



# ROLE OF PARENTAL SUSPICION OF HEARING IMPAIRMENT ON AGE OF DIAGNOSIS & INTERVENTION: A PAKISTANI PERSPECTIVE

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## ABSTRACT

**OBJECTIVE:** To determine the role of parental suspicion of hearing impairment (HI) on age of identification and intervention.

**METHODS:** This retrospective chart review, reviewed medical records of hearing-impaired children of both genders, aging 6 months to 12 years, who attended Cochlear Implant Centre, Department of Otolaryngology, Capital Hospital, Islamabad, Pakistan from 1<sup>st</sup> July 2015 to 31<sup>st</sup> June 2016. Data extracted from medical records included basic demographic information and facts like when hearing loss was suspected, who suspected hearing loss, which professional conducted the first assessment, when was final diagnosis established and when did child receive intervention.

**RESULTS:** Out of 81 hearing impaired children, Majority (n=55; 67.9%) were males. Most (n=62; 76.5%) of the patients were suspected to have HI by parents and 56 (69.2%) were suspected to have HI in first year of life. In 67 (82.7%) cases, diagnosis was made within the first two years of life. Forty two (42.9%) patients received intervention in the first two years of life. There was significant association of age of suspicion of hearing impairment by parents with the age at diagnosis (p<0.001) and age at intervention (p<0.001) with those in whom HI was suspected earlier were able to be diagnosed and received intervention at an earlier age. No significant association was found for age of suspicion, age of diagnosis and age of intervention with persons who suspected HI and gender of the patients.

**CONCLUSION:** Parental suspicion of hearing impairment has significant role to play in the early diagnosis as well as intervention.

**KEYWORDS:** Cochlear Implants (MeSH); Hearing Loss (MeSH); Neonatal Hearing Screening (Non-MeSH)

**THIS ARTICLE MAY BE CITED AS:** Ahmed J, Saqulain G, Khan MIJ, Kausar M. Role of parental suspicion of hearing impairment on age of diagnosis & intervention: a Pakistani perspective. *Khyber Med Univ J* 2022;14(2):132-7. <https://doi.org/10.35845/kmuj.2022.20565>.

## INTRODUCTION

Hearing loss (HL) is a major disability, with 1.6 per 1000 individuals suffering from bilateral HL.<sup>1</sup> This is tip of an iceberg with burden of Hearing impairment (HI) touching high levels, demanding it to be catered to as a major disability,<sup>2</sup> especially in the developing countries like Pakistan.

Though Universal Neonatal Hearing Screening results in early diagnosis and intervention,<sup>3</sup> but unfortunately the same is still not available in low and middle income countries,<sup>2</sup> like Pakistan resulting in late identification of HI.<sup>4</sup>

According to Musani MA et al. around 50% of the cases are reported to be conductive, while only 20% are sensorineural and 30% constitute cases with mixed HL,<sup>5</sup> compounded on this it was also noted that 70% increase is contributed by consanguineous marriages.<sup>1</sup> With these figures it is quite evident that early intervention is of utmost importance to start catering to this burden of disability.

According to Marchbank AM, et al. mother's concern about HI in their children may be of importance even in the absence of neonatal hearing screening (NHS).<sup>6</sup> Also Storbeck & Young et al. have recommended to

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Date Submitted: July 06, 2020

Date Revised: June 08, 2022

Date Accepted: June 10, 2022

screen children on basis of maternal suspicion, in the absence of NHS.<sup>7</sup> It has also been reported that the prevalence of bilateral HL in children increased with age,<sup>8</sup> hence suspicion and early identification should be the prime objective of any neonatal screening to ensure successful intervention especially cochlear implantation. Compounding factors like stigma of HL can influence decisions in connection with acceptance, diagnosis as well as intervention,<sup>9</sup> hence around 26% mild HL cases might even be missed in the presence of NHS programs.<sup>10</sup>

Ansari MS in an Indian study has concluded that parents might be in a good position to suspect HL and recommended their opinion to be used for early identification of HL.<sup>11</sup> Cochlear Implant Centre of the present study setting was established in 2015 being the countries' first cochlear implant center in the public sector, where funding was provided by the Federal Government for provision of free cochlear implants to deserving children.

Keeping in view the high burden of hearing disability,<sup>2</sup> possibility of parents being at an advantageous position to suspect HL,<sup>11</sup> possibility of 26% cases being missed in countries with NHS programs,<sup>10</sup> marred with absence of NHS program in the country this study was conducted with the objective to determine the role of parental suspicion of HL on age at identification and intervention. This study is of significant importance due to the lack of local

research on the subject and because findings of the study may be helpful in guiding future programs and research.

**METHODS**

This retrospective chart review reviewed medical records of eighty-one hearing impaired children, of both genders, aged 6 months to 12 years, who attended Cochlear Implant Centre, Department of Otolaryngology, Capital Hospital postgraduate Medical Institute, Islamabad, Pakistan. After obtaining ethical approval of Institutional Ethics Committee vide Registration No. 201-02-002 dated 15<sup>th</sup> February, 2017, relevant records of children who attended and got investigated at the Cochlear Implant Centre over a period of one year from 1<sup>st</sup> July 2015 to 31<sup>st</sup> June 2016 were reviewed for the study. Records of children with any other or multiple disabilities and those with incomplete record were excluded from the study. Data extracted from the records included basic demographic information and facts like when hearing loss was suspected, who suspected hearing loss, which professional made child's first assessment, when was the final diagnosis established and when child received intervention.

Following data collection, it was first entered in Microsoft Excel and coded followed by importing it to SPSS version-23. Descriptive statistics was employed analyze the data and presented in frequency and percentage. To look for any association cross tabulation was done and Chi-Square and  $p < 0.05$  was considered significant. The findings of the study were thereafter compared with available literature both national and international and deductions were made and discussed.

**RESULTS**

Current study based on eighty-one cases who attended cochlear implant center. Out of 81 cases, 55 (67.9%) were males and 26 (32.1%) were females (Table I). In majority (n=62; 76.5%) of cases, HL was suspected by parents and in 56 (69.2%) cases, HI was suspected in the first year of life. The first assessment was made by

**TABLE I: DEMOGRAPHIC CHARACTERISTICS OF THE STUDY SUBJECTS (N=81)**

Variables	Group	Frequency (%)
Gender of Child	Male	55 (67.9)
	Female	26 (32.1)
Who Suspected Hearing Loss	Parents	62 (76.5)
	Relatives	10 (12.3)
	Grand Parents	4 (4.9)
	Guardians	3 (3.7)
	Neighbours	1 (1.2)
	Friends	1 (1.2)
Age at Which Hearing Impairment was Suspected	Birth - 6 Months	22 (27.2)
	7 Months – 12 Months	34 (42)
	> 12 – 18 Months	10 (12.3)
	> 18 Months – 2 Years	10 (12.3)
	> 2 years – 3 years	5 (6.2)
Who made first assessment	Otolaryngologist	39 (48.1)
	Audiologist	23 (28.4)
	Physician	10 (12.3)
	General Physician	6 (7.4)
	Speech-language Pathologist	2 (2.5)
	Pediatrician	1 (1.2)
Age at Diagnosis	3 - 6 Months	7 (8.6)
	7 Months - 1 Years	28 (34.6)
	> 1 - 2 Years	32 (39.5)
	> 2 - 3 Years	7 (8.6)
	> 3 - 5 Years	6 (7.4)
	> 5 - 8 Years	1 (1.2)
Age at Intervention (Years)	Waiting	24 (29.6)
	1	16 (19.8)
	> 1 - 2	26 (32.1)
	> 2 - 3	10 (12.3)
	> 3 - 5	4 (4.9)
	> 5 - 8	1 (1.2)

**TABLE II: COMPARISON OF AGE OF SUSPICION, DIAGNOSIS & INTERVENTION WITH PERSONS WHO SUSPECTED HEARING IMPAIRMENT (N=81)**

Variables		Who Suspected Hearing Impairment							P Value
		Parent (n=64)	Grandparent (n=4)	Relative (n=10)	Neighbors (n=1)	Guardian (n=3)	Friend (n=1)	Total (n=81)	
Age at Which Suspected	Birth - 6 Months	19	1	2	0	0	0	22	0.293
	7 – 12 Months	27	0	2	1	3	1	34	
	> 12 – 18 Months	5	2	3	0	0	0	10	
	18 Months - 2 Years	6	1	3	0	0	0	10	
	> 2 years - 3 Years	5	0	0	0	0	0	5	
Age at Diagnosis	3 Months - 6 Months	6	0	1	0	0	0	7	0.850
	7 Months - 1 Years	21	1	1	1	3	1	28	
	> 1 - 2 Years	22	3	7	0	0	0	32	
	>2 - 3 Years	6	0	1	0	0	0	7	
	> 3 Years - 5 Years	6	0	0	0	0	0	6	
	> 5 - 8 Years	1	0	0	0	0	0	1	
Age at Intervention	Waiting	19	0	4	0	1	0	24	0.979
	1 Year	13	1	1	1	0	0	16	
	> 1 - 2 Years	18	2	3	0	2	1	26	
	>2 - 3 Years	8	1	1	0	0	0	10	
	>3 - 5 Years	3	0	1	0	0	0	4	
	>5 - 8 Years	1	0	0	0	0	0	1	

otolaryngologists in 39 (48%) cases, followed by audiologists in 23 (28.4%) cases. In majority (n=67; 82.7%) diagnosis was established within the first 2 years of life. Intervention was done within the first 2 years of life in 42 (42.9%) cases.

There was no significant association of age of suspicion (p=0.293), age of diagnosis (p=0.85) and age of intervention (p=0.979) with of persons who suspected HI respectively (Table II). Similarly no significant association of age of suspicion (P=0.83), age of diagnosis (p=0.661) and age of intervention (p=0.252) was found with gender of the patients (Table III).

Comparison of the age of suspicion against age of diagnosis and intervention (Table IV), revealed a statistically significant association of age of suspicion with age at diagnosis (p<0.001) and age

at intervention (p=0.01) i.e., most of cases in which HI was suspected at early age were also diagnosed early and received intervention at an earlier age. The majority of cases were suspected at 7 month -1 year of age (n=34) and they were diagnosed at 7 month to 1 year (n=19) and >1 to 2 years (n=12) of age, while they received intervention at 1 year (n=8) and >1-2 years (n=15).

### DISCUSSION

Current study was based on parents of eighty one hearing impaired children who attended the cochlear implant center. The response distribution of these parents revealed that sample of HI predominantly included males (67.9%) followed by females (32.1%). However there was no significant association of gender of child with age at suspicion, diagnosis and intervention.

In this study in majority (69.2%) of cases, HL was suspected in first year of life, while majority (74.1%) were diagnosed in first 2 years of life. However, Intervention was done in 32.1% at >1-2 years age, in 10.8% at 1 year and in 12.3% at >2-3 years of age and there was significant association of age of suspicion with age at diagnosis (p<0.001) and age at intervention (p=0.01). Majority of cases in which HI was suspected at early age were also diagnosed early and received intervention at an earlier age. Similarly in a study by Storbeck & Young, mothers suspicion of infants have HL was around median age of 18 months and HL identification was possible in these children at 28 months 8 with significant (p=0.035) longer delay of identification in public health care sector compared to private.<sup>7</sup> Also in a Turkish study by

**TABLE III: COMPARISON OF AGE OF SUSPICION, DIAGNOSIS & INTERVENTION WITH GENDER OF CHILD (N=81)**

Variables		Gender of Child			P Value
		Male (n=55)	Female (n=26)	Total (n=81)	
Age at Which Suspected	Birth - 6 Months	14	8	22	0.83
	7 – 12 Months	23	11	34	
	> 12 – 18 Months	8	2	10	
	18 Months - 2 Years	6	4	10	
	> 2 Years - 3 Years	4	1	5	
Age at Diagnosis	3 Months - 6 Months	3	4	7	0.661
	7 Months - 1 Years	21	7	28	
	> 1 - 2 Years	21	11	32	
	>2 - 3 Years	5	2	7	
	> 3 Years - 5 Years	4	2	6	
	> 5 - 8 Years	1	0	1	
Age at Intervention	Waiting	12	12	24	0.252
	1 Year	12	4	16	
	> 1 - 2 Years	19	7	26	
	>2 - 3 Years	7	3	10	
	>3 - 5 Years	4	0	4	
	>5 - 8 Years	1	0	1	

Ozcebe E et al. reported average age of suspicion, identification, amplification and intervention of 12.5, 19.4, 26.5 and 33.0 months.<sup>12</sup> In contrast to our study in a local study by Mumtaz and Habibullah, reported significant gap between age of suspicion and final diagnosis with HL suspected in 33% at 0 to 6 months age bracket, but in 35%, the first consultation with professional was obtained at 19-24 months age bracket.<sup>4</sup> This might be due to the fact that following the facility of free cochlear implantation, in case of our study more parents who suspect HL reach out to the facilities for diagnosis at an earlier age. Also in an another Indian study the age of suspicion, identification, amplification and intervention being 16.5, 24.3, 31.7 and 33.4 months,<sup>11</sup> while another Indian study showed more delay with the age

of suspicion of 1.5 years, child's parents first consulted a specialist at 2.4 years age, with only 33.4% referred for rehab. With age at seeing an audiologist being 9.3 years.<sup>13</sup>

In the current study, the first assessment was made by otolaryngologists in 48% followed by Audiologist in 28.4% of cases, however no significant delay was seen in identification of HL, while in an Indian study, though doctors were consulted at 2.4 years only 33.4% were referred for aural rehabilitation and children were first seen by an audiologist at 9.3 years, with 95% of the caregivers of caregivers not recognizing the delay caused.<sup>13</sup> Hence compared to our study, Indian studies reveal professional failures.<sup>11,13</sup>

In the current study, HI was mainly suspected by Parent of HI in 76.5%

cases, followed by relatives in 12.3% and Grandparents in 4.9% cases. However, there was no significant association of who suspected HL with age at suspicion (p=0.293), age at diagnosis (p=0.85,) and age of intervention (p=0.979) respectively. Similarly in an Indian study HL was suspected by parents in 70.37% cases, grandparents in 14.82%, general practitioners in 1.48%, otolaryngologists in 5.92%, Audiologist in 4.44% & child specialists in 2.96% and only 5.18% by others.<sup>11</sup> In a study by Olusanya BO, et al. in which mother's knowledge and their attitude towards hearing loss was gauged, they had good knowledge of etiological causes of hearing loss with positive attitude towards neonatal screening and acceptance of hearing aids,<sup>14</sup> which could be the reason behind suspecting HL in their children in majority of cases.

Age of suspicion was lower in a system with Joint families which is prevalent in India compared to nuclear. Also educational level had a positive impact on suspicion.<sup>11</sup> This is also true for our study in which HI was suspected by parents 76.5%, Grandparents 4.9% and relatives 12.3% in majority of cases.

In a study by Maluleke NP et al in which maternal suspicion based identification of hearing loss resulted in late identification, but early intervention which was not up to mark.<sup>15</sup> This is because resource constraints limit rapid neonatal screening and intervention in developing countries and to cater to this awareness of public needs to be scaled up along with manpower development initiatives at all level.<sup>16</sup> This is the case of Pakistan where though neonatal hearing screening is non-existent however interventional services are being popped up even availability of cochlear implant service in public sector has been made possible.

## CONCLUSION

Parental suspicion of hearing impairment has significant role to play in the early diagnosis as well as intervention. No significant association was found for age of suspicion, age of diagnosis and age of intervention with persons who suspected hearing impairment in patients and gender of

TABLE IV: COMPARISON OF AGE OF DIAGNOSIS AND INTERVENTION WITH AGE OF SUSPICION OF HEARING IMPAIRMENT (N=81)

Variables		Age at Which Suspected					P Value	
		Birth – 6 Months (n=22)	7 – 12 Months (n=34)	>12 – 18 Months (n=10)	18 Months – 2 years (n=10)	> 2 years – 3 years (n=5)		Total
Age at Diagnosis	3 - 6 Months	7	0	0	0	0	7	0.000
	7 Months - 1 Year	9	19	0	0	0	28	
	> 1 - 2 Years	3	12	9	8	0	32	
	>2 - 3 Years	1	2	1	0	3	7	
	> 3 - 5 Years	2	0	0	2	2	6	
	> 5 - 8 Years	0	1	0	0	0	1	
Age at Intervention	Waiting	7	7	2	6	2	24	0.01
	1 Year	8	8	0	0	0	16	
	> 1 - 2 Years	4	15	4	3	0	26	
	>2 - 3 Years	3	2	3	1	1	10	
	>3 - 5 Years	0	1	1	0	2	4	
	>5 - 8 Years	0	1	0	0	0	1	

the patients. Parental education and sensitization for hearing impairment among young children will help in early diagnosis and management of hearing impairment in our population.

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### AUTHORS' CONTRIBUTION

Following authors have made substantial contributions to the manuscript as under:

**JA:** Acquisition, analysis and interpretation of data, drafting the manuscript, approval of the final version to be published

**GS:** Acquisition, analysis and interpretation of data, drafting the manuscript, critical review, approval of the final version to be published

**MIJK:** Conception & study design, critical review, approval of the final version to be published

**MK:** Analysis and interpretation of data, drafting the manuscript, approval of the final version to be published

*Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.*

### CONFLICT OF INTEREST

Authors declared no conflict of interest

### GRANT SUPPORT AND FINANCIAL DISCLOSURE

Authors declared no specific grant for this research from any funding agency in the public, commercial or non-profit sectors

### DATA SHARING STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request



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