Auditory brainstem evoked response in deaf children

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الخلاصة:

المقدمة: صممت هذه الدراسة لغرض تحديد درجة ونوع الصمم وتحديد مكان الخلل في النظام السمعي للأطفال الصم، بواسطة استخدام جهاز تخطيط جذع الدماغ.

المواد والطرق: هذه الدراسة هي دراسة مستقبلية في طبيعتها. تضمنت تقييم 56 طفلا أصم بين شهر تموز وشهر كانون الاول عام 2010 في شعبة الأنف والاذن والحنجرة في مستشفى الديوانية التعليمي- محافظة الديوانيه-العراق.

النتائج: اظهرت الدراسة ان درجة الصمم كما يلي:(صمم ضعيف 21.4%، صمم متوسط 28.6%، صمم شديد 50%).اما أنواع الصمم فكانت (صمم توصيلي 20%، صمم حسي 46.4%، صمم عصبي 30%، صمم دماغي 3.6%).

الاستنتاجات: اظهرت الدراسه ان تخطيط جذع الدماغ هو فحص سمعي مهم في تقييم النظام السمعي للأطفال.

Abstract:

This study is designed to determine the degree , type of deafness, and site of lesion in the auditory pathway of deaf children by using Brainstem evoked response audiometry.

This study is prospective in nature. It considerd 56 patients with deafness which were assessed between July and December 2010 in E.N.T outpatient clinic, department of otolaryngology, in Al-Diwaniya teaching hospital, AL-diwaniya city, Iraq.

The study shows that The degrees of deafness are: out of 56 patients, 12 patients (N=12, 21.4%) have mild deafness (20db- 40db loss), 16 patients (N-16, 28.6%) have moderate defness (40db- 60db loss), 28 patients (N=28, 50%) have sever or profound deafness (60db- 100db loss). The type and site of deafness are: out of 56 patients, 11 patients (N=11, 20% have conductive deafness, 26 patients (N=26, 46.4%) have cochlear (sensory) deafness, 17 patients (N=17, 30%) have retrocochlear (neural) deafness, 2 patients (N=2, 3.6%) have cortical deafness.

the brainstem evoked response audiometry valuable audiological test to assess the auditory pathway in children.

Introduction:

Brainstem evoked response audiometry has been valuable and diagnostic electrophysiological test in assessment of the functional integrity of the auditory pathway since the work of Jewett and Williston in 1971(1). The response evoked by a high intensity click stimulus, and recorded from a vertex and ipsilateral mastoid electrode, configuration consists of a series of up to seven waves (JI-JVII). These waves are recordings of the electrical activity from sequentially activated neurons of the ascending auditory nerve and brainstem pathways(2). The presumed generators of the waves are: JI originates from the auditory nerve, JII originates from cochlear nucleus, JIII originates from superior olivary complex, JIV originates from lateral leminiscus, JV originates from inferior colliculus.(3)

Patients and Methods:

The present study was prospective in nature, it studied 56 cases of child patients with deafness, who consulted me at my own clinic and at E.N.T outpatient clinic, department of otolaryngology in Al- diwaniya teaching hospital between

December 2008 and July 2009. The age range of patients was (1-5 year). The patients were 24 male (42.8%) and 32 female (57.2%). All the patients are sedated by chloral hydrate syrup (50 mg/ kg b.w) in order to facilitate smooth recording without any muscle artifact. All the patients remained relaxed and supine during the test. We prepared the four skin sites of electrodes (both mastoid, vertex, one cheek for ground electrode), firstly by rubbing the skin with special abrasive skin gel until the skin colour became red, then the sites were cleaned by alcohol, then each electrode applied on its site after moistened by conductive gel in order to obtain low skin impedance, then all electrodes leads were connected to preamplifier. After that we checked the impedance which should be less than 3 kΩ lead to get best results. Then we inserted the ear tip well into ear canal for sound click stimulus. The acoustic stimulus rate is 39.1 stimulus/second. The intensity is descending intensity (90db-10db) above the mean hearing threshould for normal subjects. The duration of recording is 15 millisecond. The responses were amplified and filtered with a band pass of (0-3000HZ), the amplified output was converted into digital signal in the ADC (analog to digital converter) inside the device (Eclipse 25), then the digital ABRAS(Auditory brainstem response amplified signals) recording underwent data processing handled by the computer to determine wheather or not a response is found. All ABRAS statistic

and recordings were stored on the laptop for later examination and diagnosis. The ABRAS results compared with normal results which are showed in table (1)below

Results:

The normal mean latencies and amplitudes with the standard deviation for the prominent waves (I, III, V) and interpeak latencies (IPL) (I-III, III-V, I-V) were obtained from normal volunteers of 1-5 years of age with binaural stimuli at descending intensities (90db-10db) sensation level click which reported by other workers at specialized surgical hospital, medical city, Baghdad, are showed in table(1).

Table (1) mean values in 15msec from normal subjects at descending intensities (90db-10db)

waves & IPL (msec) / Intensity Nhl(db)	Wave I		Wave III		Wave V		I-III IPL	III-v IPL	I-v IPL
	position	deviation	Position	deviation	position	deviation			
90db	1.13	0.26	3.70	0.30	5.2	0.5	2.3	1.8	4.16
80db	1.65	0.5	3.80	0.16	5.76	0.6	2.14	1.75	4
70db	1.8	0.2	3.85	0.26	5.8	0.6	2.13	1.7	3.8
60db	2.30	0.16	4.20	0.10	6	0.6	2.09	1.63	3.7
50db	2.37		4.30		6.30	0.33	2.07	1.6	3.65
40db	2.8		5		6.80	0.36	2	1.5	3.6
30db	3.5		5.47		7.10	0.4	1.97	1.49	3.47
20db			6		7.70	0.36			
10db			6.57		8.30	0.3			

The Brainstem evoked response audiometry is done on 56 patients of 1-5 years of age, 24 male (42.8%) and 32 female (57.2%). We found that children with mild degrees of hearing loss (20db-40db) were 12 patients (n=12, 21.4%) while 16 patients (n=16, 28.6%) had moderate hearing loss (40db-60db). The rest 28 patients (n=28, 50%) had sever and profound hearing loss (60db-100db).

Among all patients, 26 patients were mentally retarded, 15 patients had speech defect and delay in language acquisition. According to the changes in the waves latencies and amplitudes and interpeak latencies (IPL), the results can be categorized into the following 4 groups (**A, B, C, D**).Group **B** is subdivided into 2 groups (**B1, B2**) as showed in table (2).

Table (2) groups of subjects according to the waves and IPL latencies changes.

Waves & IPL / Groups		Wave I	Wave V	I-III IPL	III-v IPL	I-v IPL
(**A**) N=11 20%		delay	Delay	normal	Normal	normal
(**B**)	(**B1**)			Prolong	Normal	

N=17 30%	N=4	normal	delay			prolong
	(**B2**) N=13			normal	Prolong	
(**C**) N=26 46.4%		delay	Normal	reduced	Normal	reduced
(**D**) N=2 3.6%		normal	Normal	normal	Normal	normal

The absolute and (IPL) obtained from 56 patients were compare with standard normal mean values. The results can be categorized in the following 4 groups (**A, B, C, D**). Group **B** is subdivided into 2 groups (**B1, B2**) according to the waves and IPL latencies changes:

Group (**A**) consists of 11 patients (20%) who showed delay wave (I)and delay wave (V) with normal (IPL). i.e: all the waves have shifted towards the right (conductive deafness). All patients showed increase level of hearing threshould (20db-40db), 70% of patients have delayed language acquisition and speech defect.

Group (**B**) consist of 17 patients (30%) who showed normal wave (I) and delay wave (V), with prolong (I-V IPL). In (4) patients of this group (**B1**), the prolongation of (I-V IPL) is due to increase in (I-III IPL) which indicate lower brainstem lesion while the (I-V IPL) prolongation in other 13 patient (**B2**) is due to increase (III-V IPL) which indicate upper brainstem lesion. All patients showed increase level of hearing threshold (60-90db). 90% of this group associated with severe degree of mental retardation.

Group (**C**) consisted of (26) patients (46.4%) who show delay and poorly defined wave (I). Normal wave (V), reduced (I-V IPL). The reduction of (I-V IPL) is due to reduction in (I-III IPL), suggesting inner ear disorder affecting the cochlea. All patients showed increase level of hearing threshold (40db-90db).

Group (**D**) consisted of (2) patients (3.6%)who showed normal auditory brainstem response with no positive sign of hearing (deaf mute). This may be due to extensive lower frequency hearing loss or the lesion situated above the midbrain.

Discussion:

Large number of researches interesting the deafness in children with different results-Our study showed the severe and profound type is the highest incidence (50%) and this agree with the resultes of the study done by Mason SM who found the sever and profound types about(60%) (4),but disagree with the results of Jacobson JT,Jacobson CA and Spahr RC who found higher incidence in moderate type(70%).(5)

The percentage of patients with mental retardation in our study is(46%) and the percentage of speech defect is (26%) but in the study by Musiek FE and Geurkink NA the percentage is of mental

retardation is (30%) and speech defect is(15%)(6),and it correlated with the result of Laukli E and Mair IWS who found the percentage of mental retardation is(45%) and the percentage of speech defect is (20%).(7)

Our study showed hearing impairment due to different lesions, the conductive deafness is (20%),the lower and upper brain stem lesion is (30%),inner ear disorder affecting the cochlea is (46,4%) and the lesion above the midbrain is(3,6%) >And these result correlated with the result by Elberling C who find the resultes as following, the conductive deafness is (25%),the lower and upper brain stem lesion is(25%),inner ear disorder affecting the cochlea is(44%) and lesion above the midbrain is(6%).(8)

Conclusion:

Brainstem evoked response audiometry is a valuable objective audiological test in children to assess the functional integrity of the auditory pathway up to the brainstem. We used Brainstem evoked response audiometry to determine the degree of hearing loss, type of deafness and site of lesion in the auditory pathway.

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