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Original Article

Do Otologists and Other Otolaryngologists Manage Single-Sided Deafness Differently?

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BACKGROUND: The aim of this study was to survey the knowledge and treatment management practices for single-sided deafness (SSD) among different subspecialties of otolaryngology.

METHODS: A questionnaire was sent via Google Sheets to members of the Turkish and Egyptian Otorhinolaryngology Societies between December 2021 and February 2022. For the statistical analysis, the respondents were divided into 3 groups as otologists, non-otologists, and residents at the department of otolaryngology—head and neck department.

RESULTS: There were no statistically significant differences between otologists and non-otologists in radiological imaging (child $P = .469$, adult $P = .140$) and preferred treatment method (child $P = .546$, adult $P = .106$). However, otolaryngologists showed significant differences in radiological evaluation ($P < .001$), vestibular evaluation ($P = .000$), and frequency of treatment options recommended for pediatric and adult SSD patients ($P = .000$).

CONCLUSION: There were no significant differences in SSD diagnosis, treatment, and rehabilitation between otologists and non-otologists. However, when comparing pediatric and adult patients, there was a difference in the treatment management of SSD patients.

KEYWORDS: Single-sided deafness, cochlear nerve deficiency, cytomegalovirus, mumps, cochlear implant, bone conduction device

INTRODUCTION

Single-sided deafness (SSD) is when normal hearing [pure-tone audiometry (PTA) ≤ 30 dB HL] is observed in one ear and severe or profound hearing loss (PTA ≥ 70 dB HL) in the other ear.[1] The prevalence of SSD is approximately 0.11%- 0.14%.[2] The incidence of congenital SSD in newborn infants is 0.027%,[3] and the annual rate of newly diagnosed SSD cases is 2/10 000.[4] The etiological causes of SSD are diverse. In the pediatric age group, the most common cause of SSD is cochlear nerve deficiency, while the most common cause in adults is sudden sensorineural hearing loss.[5] Other etiological causes include inner ear anomalies, cytomegalovirus and mumps infections, cholesteatoma, cerebellopontine angle tumors, and more rarely, head trauma, autoimmune disorders, and Meniere's disease.[5,6]

The main goal of SSD treatment is to reduce the negative impact of SSD on patients' communication and social and academic development.[7,8] Dwyer et al[9] found that patients with SSD had significantly lower speech recognition scores in noisy environments. In the pediatric patient group, speech, communication, and social and academic development problems have been observed compared to their peers.[10] Patients with SSD have difficulty determining the direction of sound, have difficulty understanding speech in the presence of background noise and on the affected ear side, and have to exert more effort to distinguish sounds, leading to a decrease in quality of life and social isolation.[11-16]

Current rehabilitation options for SSD patients include bone conduction device (BCD), contralateral routing of signal (CROS), and cochlear implant (CI). Bone conduction devices improve comprehension in noise but fail in sound localization and can cause skin problems.[17] Contralateral routing of signals are also useful in the presence of background noise, but it remains difficult to determine the direction of sound.[18] Cochlear implant is the only treatment option that provides bilateral hearing in selected patients,

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which improves quality of life due to better understanding of speech in noisy environments and the benefit it provides in determining the direction of sound.[19] Choosing the appropriate treatment method according to the characteristics and expectations of the patient will increase the success of the treatment option.[20]

The most important factors in the selection of a device for SSD treatment have been reported to be comfort while using the device, ease of use, easy access to customer service, clinician recommendations, and protection of the hearing ear.[21] There are studies in literature that have compared these treatment methods, investigated the superiority and limitations of the devices, and examined the perspective of SSD patients.[12,15,18,19,21-24] However, no study has investigated the awareness and knowledge level that would affect clinician advice, which is very important support in the management of patients when there is conflict in the decision of treatment selection. To the best of our knowledge, this is the first study to compare the current knowledge and practice between otologists and non-otologists in the area of SSD and to report these results. As a secondary outcome, the diagnostic and treatment practices applied to pediatric and adult SSD patients were also evaluated.

MATERIAL AND METHODS

A questionnaire was prepared by the third author, who has more than 25 years of experience in this field, and was sent twice via Google Sheets to members of the Turkey and Egypt Otorhinolaryngology Societies between December 2021 and February 2022. Each participant was allowed to complete the survey only once and was not allowed to see the results of the survey. The survey was divided into 3 sections of 21 items (Appendix 1—The Survey Questionnaire). The first section (5 items) was to elicit the demographic characteristics of the respondents, the second section (6 items) aimed to investigate the level of knowledge about SSD, and the third part (10 items) to evaluate the diagnosis, treatment, and rehabilitation methods used for SSD. The questionnaire could be completed in approximately 4 minutes. This non-validated survey was approved by Kütahya Health Science University Clinical Research Ethics Committee (Approval No: 2021/15-28). Informed consent was not obtained because patients were not included in our study.

Statistical Analysis

The responses were collected anonymously, and only fully completed questionnaires were included in the study. For the statistical analysis, the respondents were divided into 3 groups as otologists, non-otologists, and residents. The data obtained in the study were first entered into the Microsoft Office—Excel program in detail and then transferred to the IBM Statistical Package for Social Sciences Statistics version 20.0 (IBM SPSS Corp.; Armonk, NY, USA) program for statistical analysis. In the evaluation of the data, the methods used depended on the type of data. For qualitative data, frequency tables were used with frequency (n) and percentage (%). Cross tabulations were created according to the number of categories to show the relationship between qualitative variables and the differences between groups. Chi-square test statistics and *P*-values were obtained through chi-square tests. The results were evaluated at a significance level (margin of error) of .05 and .01; thus values of $P < .05$ and $P < .01$ were accepted as statistically significant.

MAIN POINTS

- This study highlights many common trends between otologists and non-otologists.
- There were no significant differences in SSD diagnosis, treatment and rehabilitation between otologists and non-otologists.
- However, when comparing paediatric and adult patients, there was a difference in the treatment management of SSD patients.
- Awareness of current treatment options will have a positive impact on the patient's life by reducing the difficulty of SSD for both the patient and the physician.

RESULTS

Approximately 1000 otolaryngologists received the survey, and from a total of 120 respondents to the questionnaire, 12 were excluded because they did not complete the survey, so a final analysis was made of 108 questionnaires (108/1000-10.8%). Of the total respondents, 32 were working in otology, 59 in non-otology, and 17 as residents. The age range of the participants was as follows: 24 were aged 20-30 years, 30 were aged 31-40 years, 29 were aged 41-50 years, 14 were aged 51-60 years, and 11 were aged >61 years. The place of work was a state institution in 61 cases, a private institution in 27, and both state and private institutions in 20. In terms of years of employment, it was observed that the highest number, 41 respondents, had worked <10 years with 41 people, and the second largest group was 28 at 11-20 years. Of the total respondents, 64.8% (n = 70) worked in a tertiary-level hospital, 53.7% were Turkish, and 46.3% were Egyptian. Other responses are summarized in Table 1.

Awareness of the definition of SSD was reported by 96.9% of the otology group, 93.2% of the non-otology group, and 100% of the residents, with no significant difference ($P = .448$). The thought that quality of life was affected by SSD was stated by 78.1% of the otology group, 78% of the non-otology group, and 88.2% of the resident group, with no significant difference between the groups ($P = .631$). Additional examinations (blood–serology examination) in addition to imaging for SSD were requested by 21.9%, 32.2%, and 35.3% of the otology, non-otology, and resident groups, respectively. A difference was observed between the groups in the rates of requesting additional examination—serological examination—but not at a significant level ($P = .504$). When newborn hearing screening (NHS) was evaluated in the clinics, 84.4% NHS was performed in the otology group, 88.1% in the non-otology group, and 88.2% in the resident group. No significant difference was determined when the groups were compared in terms of newborn hearing screening (NHS) ($P = .867$). To the question "Are infant patients with SSD sent to your clinic for follow-up?", 71.9% of the otology group, 52.5% of the non-otology group, and 70.6% of the residents answered yes. Although the otology group had the highest number of follow-up visits for infants with SSD, there was no significant difference between the groups ($P = .134$) (Table 2).

To the question "Do you routinely perform radiological evaluation in children with single-sided deafness?", 46.9% of the otology group, 55.9% of the non-otology group, and 64.7% of the resident group answered yes. There was no significant difference between the groups in terms of routine radiological evaluation of pediatric

Table 1. Demographic Characteristics of the Study Participants

	Otology (n = 32)	Non-Otology (n = 59)	Resident (n = 17)
Age (years) (n)	–	–	–
>61	4	7	–
51-60	7	7	–
41-50	10	19	–
31-40	9	20	1
20-30	2	6	16
Institutions (n)			
State	15	29	17
Private	10	17	–
State + private	7	13	–
Hospital (n)			
Non-tertiary	11	24	3
Tertiary	21	35	14
Number of years worked (n)			
<10 years	5	19	17
11-20 years	9	19	–
21-30 years	10	10	–
31-40 years	6	9	–
>41 years	2	2	–
Nationality (n)			
Turkish (58)	17	32	9
Egyptian (50)	15	27	8

SSD ($P = .469$). A response of yes was given to the question "Do you routinely perform radiological evaluation in adults with single-sided deafness?", by 71.9% of the otology group, 71.2% of the non-otology group, and 94.1% of the resident group. Although the resident group had the highest number of requests for routine radiological evaluation of adults, there was no significant difference between the groups ($P = .140$). In the comparison of routine radiological evaluation of children and adults, the physicians showed statistically significantly different behaviors (chi-square: 4; $P < .001$).

Table 3. Child and Adult Vestibular Assessment

		Adult Vestibular Assessment		*P*
		Yes, n (%)	No, n (%)	
Child vestibular assessment	Yes	13 (81.2)	3 (18.8)	.000
	No	29 (31.5)	63 (68.5)	

When asked "Would you ask for vestibular evaluation in a child with single-sided deafness, even if there is no complaint?", 6.2% of the otology group, 18.6% of the non-otology group, and 17.6% of the resident group stated that they would request a test for vestibular evaluation. There was no significant difference between the groups in terms of requesting a test for vestibular evaluation in pediatric patients ($P = .265$). When asked "Would you ask for vestibular evaluation in an adult with single-sided deafness, even if there is no complaint?", 34.4% of the otology group, 39% of the non-otology group, and 47.1% of the resident group stated that they would request a test for vestibular evaluation. In the comparison between groups, there was no significant difference in terms of requesting a test for vestibular evaluation in adult SSD ($P = .687$). However, it was observed that physicians behaved differently in terms of vestibular evaluation in pediatric and adult SSD patients, and this difference was significant ($P = .000$) (Table 3).

In terms of the frequency of seeing patients diagnosed with SSD, the highest frequency was 1 infant every 6 months (mean 2 per year) reported by 37.5% of the otology group; in the non-otology group, it was 1 infant per month (mean 12 per year) at 32.2%, and in the resident group it was 1 infant per month (mean 12 per year) at 35.3%. There was no significant difference between the groups with respect to the frequency of follow-up of patients with SSD ($P = .358$) (Table 4).

When asked "What is the average age of diagnosis of infants with SSD in your own practice when newborn hearing screening is not performed?", it was observed that 40.6% of the otology group answered between 6-10 years of age, 28.8% of the non-otology group answered between 6-10 years of age, and 35.3% of the resident group answered between 1-5 years of age. No significant difference was found between the groups in terms of age at diagnosis

Table 2. Questions About Single-Sided Deafness

	Otology (n = 32)		Non-otology (n = 59)		Resident (n = 17)		*P*
	Yes, n (%)	No, n (%)	Yes, n (%)	No, n (%)	Yes, n (%)	No, n (%)	
Awareness of identifying single-sided deafness	31 (96.9)	1 (3.1)	55 (93.2)	4 (6.8)	17 (100.0)	0 (0.0)	.448
Impact on quality of life	25 (78.1)	7 (21.9)	46 (78.0)	13 (22.0)	15 (88.2)	2 (11.8)	.631
Blood-serological examination	7 (21.9)	25 (78.1)	19 (32.2)	40 (67.8)	6 (35.3)	11 (64.7)	.504
Newborn hearing screening	27 (84.4)	5 (15.6)	52 (88.1)	7 (11.9)	15 (88.2)	2 (11.8)	.867
Referred SSD	23 (71.9)	9 (28.1)	31 (52.5)	28 (47.5)	12 (70.6)	5 (29.4)	.134
Routine radiological evaluation of children	15 (46.9)	17 (53.1)	33 (55.9)	26 (44.1)	11 (64.7)	6 (35.3)	.469
Routine radiological evaluation of adults	23 (71.9)	9 (28.1)	42 (71.2)	17 (28.8)	16 (94.1)	1 (5.9)	.140
Pediatric vestibular assessment	2 (6.2)	30 (93.8)	11 (18.6)	48 (81.4)	3 (17.6)	14 (82.4)	.265
Adult vestibular assessment	11 (34.4)	21 (65.6)	23 (39.0)	36 (61.0)	8 (47.1)	9 (52.9)	.687

Table 4. Frequency of Single-Sided Deafness and Age at Diagnosis in the Absence of Newborn Hearing Screening

	Otology (n = 32)	Non-Otology (n = 59)	Resident (n = 17)	*P*
Frequency of SSD n (%)				.358
One infant a month	10 (31.2)	19 (32.2)	6 (35.3)	
1 infant every 3 months	3 (9.4)	12 (20.3)	4 (23.5)	
1 infant every 6 months	12 (37.5)	11 (18.6)	2 (11.8)	
One infant a year	7 (21.9)	17 (28.8)	5 (29.4)	
Age at diagnosis in the absence of NHS n (%)				.501
<1 year	6 (18.8)	14 (23.7)	5 (29.4)	
1-5 years	5 (15.6)	10 (16.9)	6 (35.3)	
6-10 years	13 (40.6)	17 (28.8)	3 (17.6)	
11-15 years	2 (6.2)	2 (3.4)	0 (0.0)	
>15 years	6 (18.8)	16 (27.1)	3 (17.6)	

NHS, newborn hearing screening; SSD, single-sided deafness.

Table 5. Pediatric and Adult Radiological Imaging

		Adult Radiological Imaging				*P*
		CT + MRI, n (%)	No Imaging, n (%)	Temporal CT, n (%)	Temporal MRI, n (%)	
Pediatric radiological imaging	CT + MRI	15 (46.9)	0 (0.0)	3 (9.4)	14 (43.8)	.003
	No imaging	3 (42.9)	0 (0.0)	0 (0.0)	4 (57.1)	
	Temporal CT	13 (25.5)	1 (2.0)	23 (45.1)	14 (27.5)	
	Temporal MRI	3 (16.7)	0 (0.0)	12 (66.7)	3 (16.7)	

CT, computed tomography; MRI, magnetic resonance imaging.

(*P* = .501). The age group with the least frequent diagnosis rate was the 11-15 years age group (Table 4).

When asked which examination would be preferred for radiological evaluation, 47.2% (n = 51) stated computed tomogrpahy (CT), 29.6% (n = 32) CT + magnetic resonance imaging (MRI), and 16.6% (n = 18) MRI for children, while 35.2% (n = 38) stated CT, 32.4% (n = 35) MRI, and 31.5% (n = 34) CT + MRI for adults. There was no significant difference between the groups (otology, specialist-other, resident) in terms of radiological examination preference (*P* = .772; *P* = .846, respectively). However, it was observed that the preferred radiological imaging was different for the pediatric and adult age groups, and this difference was significant (*P* = .003) (Table 5).

When the age at diagnosis of SSD was compared with the use of radiological imaging, the rate of routine radiological imaging was 84% (n = 21) in children younger than 1 year, 85.7% (n = 18) in children aged 1-5 years, 36.4% (n = 12) in children aged 6-10 years, 50% (n = 2) in children aged 11-15 years, and 24% (n = 6) in children older than 15 years. As the age at diagnosis of SSD decreased, the use of radiological imaging increased significantly (*P* = .000) (Table 6).

When asked "What is your preferred treatment method for children with single-sided deafness?", 54.6% (n = 59) of the participants did nothing, 20.4% (n = 22) recommended hearing aids, 12% (n = 13) recommended CROS devices, 6.5% (n = 7) recommended CIs, and 0.92% (n = 1) recommended BCD devices. There was no significant difference between the groups (*P* = .546). When the participants were asked "What is your preferred treatment method for adults with single-sided deafness?", 42.6% (n = 46) did not do anything, 32.4% (n = 35) recommended CROS device, 9.3% (n = 10) recommended hearing aids, 5.5% (n = 6) recommended BCD, and 4.6% (n = 5) recommended CI. There was no significant difference between the groups (*P* = .106). However, a statistically significant difference was determined in the frequency of recommending treatment options for pediatric and adult patients with SSD (chi-square: 358.804; *P*-value: 0.000) (Table 7).

When asked "In patients with single-sided deafness, are the costs of devices (CROS, bone anchored hearing aids, and cochlear implants) covered by reimbursement systems?", 38% (n = 41) of the participants said yes, while 62% (n = 67) said no. There was no significant difference between the groups (*P* = .608).

Table 6. Age at Diagnosis and Routine Radiological Imaging for Children

	Age at Diagnosis					*P*
	<1 year, n (%)	1-5 years, n (%)	6-10 years, n (%)	11-15 years, n (%)	>15 years, n (%)	
Routine radiological imaging for children						
Yes	21 (84)	18 (85.7)	12 (36.4)	2 (50)	6 (24)	.000
No	4 (16)	3 (14.3)	21 (63.6)	2 (50)	19 (76)	

Table 7. Treatment Options for Child and Adult

		Adult Treatment Options					*P*
		CROS Device n (%)	Hearing Aid, n (%)	Nothing, n (%)	BCD, n (%)	Cochlear Implant, n (%)	
Child Treatment Options	CROS device	11 (84.6)	–	2 (15.4)	–	–	.000
	Nothing	15 (25.4)	1 (1.7)	39 (66.1)	4 (6.8)	–	
	Hearing aid	6 (27.3)	8 (36.4)	3 (13.6)	2 (9.1)	1 (4.5)	
	BCD	1 (100.0)	–	–	–	–	
	Cochlear implant	2 (28.6)	1 (14.3)	–	–	4 (57.1)	

BCD, bone conduction device; CROS, contralateral routing of signal.

DISCUSSION

Otolaryngologists, who play an important role in the diagnosis, treatment, and rehabilitation management of patients with SSD, should have sufficient knowledge about the condition to be able to help patients with decision-making for the appropriate method of treatment, including advantages and disadvantages. The aim of this study was to determine the differences in diagnosis and treatment practices of SSD among subspecialties of otolaryngology. There was no significant difference between the otology and non-otology groups with respect to the definition of SSD ($P = .448$), radiological imaging (child $P = .469$, adult $P = .140$), and the preferred treatment method (child $P = .546$, adult $P = .106$). However, otolaryngologists showed significant differences in radiological evaluation ($P < .001$), vestibular evaluation ($P = .000$), preferred imaging modalities ($P = .003$), and frequency of treatment options recommended for pediatric and adult SSD patients (chi-square: 358.804; $P = .000$).

Of the physicians participating in this study, 87% worked in centers where NHS was performed, while 13% worked in centers where NHS was not performed. The NHS provides the opportunity for early diagnosis and treatment by detecting infants with congenital unilateral deafness. The mean age at diagnosis for unilateral hearing loss before the introduction of NHS has been reported to be older than 8 years during screening in primary schools.[25,26] The NHS protocols vary according to countries.[27] It should not be forgotten that approximately 24% of children with SSD have been reported to have undergone NHS.[28] This may be due to the fact that only one ear is tested in newborn hearing screening, or a follow-up testing may be missed, or late onset loss.[28,29] More research is needed on the reasons for lack of detection in NHS. In the current study, the age at diagnosis of SSD was 6-10 years in the otology and non-otology groups, whereas it was 1-5 years in the residents group. In a study by Mei et al[30] the mean age at diagnosis of SSD in children was reported to be 6 years. The results of the current study were similar to those in literature. The lower age at diagnosis in the resident group may have been due to the fact that they were working in tertiary-level hospitals where NHS was performed, and the younger physicians had been introduced to SSD during their studies in comparison to older physicians. In the comparison between the groups (otology, non-otology, and resident), it was observed that different subspecialties of otolaryngology did not affect the age at diagnosis.

Birdane et al[31] recommended that temporal bone CT and MRI should be performed together because inner ear anomalies may be observed in children with unilateral sensorineural hearing loss. However, Zhan et al[28] reported that MRI imaging was their first choice in children, and if MRI findings were not optimal, they used temporal bone CT as an adjunct. Tahir et al[32] reported that they generally preferred CT + MRI together as imaging for children with a diagnosis of SSD but recently stated that to reduce radiation exposure, they prefer only MRI for children for whom surgery is not considered.[32] While CT is useful for the diagnosis of middle and inner ear anomalies (partition anomalies and common cavity), MRI is a standard diagnostic tool to detect the absence of the cochlear nerve. Therefore, Park et al[33] recommend high-resolution 3-dimensional MRI imaging. The physicians who participated in the current study preferred 47.2% CT and 29.6% CT + MRI together most frequently for children. In contrast to the literature, CT was preferred more frequently for the pediatric age group by the majority of the physicians in this study. In a study conducted in a center where SSD patients were evaluated for CI, MRI or CT was preferred for the detection of the cochlea and cochlear nerve in adults, but no information on the frequency of the evaluation methods used was provided.[34] In the current study, the frequency of radiological evaluation methods for adults was 35.2% CT, 32.4% MRI, and 31.5% CT + MRI. In the comparison of imaging tests for children and adults, a significant difference was determined in terms of the preferred test ($P = .003$). The choice of imaging modality for pediatric and adult SSD may have been influenced by the etiological cause of SSD observed in different age groups. In addition, referral to radiological imaging increased with decreasing age at diagnosis of unilateral deafness, and this increase was found to be significant ($P = .000$). These are the first data on the relationship between age at diagnosis and the use of radiological imaging. The increasing frequency of imaging to determine the etiological cause in patients may be a product of an effort to increase optimal treatment success.

The wide variety of etiological causes in SSD creates difficulty in determining the appropriate treatment option. Investigation of the causes will increase the chance of success of the treatment option recommended to patients with decision conflicts.[5,35-37] The progressive nature of hearing loss necessitates careful follow-up of this condition. Regular hearing tests are recommended. The addition of serological tests to genetic testing may improve the etiological diagnosis in patients with SSD.[5] Birdane et al[31] reported that 22/33 children with unilateral sensorineural hearing loss were positive for mumps immunoglobulin G. A study conducted in Japan showed that a significant group of patients were still affected by mumps.[38]. In this study most physicians in all groups did not order serological tests to determine the etiological cause (otology 78.1%, non-otology 67.8%, resident 64.7%). It can be suggested that raising levels

of awareness on this issue might make a difference in the choice of SSD treatment management. Although genetic testing is not recommended unless a specific syndrome is considered as the etiological cause of SSD, genetic examination can be recommended in the presence of additional craniofacial anomalies.[33] Dermatological, ophthalmological, and neurotological examinations should be included in the determination of the etiological cause in children with congenital SSD. Especially, evaluation in terms of pigment abnormality is recommended.[39]

Depending on the etiology of SSD, vestibular dysfunction may affect both children and adults. Vestibular symptoms may accompany hearing loss, especially if it has a sudden onset and is secondary to trauma.[40] Up to 45% of adults with SSD have been shown to have symptoms of vestibular dysfunction.[41] The prevalence of peripheral vestibular dysfunction is 17%-48% in pediatric patients with SSD. This rate is similar to that observed in pediatric patients with bilateral deafness.[40] In a study by Birdane et al,[31] 68% (21/31) of pediatric patients with SSD showed canal paresis in an electronystagmography (ENG) test.[31] Despite the similar rates of vestibular involvement in the adult and pediatric age groups, the otolaryngologists in our study behaved differently in terms of vestibular evaluation in the management of pediatric and adult SSD ($P = .000$; Table 3). Further studies are required to determine the reasons for this discrepancy. In addition, children with SSD may have difficulties in daily practical life, such as riding a bicycle or crossing the street.[42-44] We recommend routine vestibular evaluation in adult and pediatric patients with SSD to optimize the management of difficulties in daily practical life (such as crossing the street or riding a bicycle).

In patients with SSD, difficulty in determining the direction of sound and difficulty in understanding in noisy environments cause social and psychological problems and lead to a decrease in quality of life.[11,45,46] In addition to its negative impact on quality of life, SSD is a risk factor for speech and language delay in children, which may lead to problems in the child's behavior and school performance.[14,47] In all the groups included in the current study, the rates of those who thought that SSD negatively affected quality of life were similar (otology; 78.1%, non-otology; 78%, resident; 88.2%; $P = .63$).

A number of studies and meta-analyses documented improvements in quality of life (QOL) and benefits after different forms of rehabilitation for SSD, including bone-anchored devices, CIs, and CROS aids[23,24,48-52] However, satisfaction with different devices varies and patients should be evaluated holistically, and expectations should be well understood by the physician, who plays a critical role in the management of SSD, to achieve an optimal outcome.[48,53]

The current treatment options available for children with SSD include CROS hearing aids, BCDs, and CIs. Methods such as CROS and BCD, which offer a treatment option through the hearing ear, are generally avoided in pediatric patients.[54] In the last decade, research into all 3 strategies has accelerated, and while each option has advantages, it may also provide disadvantages by limiting the patient's expectations, rehabilitation, and financial capacity. In the current study, 54.6% (n = 59) of physicians continued with observation only, 20.4% (n = 22) recommended hearing aids; 12% (n = 13) recommended CROS devices; and 6.5% (n = 7) recommended CIs in the management of SSD children. In a previous study of 88 children with congenital SSD, 32.5% of patients chose to continue observation only, followed by bone conduction hearing aids (27.7%), CROS devices (20.5%), conventional hearing aids (13.3%), or CI (6%).[28] This can be considered to be due to the thought that unilateral auditory input is sufficient in SSD patients.[55] The device selection rates in the current study were seen to be similar to those in literature.

In the current study, 62% (n = 67) of the respondents stated that the devices (CROS, bone-anchored hearing aid, and CI) used in SSD patients are not covered by reimbursement systems, while 38% (n = 41) stated that the cost of the device is covered. In July 2019, the FDA approved the use of CIs in adults and children over 5 years of age, and it is expected that the coverage of these systems by reimbursement systems will increase in the near future.[56] In a study investigating the effect of socioeconomic differences on treatment outcomes in SSD, it was reported that treatment rates were similar in private and public insurance groups ($P = .42$), but differences were observed between the device methods used (Cros, BAHD, TransEar, FM System, CI, Conventional HA) ($P = .02$).[57] Cochlear implantation has been shown to be a cost-effective option in patients with SSD, even when no other treatment option is considered.[58,59]

The main limitation of this study was the low number of participants (10.8%) and the heterogeneity of the otolaryngologist sample. The precise number of functional or non-functional email addresses that received the survey was difficult to evaluate. A further limitation was the differences in the management of SSD and the prevalence of objective testing methods across world regions, which may alter practices in subspecialties. However, the findings of this study may lead to future studies and may result in the development of guidelines for the management of the large SSD patient population.

This study highlights many common trends between otologists and non-otologists. A high awareness of the SSD condition was observed in all groups. There were no significant differences in SSD diagnosis, treatment, and rehabilitation between otologists and non-otologists. However, when comparing pediatric and adult patients, there was a difference in radiological evaluation, vestibular evaluation, and the frequency of treatment options recommended for SSD patients. Further studies are needed to determine the factors that cause this situation. In addition, awareness of current treatment options will have a positive impact on the patient's life by reducing the difficulty of SSD for both the patient and the physician.

We recommend increasing awareness on the incidence and impact of SSD on the QOL of children and adults. We also recommend routine radiological evaluation in all patients and the addition of serological and vestibular testing especially in children and emphasize regular audiological follow-up for the apparently normal ear.

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THE SURVEY QUESTIONNAIRE

A. Demographic information

1 What is your (sub)specialty?
- (A) Otology
- (B) Non-otology
- (C) Residents

2 How old are you?
- (A) Between 20 and 30
- (B) Between 31 and 40
- (C) Between 41 and 50
- (D) Between 51 and 60
- (E) Over 61

3 Where do you work?
- (A) State institution
- (B) Private institution
- (C) Both state and private institutions

4 How many years have you practiced otorhinolaryngology?
- (A) Below 10 years
- (B) Between 11 and 20
- (C) Between 21 and 30
- (D) Between 31 and 40
- (E) Over 41 years

5 What is the hospital in which you work?
- (A) Tertiary
- (B) Non-tertiary

B. The level of knowledge about SSD

6 (Single-sided deafness (SSD) is a unilateral or asymmetric hearing loss where hearing in the worse hearing ear is of a severe-to-profound level (>70 dB HL) and normal or near-normal in the better hearing ear (≤25 dB HL).
- (A) Yes
- (B) No

7 Do you think that single-sided deafness has an impact on the quality of life?
- (A) Yes
- (B) No

8 Do you perform blood serological examinations in addition to imaging in SSD?
- (A) Yes
- (B) No

9 Are newborn hearing screenings available at your clinic?
- (A) Yes
- (B) No

10 Are infant patients with SSD sent to your clinic for follow-up?
- (A) Yes
- (B) No

11 In patients with single-sided deafness, are the costs of devices (CROS, bone-anchored hearing aids, and cochlear implants) covered by reimbursement systems?
- (A) Yes
- (B) No

C. Evaluate the diagnosis, treatment, and rehabilitation methods used for SSD

12 Do you routinely perform radiological evaluation in children with single-sided deafness?
- (A) Yes
- (B) No

13 Which examination would be preferred for radiological evaluation?
- (A) Temporal CT
- (B) Temporal MRI
- (C) CT+MRI
- (D) No imaging

14 Do you routinely perform radiological evaluation in adults with single-sided deafness?
- (A) Yes
- (B) No

15 Which examination would be preferred for radiological evaluation?
- (A) Temporal CT
- (B) Temporal MRI
- (C) CT+MRI
- (D) No imaging

16 Would you ask for vestibular evaluation in a child with single-sided deafness, even if there is no complaint?
- (A) Yes
- (B) No

17 Would you ask for vestibular evaluation in an adult with single-sided deafness, even if there is no complaint?
- (A) Yes
- (B) No

18 How often do you see SSD babies?
- (A) One infant a month
- (B) 1 infant every 3 months
- (C) 1 infant every 6 months
- (D) One infant a year

19 What is the average age of diagnosis of infants with single-sided deafness in your own practice when newborn hearing screening is not performed?
- (A) <1 year
- (B) 1-5 years
- (C) 6-10 years
- (D) 11-15 years
- (E) >15 years

20 What is your preferred treatment method for children with single-sided deafness?
- (A) CROS device
- (B) Hearing aid
- (C) Cochlear implant
- (D) Bone conduction devices
- (E) Nothing

21 What is your preferred treatment method for adults with single-sided deafness?
- (A) CROS device
- (B) Hearing aid
- (C) Cochlear implant
- (D) Bone conduction devices
- (E) Nothing