSHNL during pregnancy is rare, and because the available evidence is limited to a small number of clinical reports,[3] no standard guidelines for therapy have been developed.[4–7] Some patients with SSNHL spontaneously recover.[5,6,8] Because of the potential side effects of medications on the fetus, the potential benefits and risks need to be weighed before commencing treatment. Current guidelines for the treatment of SSNHL are aimed at adults who are not pregnant. First line therapy is typically with systemic steroids, while intratympanic steroids (ITS) are administered when there is a contraindication or no improvement following systemic treatment. However, there is lack of data on ITS administration in pregnant women[1,9] to inform specific management of pregnant women with SSNHL.

The objective of this study was to review cases of SSNHL during pregnancy at our department in terms of etiology, clinical features, treatments, and outcomes.

Materials and methods

Patient population

Pregnant women with SSNHL were hospitalized in the Department of Otorhinolaryngology, First Affiliated Hospital of Chongqing Medical University from February 2012 to September 2019. The medical records of age matched non-pregnant women with SSNHL and severe and profound hearing loss diagnosed during the same period were included as a control group. Auditory brainstem response (ABR) testing or magnetic resonance imaging (MRI) were performed in all patients to exclude retrocochlear pathology. We reviewed the records of all patients diagnosed with SSNHL according to the criteria defined in "Clinical Practice Guidelines: Sudden Hearing Loss".[1,10]

Our investigation was approved by the local ethics review board and was performed in accordance with the principles laid out in the Declaration of Helsinki and Good Clinical Practice guidelines.

Assessment

All patients provided a detailed history and underwent local inspections of the ear, nose, and throat, obstetric examination, physical examination, neurological examination, and otoscopy. The hearing threshold was measured by pure-tone audiometry and tympanometry was performed to exclude disorders of the middle ear. Patients who had vertigo underwent

nystagmographic investigation of spontaneous nystagmus, a bithermal caloric test, evaluation of optokinetic nystagmus, gaze tests, ocular dysmetria tests, smooth pursuit tests, and apositioning tests. Each patient underwent follow-up audiometry. After birth, infants were followed regularly for 6 months at local pediatric clinics.

Audiograms were classified into four types based on audiographic configuration: ascending, descending, flat, and profound. The ascending audiogram group included patients whose average hearing threshold at 0.25 kHz to 0.5 kHz was 20 dB higher than that at 4 kHz to 8 kHz. The audiogram shape was described as descending when the average hearing threshold at 4 kHz to 8 kHz was 20 dB higher than at 0.25 kHz to 0.5 kHz. The flat type of audiogram occurred in patients whose threshold was similar across the entire frequency range and did not exceed 80 dB HL. For patients with flat audiograms and hearing thresholds of over 80 dB, the audiogram shape was classified as profound.

Degree of hearing loss was categorized as mild (26–40 dB HL), moderate (41–60 dB HL), severe (61–80 dB HL), or profound (>80 dB HL). Outcome was defined as cured (final hearing improved to normal or pretreatment levels), partial improvement (hearing improvement of >30 dB HL), slight improvement (hearing improvement of 15–30 dB HL), or no improvement (hearing improvement of <15 dB HL) (Table 1).

Treatment

All patients were informed of treatment benefits and associated risks. Available treatments included ITS, oral steroid treatment, intravenous ginkgo leaf extract and dipyridamole (15 mg twice per day), alprostadil infusions (10 μg once per day), batroxobin every other day, and postauricular steroid administration (methylprednisolone). Once the patients' fibrinogen levels decreased to ≤ 0.5 g/L, batroxobin therapy was withdrawn. A natural course without medication was also chosen by some patients.

Intratympanic and postauricular steroid administration

Before the procedure, patients were provided with a clear explanation of the different injection sites and the risks and benefits of each procedure. All patients provided written informed consent. Prior to the procedures, each patient was placed in a supine position with the head rotated toward the opposite side of the sterilized external auditory canal. ITS was performed under a microscope. First, 0.4 mL of methylprednisolone (40 mg/mL) and 0.1 mL of 2% lidocaine were mixed in a 1-mL syringe. After a surgeon confirmed that the tympanic membrane was intact and assessed the status of the middle ear, a 25-gauge spinal needle was introduced into the antero-inferior portion to administer the lidocaine-methylprednisolone mixture. This procedure was performed five times, once every 2 days. Patients were instructed to avoid swallowing or moving for 30 minutes and to stay in the same position to enable maximal absorption of the medication through the round window. The patients were also asked to keep their ears dry and clean to avoid infection.

Postauricular steroid injection was administered to three pregnant woman who refused ITS. Betamethasone (1 mL) was injected subperiosteally in the upper half of the retroauricular groove at the mastoid. A single injection was administered to each patient.

Statistical analyses

Differences in age, initial pure tone average (PTA) and final PTA between groups were assessed using unpaired t-tests (these

Table 1. Clinical characteristics of pregnant women with SSNHL.

Case No.	Age (years)	Trimester	Side	Vertigo	Tinnitus	Aural fullness	Tiredness	Influenza	Treatment time after onset	Degree of hearing loss	Audiogram curve type	Fibrinogen (g/L)	Initial PTA (dB)	Final PTA (dB)	Treatment	Outcome
1	23	2	L	−	+	−	−	−	6H†	Profound	Profound	3.69	105	67.5	Ginkgo leaf+ alprostadil+ batroxobin+ ITS	Partial improvement
2	29	3	L	+	+		−	−	5D‡	Profound	Profound	4.87	110	110	Ginkgo leaf	No improvement
3	24	3	L	+	+	+	−	−	3D	Profound	Profound	3.62	100	95	ITS	No improvement
4	25	3	R	+	+	−	−	−	1D	Profound	Profound	3.96	94	54	Ginkgo leaf+ alprostadil+ batroxobin+ ITS	Partial improvement
5	27	3	L	+	+	−	−	−	7D	Profound	Profound	5.16	120	81.5	OS+ITS	Partial improvement
6	28	2	R	+	−	+	−	−	1D	Profound	Profound	3.79	110	110	OS+ITS	No improvement
7	28	3	R	+	+	+	−	−	5D	Profound	Profound	3.66	106	103	ITS	No improvement
8	33	2	R	+	+	−	−	−	4D	Profound	Profound	3.81	110	100	Ginkgo leaf+ alprostadil+ ITS	No improvement
9	33	2	L	+	−	−	−	−	3D	Profound	Profound	3.57	106	106	Nil	No improvement
10	36	3	L	+	+	+	−	−	15D	Profound	Profound	3.93	87.5	87.5	Nil	No improvement
11	36	3	L	+	+	+	−	−	5D	Profound	Profound	3.55	88	98	PAS	No improvement
12	37	3	L	+	+	−	−	+	4D	Profound	Profound	3.47	109	110	ITS	No improvement
13	28	3	L	−	+	−	−	−	13D	Profound	Profound	4.40	98	98	ITS	No improvement
14	38	3	L	+	+	−	+	−	25D	Profound	Profound	4.50	112	80	ITS	Partial improvement
15	27	3	R	−	+	−	−	−	3D	Mild	Ascending	4.68	35	15	Nil	Spontaneously cured
16	34	3	R	−	+	−	−	−	7D	Mild	Ascending	4.37	30	10	Nil	Spontaneously cured
17	28	3	R	+	+	−	−	−	7D	Profound	Profound	4.23	104	54	ITS	Partial improvement
18	24	2	R	−	+	−	−	−	7D	Mild	Ascending	4.01	35	20	Nil	Cured
19	24	2	R	−	+	+	−	−	7D	Severe	Flat	3.93	72.5	23.3	ITS	Cured
20	29	2	R	−	+	−	−	−	30D	Moderate	Ascending	3.84	45	30	PAS	Slight improvement
21	26	1	L	−	+	−	−	−	11D	Moderate	Ascending	2.59	47.5	20	PAS	Cured
22	27	1	L	+	+	−	−	−	1D	Profound	Profound	3.08	111.8	107.5	ITS	No improvement
23	24	2	R	−	+	−	−	−	1D	Profound	Profound	3.84	116.25	116.25	Nil	No improvement
24	38	1	R	−	+	−	−	−	4D	Severe	Flat	2.21	70.8	23.3	ITS	Cured
25	33	1	R	+	+	−	−	−	1D	Profound	Profound	2.15	118.75	88.75	ITS	Partial improvement

H†, hour; D‡, day; OS, oral steroid; ITS, intratympanic steroid; PAS: postauricular steroid; PTA: pure tone average (0.25, 0.5, 1, 2, 4, or 8K Hz); for case 15 and 16 PTA (0.25, 0.5, and 1K Hz).

variables were normally distributed). Differences in variables that were not normally distributed were compared using the Mann–Whitney U test. Hearing improvement rates were compared using Fisher's exact test. All statistical analyses were performed using SPSS version 16.0 for Windows (SPSS, Chicago, IL, USA). Values of $p < 0.05$ were considered statistically significant.

Results

Demographics

Twenty-five pregnant women with SSNHL were included. Seven pregnant women underwent ABR testing and three women underwent MRI to exclude retrocochlear pathology. In the remaining 15 patients MRI was performed after delivery to exclude retrocochlear pathology. The medical records of 49 age matched non-pregnant women with SSNHL and severe and profound hearing loss diagnosed during the same period were included as a control group.

The mean age of pregnant women with SSNHL was 29.6 years (range 23–38 years). All patients were affected in one ear only; 13 (52.0%) were affected in the right ear and 12 (48.0%) were affected in the left ear. SSNHL occurred during the first trimester in four patients, during the second trimester in eight patients, and during the third trimester in 13 patients. On average, women were hospitalized for treatment 6.8 days after hearing loss onset (range 6 hours to 30 days). Eighteen women (72.0%) had profound hearing loss, two women (8.0%) had severe hearing loss, two women (8.0%) had moderate hearing loss, and 3 women (12.0%) had mild hearing loss. According to the four types of audiogram curves, 18 (72.0%) women had profound type audiograms, five women (20.0%) had ascending type audiograms, and two women (8.0%) had flat type audiograms. The clinical manifestation of the 25 women included hearing loss and tinnitus (23 women, 92.0%), vertigo (15 women, 60.0%), and aural fullness (six women, 24.0%).

Fifteen patients received ITS therapy. ITS alone was administered in 10 women (31.3%). Two women received ITS as well as oral steroids. Two women received ITS with addition of intravenous ginkgo leaf extract and dipyridamole, alprostadil infusions, and batroxobin. One woman received ITS with addition of intravenous ginkgo leaf extract and dipyridamole as well as alprostadil. Postauricular steroid injection was administered to three pregnant woman who refused ITS. One woman was treated with ginkgo leaf extract and dipyridamole alone and the remaining six women chose a natural course without any medications (Table 1).

Six months after the onset of SSNHL, each patient underwent follow-up audiometry. Infants were followed regularly at local pediatric clinics for 6 months after delivery. We found that both mothers and babies were healthy. Hearing was cured in 6 women (12.5%), partially improved in 6 women, slightly improved in 1 women, and not improved in 12 women. The overall proportion of pregnant women with SSNHL who experienced hearing improvement following treatment was 52.0%. The overall improvement rate of women with ascending and flat audiograms was 100%, while the improvement rate in women with profound audiograms was 33.3%. Among the 15 pregnant patients with vertigo, 5 (33.3%) had hearing improvement. By contrast, among the 10 pregnant women without vertigo, 8 (80.0%) had hearing improvement (Table 1).

Five of 15 women experienced transient dizziness of less than 1 minute during ITS administration. However, no patients suffered from dizziness, instability or

Table 2. Hearing outcomes in treated and untreated patients with severe and profound hearing loss.

	Initial PTA (dB)	Final PTA (dB)	*p*-value
Treated	102±14	83±29	0.011*
Untreated	103±15	103±15	1.000

*$p<0.05$.
All data represent means ± standard deviations.
PTA, pure tone average.

intratympanic perforation 1 month after the procedure.

Hearing outcomes

The initial PTA for women with severe and profound hearing loss receiving any treatment was 102 ± 14 dB, while the final PTA was 83 ± 29 dB ($p<0.05$), reflecting significant hearing improvement. In the untreated group, there was no difference between initial and final PTA (Table 2).

The initial and final PTAs of women with profound type audiograms who received ITS were 103 ± 14 dB and 80 ± 29 dB, respectively ($p < 0.05$). In contrast, the initial and final PTAs in patients who did not receive ITS treatment showed no significant difference ($p > 0.05$), indicating that ITS treatment resulted in more favorable hearing outcomes than other treatments (Table 3).

Comparison of fibrinogen levels in pregnant and non-pregnant women

Blood coagulation function was tested in all women. Among pregnant women with SSNHL, fibrinogen levels in 20 (80.00%) were higher than normal (mean value 3.77 ± 0.71 g/L, reference 1.5–3.5 g/L). These levels were significantly higher than those of control group women (mean value 2.54 ± 0.48 g/L) ($p < 0.001$). The initial PTAs of pregnant and non-pregnant women did not differ significantly. In addition, the final PTAs, mean hearing gains and hearing improvement rates between the two groups were not significantly different (Table 4).

Virus infection

Cytomegalovirus (CMV) immunoglobulin G (IgG) antibodies and herpes simplex virus (HSV) IgG antibodies were detected in two women, while rubella virus (RV) IgG antibodies were detected in one woman.

Discussion

SSNHL during pregnancy is rare and poorly understood. Wang et al.[3] reported on 12 pregnant women with SSNHL, accounting for only 3% of all patients (391) seen over 9 years. Zhang et al. reported on 16 pregnant women with SSNHL, accounting for only 1.6% of all 970 patients during the study period.[7] Our study identified 25 pregnant women with SSNHL, accounting for only 0.7% of patients (3389) seen over 7 years.

The mean age of pregnant women with SSNHL was 29.6 years. This is much younger than the age of patients affected by SSNHL in the general population, which is between 50 and 60 years.[11] All patients in this study were affected in one ear, with roughly half of women affected in the right ear. A retrospective study of 501 patients (530 ears) at our department revealed that the left ear was affected (243 ears) slightly more often than the right ear (229 ears), while both ears were affected in 29 patients.

Table 3. Hearing outcomes in patients with severe and profound hearing loss treated or not treated with ITS.

	Initial PTA (dB)	Final PTA (dB)	*p*-value
ITS	103 ± 14	80 ± 29	0.012*
No ITS	99 ± 16	104 ± 8	0.500

*$p<0.05$.
All data represent means ± standard deviations.
ITS, intratympanic steroids; PTA, pure tone average.

Table 4. Comparison of fibrinogen levels in pregnant and non-pregnant women with severe and profound hearing loss.

	Fibrinogen (g/L)	Age (years)	Initial PTA (dB)	Final PTA (dB)	Hearing gain (dB)	Improvement rate (n [%])
Pregnant women (n=20)	3.77 ± 0.71	30.0 ± 5.0	102 ± 14	86 ± 28	17 ± 18	8 (40.0)
Non-pregnant women (n=49)	2.54 ± 0.48	31.3 ± 4.9	106 ± 12	76 ± 33	26 ± 33	27 (55.1)
p-value	<0.001*	0.496	0.958	0.382	0.189	0.191

*$p < 0.05$.
All data represent means ± standard deviations.
PTA, pure tone average.

However, which ear was affected was not a prognostic factor for outcome.[12]

The etiology of SSNHL is presumed to involve vascular, viral, immune, and other factors.[2] However, these factors may differ in pregnant women. In our study, we detected CMV IgG antibodies and HSV IgG antibodies in two women as well as RV IgG antibodies in one woman. This finding indicated that these pregnant women had been infected in the past. The inflammatory response to inner ear CMV infection results in both immediate and delayed damage to hair cells and the inner ear in general.[13] However, neither CMV, HSV nor RV IgM antibodies were identified in these patients. Furthermore, we identified no evidence of active viral replication.

In patients with SSNHL, severe and profound hearing loss probably results from microthrombosis in the inner ear.[9] Pregnancy causes noticeable changes in the cardiovascular system, hematological system, endocrine system, and other systems. SSNHL during pregnancy may be related to increased activation of both blood coagulation and fibrinolysis, resulting in a hypercoagulable state. Blood volume during pregnancy increases by 30% to 45%. Pregnancy also results in increased levels of coagulation factors II, V, VII, VIII, IX, X as well as fibrinogen, along with a decrease of fibrinolytic activity. These changes increase the risk of venous thromboembolism by 4 to 6 fold and may lead to vascular occlusion in the microcirculation of the inner ear by microemboli.[14] Furthermore, the blood supply of the cochlear ear cannot be compensated once thrombosis occurs, as the common cochlear artery is a terminal artery.

In our study, most pregnant women (52%) had SSNHL in the third trimester. Wu et al. [15] also reported that 39 pregnant patients (57%) had inner ear disease in the third trimester, including 14 women with SSNHL. Thus, the highest prevalence of inner ear deficit appears to occur during the third trimester. Estrogen and progestin increase dramatically during this period of pregnancy. These hormonal alterations lead to salt and water retention. Sennaroglu et al.[16] proposed that this shift in fluid osmolarity could affect the inner ear and cause a low frequency hearing loss pattern as in Ménière's disease. Pregnancy also leads to decreased erythrocyte deformability and plasma viscosity and increased erythrocyte aggregation, increasing the risk of thrombosis in the inner ear. Estrogen can also affect the auditory system. Some studies have indicated that two intracellular estrogen receptors (α and β) were expressed in the cochlea in both humans and experimental animals.[16,17] Stenberg et al. reported that estrogen α was expressed in the spinal ganglion and estrogen β in the stria vascularis, locations vital for hearing transmission and inner ear homeostasis. In addition, estrogen may impact auditory function at different levels of the central nervous system by modulating the GABA-ergic, serotonergic, and glutamatergic systems.[17,18]

Treatment of SSNHL in pregnancy is challenging. Physicians face a dilemma, as saving a patient's hearing risks exposing the fetus to harmful side effects of medications. Current guidelines for treatment of SSNHL recommended systemic steroids as first-line treatment and ITS as second line or salvage therapy.[1] In our study, oral methylprednisolone (US Food and Drug Administration [FDA] category C) was administered in two patients (40 mg) for 3 days. Despite the absence of established adverse effects on the mother or the fetus, we should weigh the potential benefits and risks before commencing treatment, and emphasize clear communication with the patient. Corticosteroids (e.g., prednisolone, methylprednisolone, and betamethasone) have serious side effects such as peptic ulcers, infection, diabetes mellitus, shock, and infarction. These effects may complicate pregnancy. Furthermore, excessive prenatal exposure to steroids may cause detrimental effects on the fetal liver, spleen, and kidney, as well as causing placental dysplasia and cheilopalatognathus.

There is much evidence to suggest that ITS improves patient outcomes by increasing intracochlear steroid concentrations and reducing systemic side effects.[19–22] In the present study, 15 pregnant women were treated with ITS. Eight (40%) patients had hearing improvements. Among patients with severe and profound hearing loss who were treated with non-ITS regimens, none had hearing improvements. Patients receiving ITS treatment had significant hearing improvements ($p < 0.05$, Table 3). There were no serious or unexpected adverse events in the 15 patients; neither perforation of the tympanic membrane nor infection occurred. Few studies have examined pregnant women with SSNHL who received ITS therapy. Although the numbers of patients examined in our study were relatively small, it seems that ITS can benefit pregnant women with SSNHL. Chen et al. described the case of a pregnant woman with moderate hearing loss who was treated with endoscopic intratympanic methylprednisolone injection and was cured.[9] Conversely, pregnant women with profound hearing loss who received no medication showed no improvement in hearing. Hence, SSNHL with severe and profound hearing loss in pregnant women requires treatment. ITS has been demonstrated to be effective in improving hearing without side effects on the mother or the fetus.

In the Chinese guidelines for treatment of SSNHL, ginkgo leaf extract, alprostadil

and batroxobin are recommended.[10] However, treatments like ginkgo leaf extract, alprostadil and batroxobin are not mentioned in the American Academy of Otolaryngology guidelines.[1] Ginkgo leaf extract (US FDA category C) is widely used worldwide to treat patients with neurodegenerative, vascular, and audiovestibular disorders. The effects of ginkgo depend on its antioxidant activity.[23,24] Alprostadil (US FDA category B) is a prostanoid that acts as a vasodilator and improves vascular circulation.

Batroxobin (US FDA category C) can reduce plasma fibrinogen to improve the rheological properties of blood and the endothelial functions of coronary and peripheral arteries. Batroxobin is used to treat SSNHL, cerebral infarction, arteriosclerosis obliteration, and deep vein thrombosis. Fibrinogen is a large glycoprotein (340 kDa) that defines the rheological properties of whole blood by increasing plasma viscosity and inducing aggregation of erythrocytes, thrombocytes, and leucocytes. However, the role of fibrinogen in SSNHL is controversial. Fibrinogen level is thought to be a risk factor for inner ear disorders as high levels can reduce cochlear blood flow.[25,26] Some reports showed elevated fibrinogen in SSNHL patients compared with controls, which could act as a risk factor and negative prognostic factor.[27,28] It has been reported that treatment to lower fibrinogen increases cochlear blood flow in animals and similar strategies have been attempted in patients with SSNHL.[29] By contrast, Berger et al. proposed that fibrinogen is not a prognostic factor for response to heparin-induced extracorporeal low-density lipoprotein precipitation apheresis in patients with SSNHL. In the current study, most patients' fibrinogen levels were higher than normal, and pregnant women had higher fibrinogen levels than nonpregnant women ($p < 0.001$). Thus, higher fibrinogen may be a risk factor for SSNHL during pregnancy. However, the final PTAs, mean hearing gains and hearing improvement rates of the two groups were not significantly different. Thus, fibrinogen may not be a prognostic factor in SSNHL during pregnancy. Because the number of patients analyzed in our study was small, further large controlled clinical studies should be performed to confirm the safety and benefits of ITS in mother and fetus, as well as the relevance of fibrinogen levels.

In the current study, three pregnant women with ascending type audiograms and mild hearing loss who received no treatment were cured spontaneously. Another two women with ascending audiograms and moderate hearing loss were treated with postauricular steroids and were cured or experienced slight hearing improvement. Hou and Wang reported on one patient in the sixth week of pregnancy with an ascending-type audiogram and low-frequency hearing loss who was cured spontaneously.[5] However, this patient suffered from fluctuating low-frequency hearing loss, and no longer had hearing loss after delivery. Kenny et al.[6] documented temporary, unilateral, low-frequency sensorineural hearing loss in a 42-year-old pregnant woman who recovered spontaneously without treatment. Therefore, ascending-type audiograms and low-frequency hearing loss during pregnancy may be associated with spontaneous recovery.

Studies of prognostic factors of SSNHL have yielding conflicting findings, making it difficult to draw strong conclusions. Some studies showed that vertigo was a negative predictive factor for hearing recovery in SSNHL,[30–32] while other studies found that vertigo was not related to hearing improvement.[12,33,34] Various studies have reported that in patients with tinnitus, early treatment within 7 days of onset, ascending-type audiograms, younger age, unilateral affected ear, absence of benign paroxysmal positional vertigo (BPPV),

and initial audiometric threshold < 50 dB were associated with favorable outcomes.[30,33,35–39] However, other studies suggested that tinnitus, age, or BPPV were not associated with hearing outcome.[34,40] In the current study, pregnant women with vertigo had lower hearing improvement rates (33.3%) than women without vertigo (80.0%). However, the sample size was too small to draw a strong conclusion.

The major limitation of our study was the small sample size because of the rarity of SSNHL in pregnant women. In addition, the study design was retrospective. Future studies should be randomized double blind multicenter controlled trials to establish stronger conclusions.

Conclusion

SSNHL during pregnancy is rare. Fibrinogen may play a role in development of SSNHL during pregnancy. There is no standard guideline for therapy of SSNHL during pregnancy. Our results suggest that ITS could benefit pregnant women with severe and profound SSNHL without side effects on mothers or the fetus. However, patients with ascending type audiograms may recover spontaneously.

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Declaration of conflicting interest

The authors declare that there is no conflict of interest.

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