

STANDARDIZATION OF NORMAL ABR AND MLR IN EGYPTIAN CHILDREN

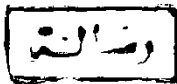
Thesis

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INTRODUCTION AND RATIONALE

INTRODUCTION

Behavioral audiometric procedures have traditionally been the method of choice to determine a patient's hearing status . In the difficult-to-test patient , however , alternative techniques may be necessary because behavioral methods are not clinically (as in testing infants and mentally retarded subjects) or economically feasible.

One alternative technique is evoked potential (EP) testing. The objective is to generate a physiologically- based audiogram that can be used for habilitation or rehabilitation. Because the patient is difficult-to-test , it is typically necessary to use sedation . Consequently , the evoked potential procedure must not be too long , nor should the sedation adversely influence test results (Owen , 1988).

Acoustically-elicited potentials are typically classified according to their time of occurrence (e.g. , early , middle , late) or their anatomical site(s) of origin (e.g. , cochlear , brainstem ,

cortical). Table (1) depicts a version of a classification scheme (Owen and Davis, 1985).

AUDITORY BRAINSTEM RESPONSE (ABR).

Jewett and Williston (1971) systematically recorded the early auditory brainstem human responses to varying stimulus and recording parameters. They labelled their seven positive peaks from I to VII at about 1.0 msec. intervals (figure 1). These evoked potentials were of very short latency, within the initial 10 msec. poststimulus, and of remarkable stability and consistent waveform latency.

The latency-intensity function is usually plotted for wave I, III and V, and the interpeak intervals are relatively constant over the entire intensity range. In general, the I-III interpeak interval is about 2 msec., the III-V interval is approximately 2 msec., and the I-V interval is about 4 msec. (Northern and Down, 1984).

The introduction of auditory brainstem response audiometry in pediatric Audiology represented a great step forward. Mjoen (1981) stated that the method seems superior to any other audiological test in uncooperative children and high-risk neonates.

Jerger et al. (1980) stated that in children who can be tested by conventional behavioral and / or impedance techniques , auditory brainstem response audiometry provides an invaluable cross - check on the behavioral and / or impedance prediction . In children who cannot be successfully tested by conventional techniques , auditory brainstem response audiometry may provide the only basis for prediction of auditory status .

THE MIDDLE LATENCY RESPONSE .

The auditory middle latency evoked responses , so called , because their latency lie between that of the early or brainstem responses and that of the cortical evoked responses . The latencies of the middle latency response peaks are found between 12 and 60 msec. poststimulus .

Hood (1975) and Picton et al., (1977) described the morphology of the middle latency response in adults to be composed of two major positive peaks , Po with a latency of 12 msec and Pa with a latency of 32 msec ., and three negative troughs , No , Na , Nb, occurring at 8 , 18 and 52 msec. , respectively (figure 2) .

In children , there was controversy about the detectability of middle latency response in children. Suzuki et al. (1983) found that wave Pa was recorded in 83 % of children 1 to 7 years of age . Kraus et al. (1985) reported that the presence or absence of middle latency response components Na and Pa varies systematically with age. On the other hand , Mendel et al. (1977) reported adult-like Pa waves in response to 1 KHZ.

Ozdamar and kraus (1983) found that while Pa of the middle latency response was present at low-stimulus intensities , wave V of the auditory brainstem response had a higher detectability at threshold . Musiek and Geurkink (1981) reported that for measurement near auditory threshold , middle latency response may be as good or better a procedure than auditory brainstem response .

RATIONALE .

Cox (1985) recommended that each clinic or laboratory must obtain exclusive normative data . As the normative data for both adult and geriatric populations were established at Ain Shams Audiology Unit , the need to establish normative data for auditory brainstem response and middle latency

response for Egyptian children was necessary . Such normative data will determine the necessary absolute and interwave latencies of these responses in this age group to adress issues related to the validity of middle latency response and auditory brainstem response in threshold determination .

REVIEW OF LITERATURE

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AUDITORY BRAINSTEM RESPONSE IN CHILDREN

Auditory brainstem response (ABR) is the response recorded to a transient acoustic stimulus that occurs between 2 and 15 msec. following the onset of the acoustic stimulus . Usually these potentials are recorded between the vertex or forehead placed electrodes and both mastoids or ear lobes . The response is characterized by a series of 6 or 7 positive peaks and their corresponding negative troughs at about 1.0 msec. intervals (Jewett and Williston, 1971).

1 - ABSOLUTE LATENCY OF AUDITORY BRAINSTEM RESPONSE.

Absolute latency of a given wave can be defined as the time period (in milliseconds) between the onset of the acoustic stimulus and the peak of the averaged response . While no standards exist as to the exact point on the waveform for calculating absolute latency , the prevailing opinion suggests that latency is measured at a point representing the

beginning of the down slope of a given peak (Chwartz and Barry , 1985) .

The absolute latency of wave V , the rostral component of the auditory brainstem response , has received the most widespread clinical attention in differential diagnosis of otoneurologic disorders , as well as for deriving estimate of hearing sensitivity . The importance of wave V relates to its robust character and reliability under varying measurement conditions . In other words , as stimulus intensity decreases , wave V latency increases proportionally and by a predictable amount.

The effect of increased latency with decreased stimulus intensity is common to all neural systems , that is , neural firing becomes less rapid as stimulus intensity decreases in magnitude . The effect is a more slowly rising postsynaptic potential with resultant prolonged latency of synaptic transmission (Picton et al. , 1977) . Alternatively, the earlier primary wave components I and III become unstable as intensity is reduced much below 50 dB normal hearing level (nHL) (Schwartz and Berry , 1985).

The obvious difference between the infant and the adult is the prolonged latency of all components. With increasing age , the latency of all components decreases . The rate of change occurs in a consistent fashion with wave I reaching adult value by 2 -3 months (Jacobson et al. , 1982) and wave V sometimes after 1 to 2 years of age (Hecox et al. , 1974 ; Salamy and Mckean , 1976) . Wave III follows a timetable similar to wave V . Wave II and IV , which are typically not seen in the newborn , follow maturation schedules which parallel adjacent waves , that is , wave II follows wave I and wave IV follows wave V (Salamy et al. , 1982) .

Mjoen (1981) studied auditory brainstem response (ABR) recorded from 212 subjects ranging in age between birth and 13 years . He reported that there were no fundamental difference between the auditory brainstem response derived from children and adults. Three distinct positive peaks are usually identifiable , labelled with roman numerals I , III , and V (figure 3) .

Gorga et al. (1989) measured auditory brainstem response (ABR) in 535 children from 3 months to 3 years of age . They reported that the absolute latency of wave I measured for this age

range showed little or no change and no significant difference across age groups . If wave I latency was taken as a measure of peripheral response maturity , then it appeared that the peripheral response to click stimuli was mature early in life . At the least, wave I latency did not change from three months to three years of life . They also reported that children 33 to 36 months of age showed wave V latencies which were approximately 0.6 msec. shorter than children in the 3 to 6 months age category.

Gorga et al. (1989) attributed this difference to either the presence of subclinical middle ear dysfunction that was undetected by air-conduction auditory brainstem responses or to small developmental changes that occur in the peripheral auditory system after 3 years of age .

Fujita et al. (1991) examined infants at 48-64 weeks postconceptional age , they reported that latency of wave I was unaffected by age or gender . Ziemmerman et al. (1987) reported that auditory brainstem response wave I latency had fully matured by about 4 weeks of age .