Objective auditory tests on non-cooperative children

Wedenberg, E.

journal: STL-QPSR
volume: 3
number: 4
year: 1962
pages: 027-029

http://www.speech.kth.se/qpsr
III. HEARING AND DEAFNESS

A. OBJECTIVE AUDITORY TESTS ON NON-COOPERATIVE CHILDREN

The following is a summary of a forthcoming more detailed publication (1).

For measuring the hearing of children less than 3 years old it is necessary to use objective methods. This is true also of children which for some reason are unable to cooperate in play audiometry (say because of intelligence defect, immaturity, or spasticity). In both kinds of subjects, I have performed two kinds of objective hearing tests.

1. Threshold determination of the auropalpebral reflex (APR) consisting in the contraction of the orbicularis oculi muscle.

2. Determination of the intensity of sounds required to waken the child who is in a certain depth of sleep. A specially designed tone audiometer was used for these tests.

Those tests are conducted with the child lying on its side in a cot. In the first 20 subjects, who had been selected as probably being normals, the APR was elicited at a threshold of 105-115 dB for all the frequencies tested in the range 500-4000 c/s.

That it is possible to use these threshold determinations of APR as a test of hearing level in the newborn is due to the similarity between APR and another acoustic reflex, the stapedius reflex: this latter function is familiar in both normals and persons with defective hearing. The APR reflex-threshold curve for adults with normal hearing are very similar, also from the anatomic aspect the two reflexes have much in common. The afferent part (acoustic nerve) and the efferent part (facial nerve) of the reflex are common to both but the centre of the stapedius reflex is situated in the pons and that of the APR in the reticular formation.

The APR threshold curve for the children examined should indicate normal hearing. In the individual case, however, the fact that the APR has been elicited at a particular frequency with a tone of "normal" intensity cannot be taken as proof that the hearing for the frequency in question is normal. As has been shown
in the case of the stapedius reflex, there may be severe hearing
loss with recruitment. So as to distinguish between normal hearing
and impaired hearing with recruitment, experiments were performed
to find the intensity required to awaken a child in a depth of
sleep such that the APR could be elicited by tactile stimulus. The
audiometer was the same as that used in the APR tests. The frequencies
were 500 and 3000 c/s, and the tones were of 1-5 seconds duration,
emitted irregularly for one minute. At an intensity of 70-75 dB,
if not before, all the infants showed signs of waking such as a
change in the breathing rhythm or flickering of the eyelids.

As an aid in distinguishing between normal hearing and
different types of hearing impairment, a chart was compiled showing
how a normal child and one with impaired hearing might be supposed
to react to APR and awaking from sleep.

When the first 20 newborn underwent these hearing tests
in 1955 all reacted in the manner that was considered typical of a
child with normal hearing. As a check, a follow-up play-audiometry
test was performed on 10 of the children in 1961. They had all
normal hearing.

The same hearing tests were also carried out on 30
children suspected of having impaired hearing. They ranged in age
from 2 days to 4 years 5 months. For none of these subjects could
play audiograms be made at the first test owing to lack of cooperation
either because they were too young or because they were of 100 low
intelligence. More recently many control play audiograms have been
recorded for this series. Control audiograms have been made for
20 subjects and informal tests performed on 6. Four patients have
died.

In all but two of the series the preliminary findings
were verified by one of these two tests.

In one of the exceptions the hearing was recorded as
normal on the third day but an impairment was found at 2 years
6 months; it is highly probable that the preliminary results were
correct, but that later on there was a severe impairment, probably
of genetic origin, and similar to that associated with atrophy
occurring in certain strains of rats, cats and mice with histolog-
ically normal cochlea at birth. All the relatives of this case were deaf. In the second exceptional case there was an intelligence defect that the control tests cannot be considered either to contradict or to confirm the preliminary findings.

It is evident from the results that these objective hearing tests are extremely reliable. They enable one to determine with a high degree of certainty whether the hearing of a child, (newborn or older) is normal or defective, and in the latter case to establish the type and degree of impairment and even, in conductive and retroclear hearing loss, to record an audiogram.

E. Wedenberg

Reference: