

THE USE OF THE ELECTROENCEPHALOGRAM IN THE DIAGNOSIS OF AUDITORY PROBLEMS

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This paper is concerned primarily with the early recognition of auditory disorders in young children under the age of five years. Our clinical experience shows that diagnosis of deafness in young children can be comparatively easy or extra ordinarily difficult. I am not going to concern myself with the former, except to make comparisons. It will be appreciated that the nature of the lesion will influence the handling and management of the young child with communication disorders. When the lesion is peripheral the factors of loudness and frequency play a more direct part in the educational programme than they do in lesions involving the auditory pathways in the brainstem and cortical areas.

One further point I wish to stress is that we lay a great deal of importance on the necessity for repeated clinical examination of the baby and child (particularly of the central nervous system) as well as specific tests of auditory function. A team approach is made to this problem on the medical aspects at Manchester in that we have active cooperation from our otologists, child neurologist and psychiatrist.

A special investigation has been made into five categories of children with auditory handicaps. These are children whose lesions are mainly peripheral, children with cerebral damage without any motor manifestations of cerebral palsy, children with cerebral palsy, mentally defective children, and children with severe visual handicaps.

For these session I will concentrate on the children whose problems relate more to the central pathway and cortex.

The study was undertaken in the usual clinical approach to medical history and diagnosis. In addition these children were examined using the electroencephalogram mainly in the sleep state. It was found that these very young children were best examined by the electroencephalogram under sleep when we could control several factors which were not so readily controlled in the waking state. One important aspect in the limiting of sensory input which is possible under sleep, particularly that of vision. The other aspect which seemed important to us was the possible additional value of small doses of barbiturates on the augmenting of the arousal response.

The study was planned to spread over a period of several years. It was intended to examine very young children from as early an age as possible mostly under two years of age. In the categories already discribed and in

time to examine the results critically in retrospect to see particularly in what way the sleep encephalogram aided in the early detection.

The testing conditions are shown in the first four slides. The nature of the response has been described elsewhere. We have depended mainly on the K complex originally described by Davis, Davis, Loomis, Harvey and Hobart which is elicited best in the light stage of sleep.

The result in the different groups are of interest. Bearing in mind that we are taking a retrospective look at the results we find that the peripherally deaf follow closely on the waking audiogram.

In the next group of children with central damage without the motor manifestations of cerebral palsy we find initially a very big discrepancy between the sleep encephalogram and the subjective responses. The most interesting point is that with the maturation of the nervous system accompanied with guidance to the parents on the methods most likely to help their child the results found in the waking state improves progressively until it reaches the sleep audiogram levels.

It is necessary here to point out that whilst it is possible to gain responses to very quiet sounds in the conscious state in such children the character and nature of the response is not quite the same as found in normal or peripherally deaf children.

These slides show a girl who was referred as being profoundly deaf at 18 months. On subjective tests she did not respond to any sound. It was found that by the age of two years and six months she would respond to very quiet sounds and show ability to locate accurately. A great deal depends on the handling of the child. Particularly in relation to the state of attention and the necessity of release of visual stimulation. In the central palsied group I found two types. Firstly those whose lesions were mainly peripheral in type and whose waking and sleep audiogram closely correspond.

The other type are undistinguishable from the cerebral damaged group already described which would indicate that their lesion are not affecting the cochlea nuclei primarily.

Apart from these findings we have found the E.E.G. of use in the detection of other abnormalities. In the peripherally deaf group we found no abnormalities. In the second group we have found other clinical evidence of central abnormalities and 6 of the 16 children showed abnormalities in the E.E.G.

Either of evidence of damage in the deep midline structures or of damage in the parieto-temporal areas.

In the mentally defective group there was a similar pattern of improved clinical responsiveness after parent guidance but the period needed to gain waking and sleep correspondence was shorter than most of the children in the preceding two groups.

One last point as to the nature of the response in the centrally damaged children.

Attention was drawn earlier to the abnormal nature of the response using a distracting test.

We found that these children whilst able to respond in this way to sound of a distracting nature at very quiet levels have very retarded development when using tests which call for cooperation (or as we call, them activity tests).

It appears to me that these so called aphasic children are of different clinical categories. The least affected appear to have lesions which show evidence of more cortical dysfunction where as some of the most severely affected have difficulties of integration which are of diencephalic origin.

We believe that the diagnostic approach and our findings indicate the nature of the therapy needed in the individual children and that diagnosis is best based on a clinical approach above described. The prognostic value of the sleep encephalo audiogram in indicating the likely eventual response in the conscious state gives very valuable indication.

Resumé

Nous avons étudié la possibilité d'une vérification rapide des atteintes de l'audition chez les petits enfants, nous attachant plus particulièrement aux affections d'origine périphérique, encéphalique ou corticale.

La valeur de l'encéphalo-audiogramme d'un sujet endormi a été examinée. Une étude rétrospective démontra que lorsqu'il s'agissait d'une lésion périphérique, l'audiogramme de l'enfant éveillé avait un rapport étroit avec l'audiogramme obtenu pendant le sommeil.

Quand, par contre, la lésion était encéphalique, il y avait une différence marquée entre les réponses de l'enfant éveillé et celles de l'enfant endormi. Pendant le sommeil, ses réponses à la fréquence et à l'intensité sonore étaient d'habitude assez voisines du seuil moyen de l'audition pour être classées comme normales. Puis nous avons noté, dans l'état de veille, une amélioration des réponses grâce au développement et à la thérapeutique, jusqu'à ce qu'elles rejoignent celles du sujet endormi.

L'électroencéphalogramme s'est montré utile pour la détermination d'autres affections.

Il faut se rendre compte que la nature de la lésion doit influencer le traitement du petit enfant qui ne répond pas aux épreuves d'audition et qui a des altérations de la fonction communicative. On doit donc décider au plus tôt si la lésion est principalement périphérique ou encéphalique. L'encéphalo-audiogramme du sujet endormi peut pronostiquer les réponses qui pourront être plus tard obtenues pendant l'état de veille; il fournit ainsi au thérapeute des renseignements de la plus grande valeur.

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