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Effectiveness of electroacupuncture for the treatment of sudden sensorineural hearing loss

A retrospective study

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Abstract

This retrospective study investigated the use of electroacupuncture (EA) for the treatment of patients with sudden sensorineural hearing loss (SSNHL).

Between May 2016 and April 2020, 140 patients with SSNHL were retrospectively analyzed. They were allocated to a treatment group (n = 70, received EA) and a control group (n = 70, received acupuncture). They received EA or acupuncture for a total of 3 months. The outcomes included average hearing threshold (AHT), tinnitus (as assessed by tinnitus handicap inventory [THI]), dizziness (as measured by dizziness handicap inventory [DHI]), and adverse events (AEs).

After treatment, patients in both groups exerted more reduction in HT ($P < .01$), THI ($P < .01$), and DHI ($P < .01$), than those before the treatment. Furthermore, patients in the treatment group showed more relief in HT ($P < .01$), THI ($P < .01$), and DHI ($P < .01$), than those of patients in the control group. When it comes to AEs, both modalities had similar safety profile.

The findings of this retrospective study indicated that the effectiveness of EA is superior to acupuncture in treating SSNHL. Future high quality studies are needed to warrant the present findings.

Abbreviations: AEs = adverse events, AHT = average hearing threshold, DHI = dizziness handicap inventory, EA = electroacupuncture, SSNHL = sudden sensorineural hearing loss, TENS = transcutaneous electrical nerve stimulation, THI = tinnitus handicap inventory.

Keywords: acupuncture, effectiveness, electroacupuncture, sudden sensorineural hearing loss

1. Introduction

Sudden sensorineural hearing loss (SSNHL) refers to the sudden (within 72 hours) drop in hearing at least 30 dB at 3 contiguous frequencies.[1–4] It is characterized by an acute unilateral sensorineural hearing loss with unexplained reasons.[5–8] It is reported that its incidence ranges between 5 and 77 cases in each 100,000 people annually.[9,10] It can affect at any age and typically occurs between 40 and 55 years of age, with identical numbers of men and women affected.[11–13] Although several factors are reported to have close association with SSNHL, such as vascular dysfunction, neurological disorder, infection, autoimmune disease, ototoxic drugs, and trauma, most cases are still idiopathic.[3,14,15]

Despite a variety of comprehensive modalities are widely utilized to treat this condition, including intratympanic steroid, hyperbaric oxygen therapy, neuro-rehabilitation approach, and vasodilator, their efficacy is still unsatisfied.[16–19] In addition, long-term use of medication is often associated with severe adverse events (AEs). Thus, alternative treatment to manage SSNHL is in high demand. Non-pharmacological therapy includes transcutaneous electrical nerve stimulation (TENS), moxibustion, Tuina, and acupuncture are report to treat such condition.[20–23]

Acupuncture is one of the most popular therapies to manage SSNHL.[21–23] TENS and acupuncture have similar effectiveness to control SSNHL without severe AEs.[20] It utilizes low voltage electrical current to control pain condition that delivers electrical impulses via electrodes at trigger points on the local skin.[24–26] Electroacupuncture (EA), a combination of acupuncture and TENS, applying a small electric current between pairs of acupuncture needles,[27,28] has profound therapeutic benefits for SSNHL and is associated with a very low risk of AEs. Studies suggested that EA can be used for treating this disorder.[28,29] However, there is still limited evidence available on this topic. Thus, this retrospective study aimed to explore the effectiveness of EA in the treatment of patients with SSNHL.

2. Patients and methods

2.1. Ethical approval

This retrospective study was approved by the Institutional Review Board of Ethics Medical Committee of The First

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X-fZ and X-lJ contributed equally to this study.

The authors have no conflicts of interest to disclose.

The datasets generated during and/or analyzed during the current study are not publicly available, but are available from the corresponding author on reasonable request.

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Affiliated Hospital of Jiamusi University. The written informed consent has been waived because of the nature of retrospective study.

2.2. Patients

This retrospective study analyzed a total of 140 patient case records, diagnosed with SSNHL at The First Affiliated Hospital of Jiamusi University between May 2016 and April 2020. They were assigned to a treatment group (n = 70) and a control group (n = 70) according to the different therapies they received. The inclusion criteria consisted of age between 18 and 70 years old; SSNHL of at least 30 dB with ≥3 consecutive frequencies within 72 hours; and no definite cause was identified. The exclusion criteria included: acoustic neuroma, cerebral trauma, window rupture; middle ear or retro-cochlear pathology; history of hearing aid or otologic surgery; and incomplete patient case information.

2.3. Treatment approach

In the control group, all 70 patients received acupuncture treatment at affected side of Tinggong (SI 19, on the region of the face, anterior to the tragus and posterior to the condyloid process of the mandible, in the depression formed when the mouth is open), Ermen (TE 21, anterior to the supratragic notch and behind the posterior border of the condyloid process of the mandible with the mouth open), Yifeng (TE 17, posterior to lobule of ear in depression between the mandible and mastoid process), and vertigo-auditory area (located over temporal lobe in the lateral side of the head with a total of 4-cm horizontal line. It starts 1.5 cm superior to the apex of the auricle of the ear at its middle point, and extends 2 cm anterior and 2 cm posterior to the middle point). All acupoints are unilateral, and all their locations abide to the standard of World Health Organization.[30] After sterilizing the localized acupoint areas, disposable and sterile acupuncture needles (Huatuo Brand, 0.30 × 40 mm, Suzhou Medical Instrument Co., Ltd., Jiangsu, China) were inserted at the selected acupoints. All patients achieved *Deqi*, and were treated 60 minutes each session, 1 session daily, 3 sessions weekly for a total of 3 months.

In the treatment group, all 70 patients received EA treatment (SDZ-V; Huatuo Medical Technology Co., Ltd. Suzhou, China) with continuous wave, 25 Hz frequency, and a current intensity of 1 to 10 mA. All of them had same procedure as the control group (they also achieved *Deqi* before EA treatment), except patients in the treatment group connected EA apparatus to the acupuncture needles. They were also treated 60 minutes each session, 1 session daily, 3 sessions weekly for a total of 3 months.

2.4. Outcome measurements

Outcomes included average hearing threshold (AHT), tinnitus, dizziness, and AEs. The AHT was assessed by Denmark MADSEN MM622 Clinical Diagnostic Electric Audiometer. We calculate the hearing threshold ranging between 250 and 8000 Hz. The higher value of AHT indicates more serious hearing loss. Tinnitus was measured by tinnitus handicap inventory (THI).[31] It covers 3 aspects of function, emotion, and severity. It comprises of 25 questions, and the total score varies from 0 to 100, with a higher score indicating a more severe degree of tinnitus. The vertigo was evaluated by dizziness handicap inventory (DHI).[32] It also has 25 questions, and covers domains of function, emotion, and physical impact. Its total score ranges from 0 to 100, with a higher score suggesting more a severe degree of vertigo. The data analyst was blinded in this study.

2.5. Statistical analysis

We analyzed all data using SAS package (Version 9.1; SAS Institute Inc., Cary, NC). The *t* test or Wilcoxon test was used to analyze continuous data, and the Pearson chi-square test or Fisher exact test was utilized to analyze discontinuous data. We set $P < .05$ (2-side) as having statistical significance.

3. Results

This retrospective study included 140 eligible patient cases. Of those, 70 patients received EA, and were assigned to the treatment group. The other 70 patients received acupuncuture, and were allocated to the control group. Clinical characteristics and demographics are summarized in Table 1. No significant differences in mean age (year), sex, race (China), body mass index (kg/m^2), and affected side are detected between 2 groups.

Before treatment, there were not significant differences in AHT ($P = .61$, Table 2), THI ($P = .56$, Table 3), and DHI ($P = .19$, Table 4) between 2 groups in this retrospective study.

After treatment, patients in both group achieved better outcomes in AHT ($P < .01$, Table 2), THI ($P < .01$, Table 3), and DHI ($P < .01$, Table 4), than those before treatment. Moreover, there were significant differences in HT ($P < .01$, Table 2), THI ($P < .01$, Table 3), and DHI ($P < .01$, Table 4) between 2 groups.

As for AEs, only 3 minor adverse reactions were reported in both groups (Table 5). No severe AEs were recorded in both groups. In addition, there were not significant differences in all AEs between 2 groups (Table 5).

4. Discussion

Although a variety of treatment modalities are utilized for the treatment of patients with SSNHL, its optimal therapy strategy has not been established, because of its uncertain etiology. Acupuncture, TENS, and EA are reported to manage symptoms of SSNHL.[19–27] In addition, EA as a combination of acupuncture and TENS may benefit patients with TENS.[26–27] However, there is seldom clinical evidence to explore and support this issue.

Table 1

Comparison of patient characteristics between 2 groups.

Characteristics	Treatment group (n = 70)	Control group (n = 70)	*P* value
Mean age, y	55.7 (13.5)	57.1 (14.2)	.55
Gender			
Male	39 (55.7)	36 (51.4)	.61
Female	31 (44.3)	34 (48.6)	–
Race (China)	70 (100.0)	70 (100.0)	–
BMI, kg/m^2	24.0 (2.7)	23.7 (3.1)	.54
Affected side			
Left	32 (45.7)	37 (52.9)	.40
Right	38 (54.3)	33 (47.1)	–

Data are present as mean ± standard deviation or number (%). BMI = body mass index.

Table 2

Comparison of AHT between 2 groups.

AHT	Treatment group (n = 70)	Control group (n = 70)	*P* value
Before treatment	63.18 (10.42)	64.05 (9.96)	.61
After treatment	28.71 (12.66)	40.50 (13.19)	<.01
Difference within groups	–34.70 (–41.26, –31.09)*	–23.55 (–30.77, –19.55)*	
Difference between groups		–11.15 (–13.85, –8.93)	<.01

Data are present as mean ± standard deviation (range). AHT = average hearing threshold.
* $P < .01$, compared within group.

Table 3

Comparison of HTI between 2 groups.

HTI	Treatment group (n = 70)	Control group (n = 70)	*P* value
Before treatment	67.38 (8.51)	66.50 (9.24)	.56
After treatment	24.85 (14.06)	32.77 (15.82)	<.01
Difference within groups	–42.53 (–49.04, –33.27)*	–33.72 (–37.63, –26.80)*	
Difference between groups		–8.81 (–10.72, –7.05)	<.01

Data are present as mean ± standard deviation (range). THI = tinnitus handicap inventory.
* $P < .01$, compared within group.

Table 4

Comparison of DHI between 2 groups.

DHI	Treatment group (n = 70)	Control group (n = 70)	*P* value
Before treatment	58.83 (7.95)	57.01 (8.40)	.19
After treatment	33.15 (9.23)	41.56 (10.08)	<.01
Difference within groups	–25.68 (–30.17, –21.04)*	–15.45 (–19.86, –12.06)*	
Difference between groups		–10.21 (–13.40, –8.12)	<.01

Data are present as mean ± standard deviation (range). DHI = dizziness handicap inventory.
* $P < .01$, compared within group.

Table 5

Comparison of adverse events between 2 groups.

Safety	Treatment group (n = 70)	Control group (n = 70)	*P* value
Minor local bleeding	4 (5.7)	6 (8.6)	.49
Skin bruise	3 (4.3)	2 (2.9)	.56
Needle site pain	6 (8.6)	5 (7.1)	.56

Data are present as number (%).

This retrospective study analyzed a total of 140 patient case records to investigate the effectiveness and safety of EA for the patients with SSNHL. It assessed AHT, tinnitus, dizziness, and side effects. After treatment, the results showed that patients in both group had more relief in AHT ($P < .01$), THI ($P < .01$), and DHI ($P < .01$), than those before the treatment. It shows that both EA and acupuncture can benefit patients with SSNHL. When compared between 2 groups after treatment, patients in the treatment group exerted more decrease in AHT ($P < .01$), THI ($P < .01$), and DHI ($P < .01$), than those in the control group. It suggests that the effectiveness of EA is superior to the acupuncture for the treatment of patients with SSNHL.

With respect to the AEs, no severe AEs were reported in both groups. Only 3 minor AEs were recorded in the 2 groups. However, there were not significant differences in all those AEs between 2 groups in this retrospective study. It means that both EA and acupuncture had similar safety profile. In addition, both of them are safe for the treatment of patients with SSNHL.

Several restrictions exist in this retrospective study. First, this retrospective study only collected patient data from single center of The First Affiliated Hospital of Jiamusi University, which may impact its generalization to other hospitals. Second, this study only assessed outcomes at 3-month treatment, and no further follow-up data were reported in the original patient case records. Third, because of the nature of retrospective study, this study could not utilize the procedures of randomization, concealment, and blind. However, despite those restrictions, we still believe that this retrospective study is valuable, that because to our best knowledge, it is the first clinical study to address this topic. Futures studies should avoid above limitations.

5. Conclusion

This study showed that EA is superior to acupuncture for the treatment of SSNHL. Further studies are still encouraged to verify the present findings.

Author contributions

Conceptualization: Xu-feng Zhou, Xiu-lin Jin.
Data curation: Xu-feng Zhou, Xiu-lin Jin.
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