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ORIGINAL RESEARCH

Auricular Point Sticking for Patients with Sudden Sensorineural Hearing Loss: A Propensity Score Matching Analysis

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Purpose: Sudden sensorineural hearing loss (SSNHL) is an acute otolaryngologic emergency. Although evidence suggests that auricular point sticking (APS) may be beneficial for hearing recovery, the role of APS in sudden hearing loss is unclear. The aim of this study is to investigate the clinical application of APS in SSHL patients.

Patients and Methods: This prospective cohort study analyzed 624 patients with SSHL between January 2019 and December 2023. Patients were divided into an APS group (n=165) and a non-APS group (n=459) based on APS use. Propensity score matching (PSM) was applied to balance the two groups. Hearing recovery and cure rates were evaluated between the two groups.

Results: After PSM, hearing recovery (P=0.020) and cure rate (P=0.009) were significantly higher in the APS group than in the non-APS group. Ordered logistic regression analysis indicated that APS (odds ratio [OR] = 2.182, 95% confidence interval [CI]: 1.335–3.565, P=0.002) was significantly associated with hearing recovery. A significant improvement in cure rate (OR = 2.320, 95% CI: 1.378–3.904, P=0.002) was observed in APS patients compared to the non-APS group. Sensitivity analysis further confirmed that patients who received APS exhibited better hearing recovery.

Conclusion: APS enhances hearing recovery and cure rates in SSHL patients.

Keywords: sudden sensorineural hearing loss, auricular point sticking, hearing recovery, cure rate

Introduction

Sudden sensorineural hearing loss (SSHL), also known as sudden deafness, is an acute, unexplained sensorineural hearing loss exceeding 30 decibels (dB) across at least three consecutive pure-tone audiometric frequencies, occurring within 72 hours of onset.[1] SSHL was characterized by acute hearing loss in one ear, often associated with factors such as viral infections, endolymphatic hydrops, and cochlear circulatory dysfunction. With the increasing pace of modern life, the incidence of SSHL has risen annually, drawing growing attention to its consequences, including deafness and disability. The reported incidence of sudden deafness is approximately 5–20 cases per 100,000 people, predominantly unilateral. Bilateral sudden deafness is rare, occurring in only 1.7–4% of cases.[2,3]

SSHL is a devastating otolaryngologic emergency with limited effective treatments. High-dose corticosteroids are the standard treatment; however, long-term use has significant side effects and is poorly tolerated by SSHL patients with diabetes.[4] Other treatments include vasodilators, anticoagulants, hyperbaric oxygen therapy and microwave therapy, but the effectiveness of these treatments remains inconsistent.[4]

Recently, numerous studies have increasingly focused on the role and therapeutic potential of traditional Chinese medicine in SSHL treatment.[5–7] In traditional Chinese medicine, the ear is considered the center of various meridians and is closely associated with the body's visceral meridians and collaterals. Stimulating auricular points is believed to help regulate and harmonize the yin and yang balance within the body.[8] Similarly, the viscera, limbs, and bones of the human

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body correspond to specific auricular points.[7] Therefore, pathological changes in certain body regions may manifest at corresponding auricular points via meridian connections. Auricular point therapy is currently used in clinical practice for analgesia and the treatment of neurological,[9] digestive,[10] and endocrine disorders.[11] Jin et al[12] confirmed the efficacy of auricular point treatment in post-stroke dysphagia. Although it has been suggested that combining auricular point sticking (APS) with laser irradiation may synergistically enhance hearing recovery in patients with moderate to severe SSHL,[13] no reports have confirmed this effect. The effectiveness of APS in SSHL treatment remains unclear.

We conducted a prospective cohort study to evaluate the therapeutic efficacy of APS in SSHL patients. We suggest that this approach may serve as a novel therapeutic strategy for hearing restoration in clinical practice.

Materials and Methods

Study Design, Patient Enrollments, and Ethical Approval

In this prospective observational cohort study, we consecutively enrolled patients with SSHL admitted to Shengzhou People's Hospital between January 2019 and December 2023. Inclusion criteria were as follows: (1) age of 18 years or older and (2) hearing loss exceeding 30 dB over three contiguous frequencies within 72 hours of onset, meeting the diagnostic criteria for SSHL. Exclusion criteria were as follows: (1) onset of SSHL exceeding 15 days, with prior receipt of relevant treatment; (2) sudden hearing loss caused by an identified etiology, such as a history of acoustic trauma, Meniere's disease, or exposure to ototoxic medications; (3) history of otologic surgery; (4) magnetic resonance imaging findings suggestive of congenital cochlear malformations; (5) preexisting neurologic disorders associated with an increased risk of deafness; and (6) refusal to participate, incomplete clinical data, or loss to follow-up. This study complied with the Declaration of Helsinki and its subsequent amendments,[14] and its protocol was approved by the Ethics Committee at Shengzhou People's Hospital (No. 2023–028-01). Written informed consent was obtained from all patients or their legal proxies.

Audiometry

According to the 2015 guidelines for diagnosis and treatment of sudden deafness,[15] pure-tone audiometry was performed by qualified medical assistants in a soundproof room. Audiograms were performed with a manual audiometer coupled with TDH-39 headphones in one-octave steps at frequencies ranging from 0.25 to 8 kHz, and measured by detecting the minimum sound intensity that a subject can hear at different frequencies.

Auricular Point Sticking, Data Collections and Outcome Assessment

All patients were divided into non-APS group and APS group according to the use of APS. The non-APS group received routine nursing care upon admission. The APS group received auricular acupoint therapy in addition to routine nursing care upon admission.

In the APS group, auricular points were stimulated using Vaccaria seeds upon admission. The selected auricular points included Shenmen, heart, kidney, occipital, sympathetic, inner ear, outer ear, and endocrine points (Figure 1). APS was administered by the same physician, while trained family members performed the pressing. Family members received formal training from physicians. Auricular points were stimulated every 2 hours, except during nighttime sleep. Each auricular point was stimulated for 3 to 5 minutes per session until mild pain was induced. The treatment was administered continuously for 15 days. Each participant received auricular acupoint therapy at least 6 times per day. The pressing of the auricular points was recorded by use of manual notes.

Some relevant data were recorded at admission, including age, gender (female/male), body mass index (BMI), systolic blood pressure (SBP), diastolic blood pressure (DBP), length of stay, comorbidities (hypertension and type 2 diabetes), affected side (left/right), degree of hearing loss (mild, moderate, moderate-severe, severe, and profound), types of audiometric curve (low-frequency drop type, flat type, and total deafness type), statuses of tinnitus and dizziness, total cholesterol, total triglycerides, high-density lipoprotein cholesterol (HDL-c), low-density lipoprotein cholesterol (LDL-c), and serum glucose.

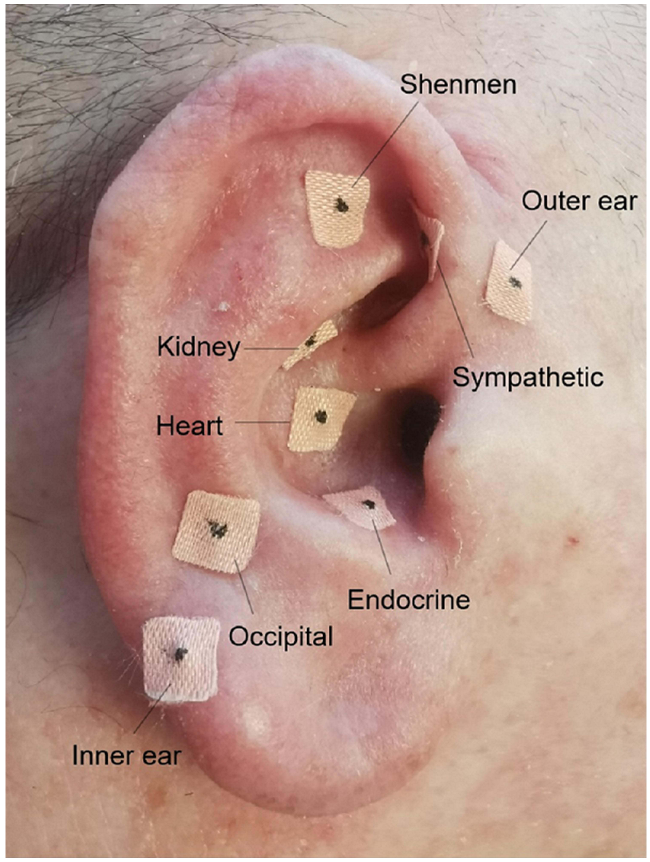

Figure 1 The auricular points of Shenmen, heart, kidney, occipital, sympathetic, inner ear, outer ear, and endocrine which were pressed using the Vaccaria seeds during the study.

According to the guidelines,[15] the patients' hearing recovery was evaluated after treatment, where a hearing improvement of < 15 dB was classified as ineffective, an improvement of 15–30 dB as effective, an improvement of > 30 dB as markedly effective, and a return to normal hearing as cured. The cure rate was calculated as follows: cure rate = (number of cured cases / total number of cases) × 100%.

All patients were followed up until they were discharged with a median follow-up of 23.2 days. Data on side effects of APS, such as redness, itching as well as rashes, and hospital length of stay were obtained from patient medical records.

Statistical Analysis

Data analyses were performed using SPSS version 23.0 (IBM Corp., Armonk, NY, USA) and R software (version 4.4.0; R Foundation for Statistical Computing). The Kolmogorov–Smirnov test was used to assess the normality of the data distribution. Continuous data were presented as mean ± standard deviation (SD) or median with interquartile range (IQR), as appropriate. Normally distributed data were analyzed using the independent samples *t*-test. Non-normally distributed data were analyzed using the Mann–Whitney *U*-test. Categorical variables are expressed as percentages and evaluated using the chi-squared test.

Propensity score matching (PSM) was conducted using the MatchIt and cobalt packages in R version 4.4.0. One-to-one matching was performed using the nearest-neighbor method with a caliper width of 0.2 times the standard deviation of the logit of the propensity score. Standardized mean differences (SMDs) were calculated before and after PSM to assess the balance between the two groups. The SMDs were calculated with the paired *t*-test for continuous variables and McNemar's test for categorical variables.

The absence of multicollinearity among covariates is a prerequisite for ordered regression analysis. The variance inflation factor (VIF) was used to diagnose collinearity, with VIF < 10 indicating no multicollinearity. Ordered logistic regression analysis was performed to assess the association between auricular point sticking, other clinical variables, and hearing recovery after PSM.

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Multivariate logistic regression analysis was performed to determine the relationship between APS and the cure rate in patients with SSHL, and the odds ratio (OR) and 95% confidence interval (CI) were calculated. We also conducted a subgroup analyse to assess whether the potential covariables (age, gender, hypertension, diabetes mellitus, affected ear) modified the relationships between APS therapy and the cure rate. The interactions between APS and the cure rate was tested using the likelihood ratio test of models with interaction terms.

Furthermore, doubly robust analysis was conducted to assess the independent association between APS and the cure rate. The doubly robust estimation method integrates a multivariate regression model with a propensity score model to estimate both the association and causal effect of an exposure on an outcome.[16] The gradient boosted model (GBM) was used to estimate patients' propensity scores for APS, ensuring covariate balance between the APS and non-APS groups. In our study, a regression tree was used as the base learner for the GBM, incorporating a total of 18 covariates.

Using the estimated propensity scores as weights, an inverse probability weighting (IPW) model was applied to create a weighted cohort.[17] A logistic regression was then performed on the weighted cohort, adjusting for the variables that remained unbalanced between the two groups in the propensity score model, thus the term doubly robust analysis.

Additionally, we performed a series of sensitivity analyses to assess the robustness of our study findings. In the sensitivity analysis, we applied four additional association inference models: a doubly robust model adjusting for all covariates, a propensity score-based IPW model, a propensity score-based patient matching model, and a logistic regression-based multivariate analysis.[18] The difference of $P < 0.05$ was defined as statistical significance.

Results

Participant Characteristics

A total of 782 patients with SSHL were evaluated between January 2019 and December 2023. Based on the exclusion criteria, 158 patients were excluded for reasons detailed in Figure 1. Ultimately, a total of 624 patients remained eligible for assessment. During the follow-up period, 12 patients (7.27%) had redness, 19 patients (11.52%) had itching and 3 patients (1.82%) had rashes in APS group. However, these side effects are relatively mild and transient. In addition, there were no statistical differences in length of hospital stay between the two groups.

Characteristics of Patients Before and After PSM

Following PSM, 160 patients were included in each group, yielding a total sample of 320 patients for comparison (Figure 2). A propensity score model was initially developed using 18 covariates with the GBM. The contributions of individual covariates to the final propensity score are presented in Figure 3. The most influential covariates include length of stay, total triglycerides, age, HDL-c, LDL-c, BMI, and total cholesterol.

Before PSM, patients who received auricular point sticking were older (SMD = 0.196, P = 0.040) and had higher levels of total cholesterol (SMD = 0.285, P < 0.001) and LDL-c (SMD = 0.330, P < 0.001) compared to those who did not receive the intervention. Additionally, the degree of hearing loss differed significantly between the two groups (SMD = 0.296, P = 0.040). After PSM, most confounding variables were effectively balanced (Table 1 and Figure 4).

Ordered Logistic Regression Analysis of Hearing Recovery After Propensity Score Matching

Table 2 showed no significant difference in hearing recovery between the two groups before PSM (P = 0.195). After PSM, hearing recovery differed significantly between the two groups, with patients receiving APS showing greater improvement in hearing recovery and cure rate of SSHL (P = 0.020).

In addition, multicollinearity analysis indicated no significant collinearity between variables after PSM (Table 3). Ordered logistic regression analysis demonstrated a significant association between APS (OR = 2.182, 95% CI: 1.335–3.565; P = 0.002) and hearing recovery. Additionally, the audiometric curve exhibited a significant relationship with hearing recovery. Compared to the total deafness type, the low-frequency drop type (OR = 1.069, 95% CI: 1.019–1.846; P = 0.018), high-frequency drop type (OR = 1.152, 95% CI: 1.101–1.797; P = 0.023), and flat type (OR = 1.092, 95% CI: 1.316–2.090; P = 0.009) were significantly associated with hearing recovery (Table 4).

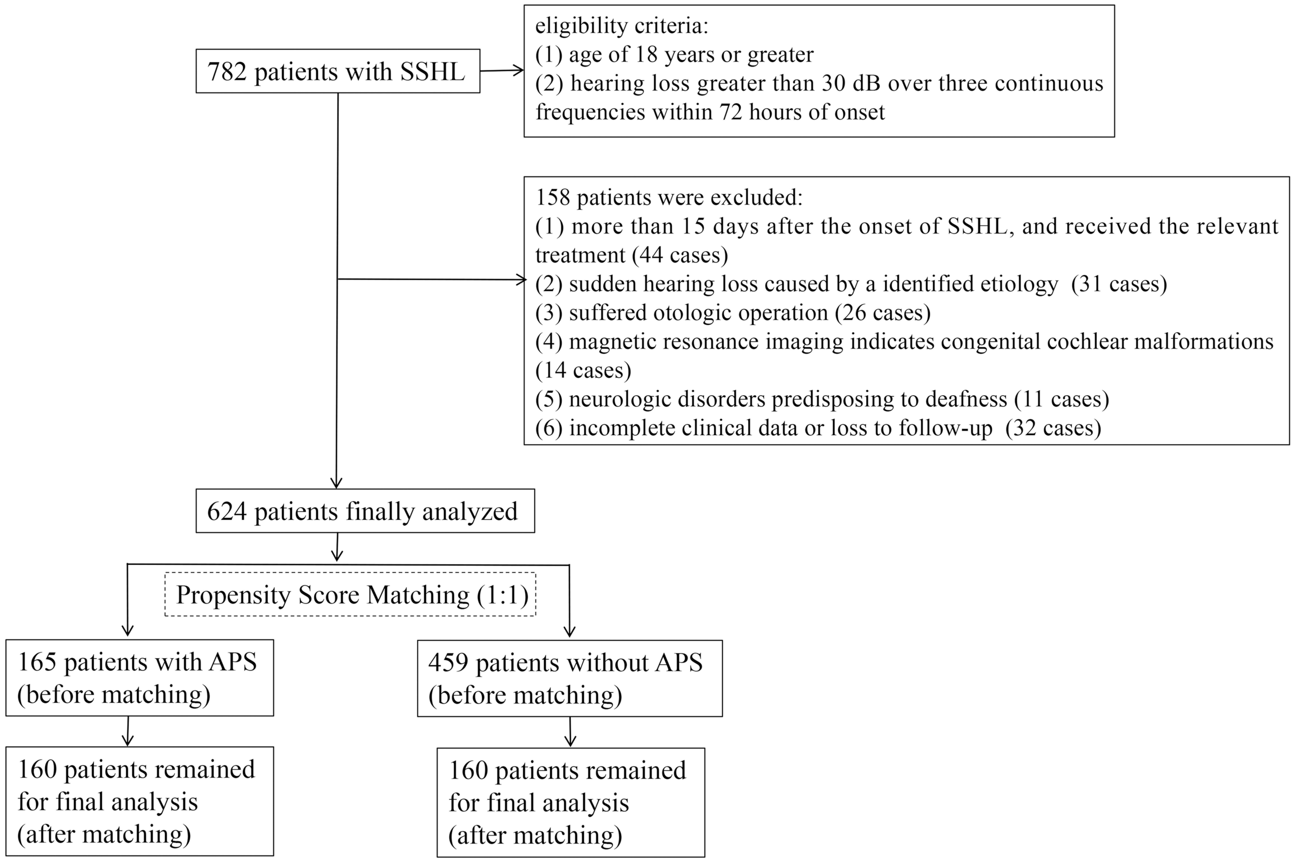

Figure 2 Flowing chart for screening eligible patients with SSHL.
Abbreviations: SSHL, sudden sensorineural hearing loss; APS, auricular point sticking.

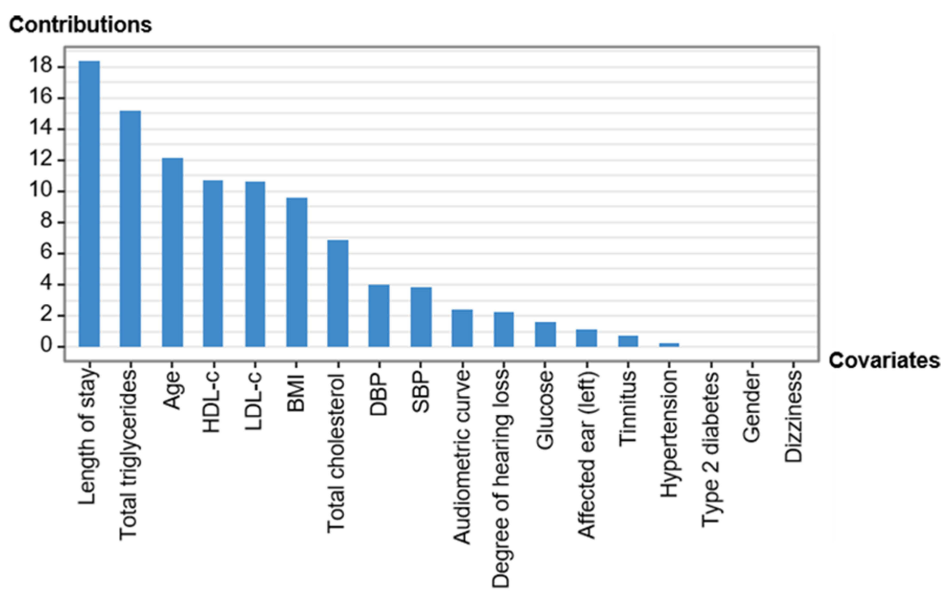

Figure 3 Relative influence factor of covariates and the contributions of individual covariates to the final propensity score. The relative influence factor measures how discriminative the 18 covariates of the propensity score model are when predicting the likelihood of auricular point sticking performance.
Abbreviations: BMI, body mass index; SBP, systolic blood pressure; DBP, diastolic blood pressure; HDL-c, high-density-lipoprotein cholesterol; LDL-c, low-density-lipoprotein cholesterol.

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Table 1 Base Characteristics of Patients Before and After Propensity Score Matching

Variables	Full Cohort (n=624)		*P* value	SMD	Matched Cohort (n=320)		*P* value	SMD
	APS Group (n=165)	Non-APS Group (n=459)			APS Group (n=160)	Non-APS Group (n=160)		
Age (years)	56.00 (48.00–64.00)	54.00 (47.00–61.00)	0.040	0.196	56.00 (48.00–64.00)	54.00 (48.00–64.25)	0.944	0.024
Gender (male) [n(%)]	94 (56.97%)	256 (55.77%)	0.791	0.024	91 (56.88%)	86 (53.75%)	0.574	0.063
BMI (kg/m^2)	23.33±3.86	24.39±2.89	0.841	0.017	24.41±3.88	24.17±2.83	0.534	0.070
SBP (mmHg)	129.58±12.25	131.15±12.93	0.175	0.125	129.67±12.38	129.79±12.10	0.927	0.004
DBP (mmHg)	68.78±8.03	69.24±9.06	0.565	0.054	68.79±8.04	68.28±9.08	0.612	0.045
Length of stay (days)	6.29 (3.91–9.37)	6.66 (4.84–9.45)	0.100	0.104	6.28 (3.89–9.32)	6.28 (4.31–9.42)	0.843	0.026
Total cholesterol (mmol/L)	4.34 (3.82–5.01)	4.02 (3.38–4.70)	<0.001	0.285	4.31 (3.78–4.96)	4.28 (3.67–5.16)	0.951	0.060
Total triglycerides (mmol/L)	1.12 (0.83–1.67)	1.23 (0.96–1.66)	0.064	0.130	1.12 (0.83–1.66)	1.17 (0.95–1.62)	0.396	0.013
HDL-c (mmol/L)	1.13 (0.97–1.46)	1.15 (0.96–1.35)	0.935	0.050	1.13 (0.97–1.43)	1.18 (1.00–1.41)	0.390	0.047
LDL-c (mmol/L)	2.68 (2.06–3.30)	2.25 (1.79–2.92)	<0.001	0.330	2.66 (2.06–3.23)	2.56 (2.03–3.25)	0.987	0.055
Glucose (mmol/L)	5.61 (5.11–6.37)	5.68 (5.12–6.40)	0.596	0.060	5.62 (5.10–6.31)	5.52 (5.07–6.35)	0.740	0.012
Degree of hearing loss [n(%)]			0.040	0.296			0.037	0.343
Mild	16 (9.70%)	83 (18.08%)			16 (10.00%)	28 (17.50%)		
Moderate	31 (18.79%)	57 (12.42%)			30 (18.75%)	15 (9.38%)		
Moderate-severe	35 (21.21%)	92 (20.04%)			35 (21.88%)	33 (20.62%)		
Severe	44 (26.67%)	135 (29.41%)			41 (25.62%)	49 (30.63%)		
Profound	39 (23.64%)	92 (20.04%)			38 (23.75%)	35 (21.88%)		
Audiometric curve [n(%)]			0.446	0.147			0.313	0.212
Low-frequency drop type	38 (23.03%)	112 (24.40%)			37 (23.12%)	38 (23.75%)		
High-frequency drop type	42 (25.45%)	114 (24.84%)			40 (25.00%)	37 (23.12%)		
Flat type	40 (24.24%)	133 (28.98%)			39 (24.38%)	52 (32.50%)		
Total deafness type	45 (27.27%)	100 (21.79%)			44 (27.50%)	33 (20.62%)		
Affected ear (left) [n(%)]	56 (33.94%)	181 (39.43%)	0.212	0.114	56 (35.00%)	59 (36.88%)	0.727	0.039
Hypertension [n(%)]	52 (31.52%)	128 (27.89%)	0.378	0.079	49 (30.63%)	46 (28.75%)	0.714	0.041
Type 2 diabetes [n(%)]	30 (18.18%)	103 (22.44%)	0.252	0.106	30 (18.75%)	29 (18.12%)	0.885	0.016
Tinnitus [n(%)]	41 (24.85%)	146 (31.81%)	0.094	0.155	40 (25.00%)	41 (25.62%)	0.898	0.014
Dizziness [n(%)]	68 (41.21%)	160 (34.86%)	0.146	0.131	64 (40.00%)	65 (40.62%)	0.909	0.013

Abbreviations: APS, auricular point sticking; BMI, body mass index; SBP, systolic blood pressure; DBP, diastolic blood pressure; HDL-c, high-density-lipoprotein cholesterol; LDL-c, low-density-lipoprotein cholesterol; SMD, standardized mean difference.

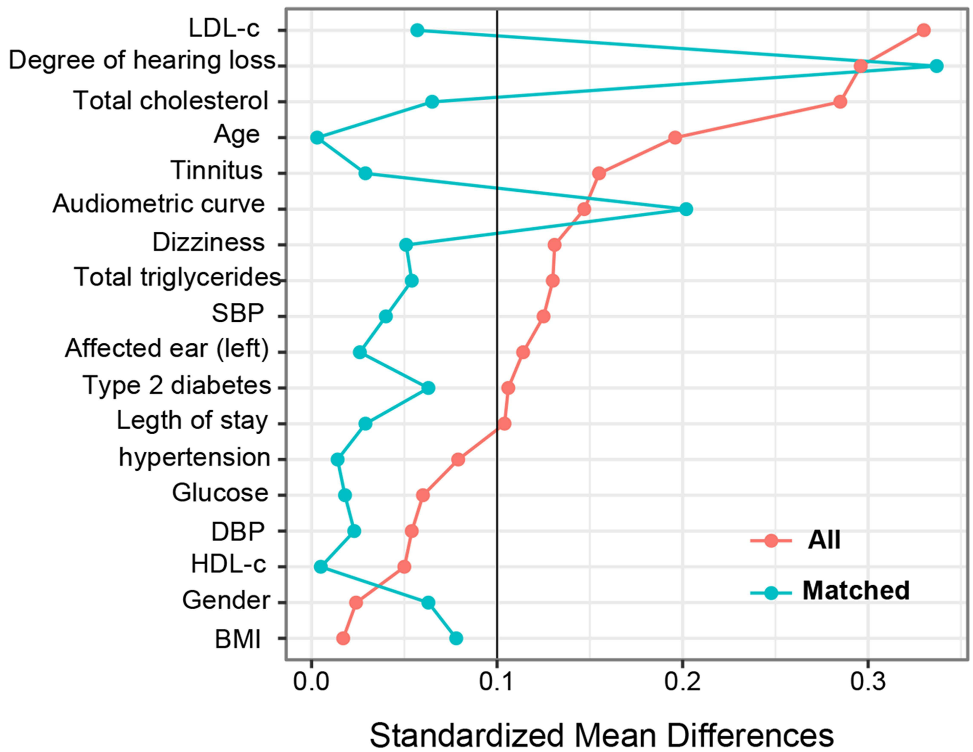

Figure 4 Standard mean differences of covariates between APS and non-APS groups before and after propensity score matching.
Abbreviations: APS, auricular point sticking; BMI, body mass index; SBP, systolic blood pressure; DBP, diastolic blood pressure; HDL-c, high-density-lipoprotein cholesterol; LDL-c, low-density-lipoprotein cholesterol.

Multivariate Logistic Regression Analysis of APS and Outcome

Multivariate logistic regression analysis showed that APS was significantly associated with the SSHL cure rate (OR = 2.704, 95% CI: 1.421–5.146; P = 0.002). The subgroup analyses demonstrated that APS was significantly associated with the SSHL cure rate in the categories stratified by age, gender, hypertension, diabetes mellitus, affect ear (all P < 0.05). These variables had no significant interactions with ASP therapy (all P > 0.05; Figure 5).

Doubly Robust Analysis of APS and Outcome

A propensity score model was initially constructed using 18 covariates with the GBM. The contributions of individual covariates to the final propensity score are depicted in Figure 3. The most influential covariates included length of stay, total triglycerides, age, HDL-c, LDL-c, BMI, and total cholesterol.

Table 2 Association Between APS and Therapeutic Effect

Variables	Full Cohort (n=624)		*P* value	Matched Cohort (n=320)		*P* value
	APS Group (n=165)	Non-APS Group (n=459)		APS Group (n=165)	Non-APS Group (n=459)	
Hearing recovery [n(%)]			0.195			0.020
Ineffective	32 (19.4%)	106 (24.8%)		31 (19.4%)	48 (30.0%)	
Effective	38 (23.0%)	129 (28.1%)		36 (22.5%)	44 (27.5%)	
Markedly effective	45 (27.3%)	119 (25.9%)		44 (27.5%)	39 (24.4%)	
Recovered	50 (30.3%)	105 (22.9%)		49 (30.6%)	29 (18.1%)	
Cure rate [n(%)]	50 (30.3%)	105 (22.9%)	0.058	49 (30.6%)	29 (18.1%)	0.009

Abbreviation: APS, auricular point sticking.

Table 3 Multicollinearity Analysis

Variables	Collinearity Diagnostics		Variables	Collinearity Diagnostics	
	Tolerance	**VIF**		**Tolerance**	**VIF**
APS	0.995	1.005	Degree of hearing loss	0.463	2.159
Gender (male)	0.806	0.240	Audiometric curve	0.472	2.120
Age	0.915	1.093	Tinnitus	0.873	1.146
BMI	0.882	1.134	Dizziness	0.937	1.067
SBP	0.829	1.206	Glucose	0.921	1.086
DBP	0.822	1.217	Total cholesterol	0.119	8.409
Type 2 diabetes	0.976	1.024	Total triglycerides	0.388	2.579
Hypertension	0.917	1.091	HDL-c	0.234	4.274
Length of stay	0.984	1.016	LDL-c	0.119	8.391
Affected ear (left)	0.941	1.063			

Abbreviations: APS, auricular point sticking; BMI, body mass index; SBP, systolic blood pressure; DBP, diastolic blood pressure; HDL-c, high-density-lipoprotein cholesterol; LDL-c, low-density-lipoprotein cholesterol; VIF, variance inflation factor.

Table 4 Ordinal Logistic Regression Analysis of Clinical Data, APS and Hearing Recovery After Propensity Score Matching

Variables		OR	95% CI	*P* value
APS		2.182	1.335–3.565	0.002
Audiometric curve	Low-frequency drop type	1.069	1.019–1.846	0.018
(Reference:Total deafness type)	High-frequency drop type	1.152	1.101–1.797	0.023
	Flat type	1.092	1.316–2.090	0.009

Abbreviations: APS, auricular point sticking; OR, odds ratio; CI, confidence interval.

Based on the estimated propensity scores, inverse probability weighting (IPW) was applied to minimize differences between the APS and non-APS cohorts. As shown in Table 1 and Figure 5, all covariates in the matched cohorts were balanced between the two groups, except for the degree of hearing loss. Within the doubly robust estimation framework, a regression model was constructed to adjust for residual imbalances in the weighted cohort.

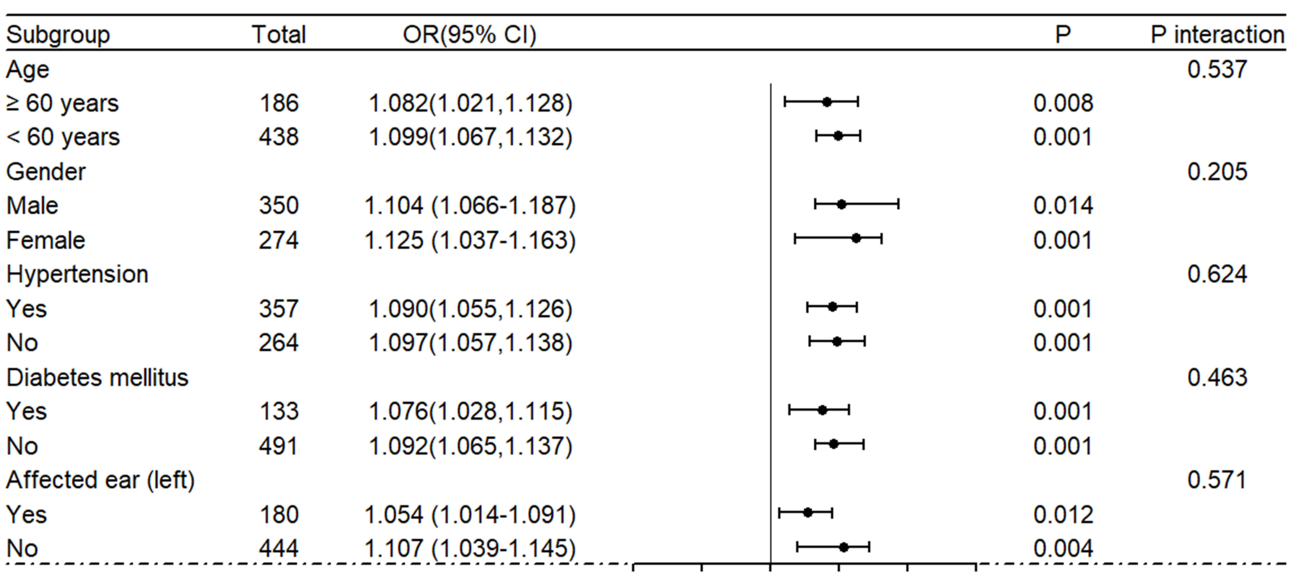

Figure 5 Subgroup analyses of interactions between APS and cure rate in patients with SSHL.
Abbreviations: APS, auricular point sticking; SSHL, sudden sensorineural hearing loss; OR, denotes odds ratio; 95% CI, 95% confidence interval.

Table 5 The Doubly Robust Analysis of APS and SSHL Cure Rate

Models	OR	95% CI	*P* value
Doubly robust model with unbalanced covariates	2.320	1.378–3.904	0.002
Doubly robust model with all covariates	2.342	1.037–5.287	0.041
Propensity score IPW	1.712	1.299–2.263	<0.001
Propensity score matching	1.994	1.181–3.368	0.010
Multivariate	2.704	1.421–5.146	0.002

Abbreviations: APS, auricular point sticking; SSHL, sudden sensorineural hearing loss; OR, odds ratio; CI, confidence interval.

The doubly robust analysis revealed a significant beneficial effect of auricular point sticking on the SSHL cure rate. The propensity score-matched SSHL cure rates were 30.6% in the APS group and 18.1% in the non-APS group. The adjusted OR was 2.320 (95% CI: 1.378–3.904, P = 0.002). Sensitivity analysis, summarized in Table 5, showed that all five estimation models yielded consistent results, confirming that patients who received APS experienced better hearing recovery.

Discussion

In our study, patients who received APS were older and had greater severity of hearing loss, as well as higher levels of total cholesterol and LDL-c. Despite these indicators suggesting a more severe patient group, hearing recovery and cure rates were significantly higher in SSHL patients who received APS, even after adjusting for confounding factors. Additionally, ordered logistic regression analysis confirmed a significant association between APS and hearing recovery in SSHL patients. The doubly robust analysis further revealed a significant beneficial effect of APS on the cure rate.

In modern medicine, the precise etiology of SSHL remains to be defined. Whether it is pharmacological or non-pharmacological approaches, effectiveness of these treatments remains unclear. Consequently, increasing research attention has been directed toward the therapeutic potential of traditional medicine in SSHL. It has been demonstrated that the therapeutic effects of auricular points encompass pain relief, endocrine modulation, immune regulation, neural modulation, and blood viscosity regulation.[5–7,19,20] Various acupuncture techniques, including traditional acupuncture, electroacupuncture, and scalp acupuncture, have proven effective in treating SSHL and are widely utilized in clinical practice.[21,22] However, the significant pain associated with auricular acupuncture makes it intolerable for some patients, thereby limiting its clinical application in SSHL treatment and potentially delaying patient recovery.

Previous studies have demonstrated that APS is an effective, acceptable treatment for tinnitus and deafness and is well tolerated by most patients with hearing loss.[8,23] Therefore, this study investigated the therapeutic effects of APS in patients with SSHL. The results suggest that APS contributes to hearing recovery in patients with SSHL. Zhou reported that APS-assisted treatment can reduce audiometric frequencies and improve auditory function in patients with moderate to severe sudden deafness,[13] supporting our findings.

A possible explanation lies in the therapeutic effects of acupuncture points. Modern research has confirmed that stimulating ear points can exert a bidirectional regulatory effect by affecting the human endocrine system.[24]

From the perspective of traditional medicine, acupuncture points such as Shenmen, heart, kidney, occipital, sympathetic, inner ear, outer ear, and endocrine are located near the ear and are believed to alleviate symptoms and enhance hearing. Additionally, APS can provide prolonged therapeutic stimulation, potentially leading to enhanced treatment outcomes.

Although the mechanism of SSHL is currently unknown, it was reported that AKT1 and NOS3 may be potential gene targets and molecular signaling pathways in the control of idiopathic sudden hearing loss. Targeting AKT1 and NOS3 could reduce inflammatory responses and damage to inner ear hair cells, thereby promoting blood circulation in the cochlea and improving hearing.[25] Thus, we speculate that APS may improve SSHL by regulating inflammation and improving blood circulation. However, such speculation requires further experimental validation.

This study has several limitations. First, the sample size was relatively small. Second, there was a lack of comparison with therapeutic effects of oral hormones. Third, this was a single-center study, not a randomized controlled study, and blinding was not feasible due to the nature of the intervention. Larger, multicenter randomized trials are needed to validate our findings.

Conclusions

This study suggests that APS may enhance hearing recovery and increase the cure rate in patients with SSHL. This treatment is simple, acceptable, and has potential for clinical application. However, the underlying mechanism of its therapeutic effect remains unclear, and further randomized trials are necessary to validate these findings.

Ethics Approval and Informed Consent

This study was approved by Ethics Committee at Shengzhou People's Hospital (No. 2023-028-01). All procedures followed were in accordance with the Declaration of Helsinki and its subsequent amendments. Informed consent was obtained from all patients for being included in the study.

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Disclosure

The authors declared no potential conflict of interest.

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