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## 苏州地区 0~14 岁儿童听力障碍流行病学调查 及发病因素的 Logistic 回归分析\*

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**摘要 目的:**调查苏州地区 0~14 岁儿童听力障碍流行病学情况,并分析发病的危险因素。**方法:**采用多阶段、随机抽样的方法,于 2020 年 1 月~2022 年 1 月期间在本地区 46 个街道和 51 个镇中,抽取调查样本 1478 例。采用《WHO 耳疾与听力障碍调查方案》进行现场调查,用 AA222 听力计对 0~14 岁儿童进行纯音测听,听力阈值 $\geq 26\text{dB}$ 提示存在听力障碍。调查苏州地区 0~14 岁儿童听力障碍流行病学情况,并分析听力障碍发病的危险因素。**结果:**纳入 0~14 岁研究对象 1478 例,资料齐全者 1459 例,回收率 98.71%。根据是否发生听力障碍将所有研究对象分为听力障碍组( $n=42$ )和无听力障碍组( $n=1417$ )。听力障碍的发生率为 2.88%,其中男性的患病率高于女性,8~14 岁的患病率高于 0~7 岁,城镇患病率高于农村。听力障碍发病与曾用过耳毒性药物、阳性耳聋家族史、母围产期感染、高胆红素血症、新生儿窒息、母孕期合并疾病、母孕期不良生活习惯、母孕期不良社会环境因素、性别、年龄有关( $P<0.05$ ),而与头颈部畸形、细菌性脑膜炎、婴幼儿期有既往疾病史、居住地无关( $P>0.05$ )。多因素 Logistic 回归分析,结果显示:年龄 8~14 岁、曾用过耳毒性药物、有母围产期感染、有高胆红素血症、有母孕期合并疾病、有母孕期不良生活习惯、有母孕期不良社会环境因素、有阳性耳聋家族史、有新生儿窒息是听力障碍发病的危险因素( $P<0.05$ )。**结论:**苏州地区 0~14 岁儿童听力障碍的发生率为 2.88%,8~14 岁的居多,发病受到曾用过耳毒性药物、母围产期感染、高胆红素血症、母孕期合并疾病、母孕期不良生活习惯、母孕期不良社会环境因素、阳性耳聋家族史、新生儿窒息等多种因素的影响。

**关键词:**苏州;0~14 岁;儿童;听力障碍;流行病学;发病因素

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## Epidemiological Investigation of Hearing Impairment in Children Aged 0~14 Years in Suzhou and Logistic Regression Analysis of its Pathogenic Factors\*

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**ABSTRACT Objective:** To investigate the epidemiological situation of hearing impairment in children aged 0~14 years in Suzhou, and to analyze the risk factors of the disease. **Methods:** Using the method of multi-stage and random sampling, 1478 samples were selected from 46 streets and 51 towns in the region from January 2020 to January 2022. On-site investigation was carried out using the 《WHO Survey Plan on Ear Diseases and Hearing Impairment》. Pure tone audiometry was performed on children aged 0~14 years with AA222 screening audiometer. Hearing threshold greater than or equal to 26dB indicated that there was hearing impairment. The epidemiology of hearing impairment in children aged 0~14 years in Suzhou was investigated, and the risk factors of hearing impairment were analyzed. **Results:** 1478 subjects aged 0~14 years were included, 1459 of whom had complete data, with a recovery rate of 98.71%. All the subjects were divided into hearing impairment group ( $n=42$ ) and non-hearing impairment group ( $n=1417$ ) according to the occurrence of hearing impairment. The incidence of hearing impairment was 2.88%. Among them, the prevalence rate of male was higher than that of female, the prevalence rate of 8~14 years was higher than that of 0~7 years, and the prevalence rate of town was higher than that of countryside. The incidence of hearing impairment was related to the previous use of ototoxic drugs, family history of positive deafness, maternal perinatal infection, hyperbilirubinemia, neonatal asphyxia, maternal disease during pregnancy, adverse living habits during maternal pregnancy, adverse social environmental factors during maternal pregnancy, gender and age ( $P<0.05$ ), but not related to head and neck deformities, bacterial meningitis, previous disease history in infancy and place of residence ( $P>0.05$ ). Multivariate Logistic regression analysis showed that age 8~14 years, previous use of ototoxic drugs, had maternal perinatal infection, had hyperbilirubinemia, had maternal disease during pregnancy, had adverse living habits during maternal pregnancy, had adverse social environmental factors during maternal pregnancy, had family history of positive deafness, and had neonatal asphyxia were risk factors for hearing impairment ( $P<0.05$ ). **Conclusion:** The incidence of hearing impairment in children aged 0~14 years in Suzhou is 2.88%, most of whom were aged

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8~14 years. The incidence of hearing impairment is affected by many factors, such as the previous use of ototoxic drugs, maternal perinatal infection, hyperbilirubinemia, maternal disease during pregnancy, adverse living habits during maternal pregnancy, adverse social environmental factors during maternal pregnancy, family history of positive deafness, neonatal asphyxia and so on.

**Key words:** Suzhou; 0~14 years; Children; Hearing impairment; Epidemiological; Pathogenic factors

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## 前言

听力障碍是指听觉系统中的传音、感音及对声音的综合分析的各级神经中枢发生功能性或器质性异常,导致听力出现不同程度的减退<sup>[1,2]</sup>。儿童的听力状况对其正常发育有很大的影响,听力作为学习语言以发展认知能力所必须的基本条件,听力障碍患儿可因丧失学习语言能力而导致聋哑,对其身心发展产生不利影响,给家庭和社会带来沉重负担<sup>[3,4]</sup>。因此,研究引起儿童听力障碍的危险因素并针对病因采取相应的预防措施,有助于降低听力障碍的发病率。苏州是国家历史文化名城,长江三角洲重要的中心城市之一。但有关该地区0~14岁儿童听力障碍的流行病学报道较少。本次研究调查苏州地区0~14岁儿童听力障碍流行病学,并分析引起听力障碍的危险因素,以期临床防治提供一定的数据参考。

## 1 资料与方法

### 1.1 研究对象

采用多阶段、随机抽样的方法,于2020年1月~2022年1月期间在苏州地区46个街道和51个镇中抽取调查样本1478例。入选标准:(1)年龄0~14岁;(2)智力正常;(3)男女不限。排除标准:(1)不愿意配合本研究的研究对象;(2)存在全身性感染疾病者;(3)合并严重基础性疾病者。

### 1.2 听力障碍调查方法

采用《WHO耳疾与听力障碍调查方案》<sup>[5]</sup>进行现场调查,用

丹麦AA222听力计(购自上海函飞医疗器械有限公司)对0~14岁儿童进行纯音测听,听力阈值 $\geq 26$ dB提示存在听力障碍。

### 1.3 影响因素

采用苏州大学附属儿童医院自制调查量表,统计研究对象性别、年龄、居住地(城镇、农村)并分析患病率,获取所有研究对象的其他一般资料包括:曾用过耳毒性药物、阳性耳聋家族史、母围产期感染、头颈部畸形、高胆红素血症、细菌性脑膜炎、新生儿窒息、母孕期合并疾病、母孕期不良生活习惯(包括吸烟史、饮酒史、营养不良)、母孕期不良社会环境因素(包括接触X放射线、电脑、噪音环境等)、婴幼儿期有既往疾病史(包括头颅外伤、反复上呼吸道感染和患渗出性中耳炎)。

### 1.4 统计学方法

经SPSS 24.00软件进行数据分析,计量资料经K-V检验,均符合正态分布,且呈方差齐性,以 $(\bar{x} \pm s)$ 表示,行t检验。计数资料以例或率表示,行卡方检验。多因素Logistic回归分析听力障碍发病的危险因素, $P < 0.05$ 设置为差异有统计学意义。

## 2 结果

### 2.1 不同性别、不同年龄段、不同居住地的听力障碍发病率

纳入0~14岁研究对象1478例,资料齐全者1459例,回收率98.71%。其中听力阈值 $\geq 26$ dB的人数有42例,听力障碍的发生率为2.88%。其中男性的患病率高于女性,8~14岁的患病率高于0~7岁,城镇患病率高于农村,具体见表1。

表1 不同性别、年龄、居住地听力障碍发病率

Table 1 Incidence of hearing impairment by gender, age and place of residence

Factors		Number of inspectors	Number of patients	Prevalence rate(%)
Gender	Male	709	28	3.95
	Female	750	14	1.87
Age(years)	0~7	843	17	2.02
	8~14	616	25	4.06
Place of residence	Town	688	25	3.63
	Countryside	771	17	2.20

### 2.2 听力障碍发病的单因素分析

根据是否发生听力障碍将所有研究对象分为听力障碍组( $n=42$ )和无听力障碍组( $n=1417$ )。听力障碍发病与曾用过耳毒性药物、阳性耳聋家族史、母围产期感染、高胆红素血症、新生儿窒息、母孕期合并疾病、母孕期不良生活习惯、母孕期不良社会环境因素、性别、年龄有关( $P < 0.05$ ),而与头颈部畸形、细菌性脑膜炎、婴幼儿期有既往疾病史、居住地无关( $P > 0.05$ ),见表2。

### 2.3 听力障碍发病的多因素分析

以是否发生听力障碍作为因变量(未发生=0,发生=1),以曾用过耳毒性药物(否=0,是=1)、阳性耳聋家族史(无=0,有=1)、母围产期感染(否=0,是=1)、高胆红素血症(无=0,有=1)、新生儿窒息(无=0,有=1)、母孕期合并疾病(无=0,有=1)、母孕期不良生活习惯(无=0,有=1)、母孕期不良社会环境因素(无=0,有=1)、性别(女=0,男=1)、年龄(0~7岁=0,8~14岁=1)作为自变量并赋值。纳入多因素分析,结果:曾用过耳毒

表 2 听力障碍的单因素分析  
Table 2 Univariate analysis of hearing impairment

Factors		Hearing impairment group (n=42)	Non-hearing impairment group(n=1417)	$\chi^2$	<i>P</i>
Previous use of ototoxic drugs	Yes	31(73.81)	398(28.09)	41.082	0.000
	No	11(26.19)	1019(71.91)		
Family history of positive deafness	Yes	10(23.81)	99(6.99)	16.706	0.000
	No	32(76.19)	1318(93.01)		
Maternal perinatal infection	Yes	26(61.90)	91(6.42)	170.245	0.000
	No	16(38.10)	1326(93.58)		
Head and neck deformities	Yes	2(4.76)	83(5.86)	0.092	0.765
	No	40(95.24)	1334(94.14)		
Hyperbilirubinemia	Yes	25(59.52)	129(9.10)	109.841	0.000
	No	17(40.48)	1288(90.90)		
Bacterial meningitis	Yes	3(7.14)	86(6.07)	0.083	0.775
	No	39(92.86)	1331(93.93)		
Neonatal asphyxia	Yes	19(45.24)	104(7.34)	75.892	0.000
	No	23(54.76)	1313(92.66)		
Maternal disease during pregnancy	Yes	20(47.62)	137(9.67)	61.284	0.000
	No	22(52.38)	1280(90.33)		
Adverse living habits during maternal pregnancy	Yes	21(50.00)	156(11.01)	58.186	0.000
	No	21(50.00)	1261(88.99)		
Adverse social environmental factors during maternal pregnancy	Yes	18(42.86)	174(12.28)	33.375	0.000
	No	24(57.14)	1243(87.72)		
Previous disease history in infancy	Yes	4(9.52)	126(8.89)	0.023	0.887
	No	38(90.48)	1291(91.11)		
Gender	Male	28(66.67)	681(48.06)	5.651	0.017
	Female	14(33.33)	736(51.94)		
Age(years)	0~7	17(40.48)	826(58.29)	5.316	0.021
	8~14	25(59.52)	591(41.71)		
Place of residence	Town	25(59.52)	663(46.79)	2.658	0.103
	Countryside	17(40.48)	754(53.21)		

性药物、有母围产期感染、有高胆红素血症、有母孕期合并疾病、有母孕期不良生活习惯、有母孕期不良社会环境因素、有阳性耳聋家族史、年龄 8~14 岁、有新生儿窒息是听力障碍发病的危险因素 ( $P < 0.05$ ), 见表 3。

### 3 讨论

听力障碍会对儿童语言、学业和人际交往等造成影响,降低其生活质量<sup>[6]</sup>, 尽早发现、诊断和积极治疗十分重要。本次研究中纳入 0~14 岁研究对象 1478 例, 资料齐全者 1459 例, 回收

率 98.71%。其中听力阈值  $\geq 26\text{dB}$  的人数有 42 例, 听力障碍的发生率为 2.88%。略低于王幼勤等<sup>[7]</sup>学者报道的贵州省 0~14 岁儿童听力障碍发生率 3.48%。

导致听力障碍的因素多种多样, 不明原因也占较高比例。本研究多因素分析结果显示, 年龄 8~14 岁、曾用过耳毒性药物、有母围产期感染、有高胆红素血症、有母孕期合并疾病、有母孕期不良生活习惯、有母孕期不良社会环境因素、有阳性耳聋家族史、有新生儿窒息是听力障碍发病的危险因素。逐一分析其原因: (1) 随着年龄的增大, 儿童用耳毒性药物、患中耳

表 3 听力障碍的多因素分析

Table 3 Multifactor analysis of hearing impairment

Variable	$\beta$	SE	Wald $\chi^2$	P	OR	95%CI
Age 8~14 years	0.587	0.196	8.969	0.000	1.396	1.178~1.559
Previous use of ototoxic drugs	0.641	0.218	8.646	0.000	1.291	1.161~1.384
Had maternal perinatal infection	0.682	0.233	8.568	0.000	1.306	1.224~1.697
Had hyperbilirubinemia	0.596	0.191	9.737	0.000	1.234	1.084~1.317
Had maternal disease during pregnancy	0.573	0.186	9.490	0.000	1.281	1.197~1.353
Had adverse living habits during maternal pregnancy	0.628	0.225	7.790	0.001	1.369	1.267~1.482
Had adverse social environmental factors during maternal pregnancy	0.715	0.246	8.448	0.000	1.274	1.218~1.543
Had family history of positive deafness	0.737	0.251	8.622	0.000	1.392	1.108~1.451
Had neonatal asphyxia	0.694	0.216	10.323	0.000	1.468	1.293~1.684

炎、外出活动增加外伤的几率增加等因素,均使得儿童听力障碍发生率增加<sup>[8-10]</sup>。(2)曾用过耳毒性药物因素是指人体接触某些化学制剂或使用某些药物后,造成位听神经系统中毒性损害,进而产生听力障碍。目前已知有 100 多种耳毒性药物,有些药物造成的听力损害可逆,有些则是永久性耳聋<sup>[11-13]</sup>。(3)母围产期感染的儿童听力障碍的发生率更高,主要是因为受宫内感染的婴儿耳蜗神经及桥脑、下丘脑均有不完全性损害,目前明确的致聋感染因素主要有疱疹、巨细胞病毒、风疹、梅毒螺旋体、弓形体等<sup>[14-16]</sup>。(4)高胆红素血症是导致儿童听力障碍的高危因素,儿童幼时血屏障发育未完善,游离胆红素可通过血脑屏障与神经细胞突触膜上的神经节苷脂和神经鞘磷脂结合,进而影响脑干听觉诱发电位。但有相关研究证实,及时对高胆红素血症患儿进行干预,可以逆转其听力障碍<sup>[17-19]</sup>。(5)母孕期合并疾病会增加听力障碍的发生几率。陈瑞芳等人<sup>[20]</sup>的研究表明,妊娠合并糖尿病、高血压、高血脂、自身免疫性疾病等妊娠合并症可导致患者本身听力受损。考虑是上述疾病可引起母体内代谢紊乱、微血管和血液改变,母婴同体,母体代谢异常亦可导致胎体内环境的变化,增加胎儿内耳缺血缺氧损伤而致聋<sup>[21,22]</sup>。(6)母孕期不良生活习惯如营养不良,可直接影响胎儿发育,可造成胎儿宫内发育迟缓,从而影响其听力;长期吸烟可透过胎盘屏障作用于发育中的胎儿,造成损害;长期饮酒史可增加胎儿听力障碍的发生风险,因酒精的主要成分乙醇可使卵子发育不成熟或卵巢发生脂肪变性,降低受精卵质量<sup>[23,24]</sup>。(7)母孕期不良社会环境因素包括接触 X 放射线、电脑、噪音环境等,可能导致胎儿发育受到影响,尤其可能导致其内耳发育受到影响,增加听力障碍的发生几率<sup>[25,26]</sup>。(8)阳性耳聋家族史的儿童可能会因为基因或染色体异常而导致听力障碍发生风险增加<sup>[27]</sup>。(9)有报道显示,新生儿窒息是引起新生儿听力障碍的首要危险因素<sup>[28]</sup>。耳蜗及听觉中枢对缺氧非常敏感,当新生儿窒息时引起的缺血缺氧首先累及耳蜗组织,使其产生类似于脑缺血时兴奋性氨基酸受体过度激动而引起的神经中毒;另外听力中枢因缺氧引起损伤可压迫血管,造成耳蜗功能异常<sup>[29,30]</sup>。

综上所述,苏州地区 0~14 岁儿童听力障碍的发生率较高,8~14 岁的居多,发病受到曾用过耳毒性药物、母围产期感

染、高胆红素血症、母孕期合并疾病、母孕期不良生活习惯、母孕期不良社会环境因素、阳性耳聋家族史、新生儿窒息等多种因素的影响,对此类儿童要重点进行听力障碍筛查,做到早发现、早诊断、早干预。

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