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ELECTROMYOGRAPHIC STUDY OF CLICK EVOKED MIDDLE EAR MUSCLE ACTIVITY IN CATS *

G. Salomon and A. Starr

In waking cats middle ear muscles responded to clicks with activity, which on emg. consisted of an initial burst of activity (latency 4.5 - 10 msec.), a pause, and a later sustained period of activity (latency 34 - 56 msec., duration 1 sec.). The latency of the first response decreased with increasing sound intensity, whereas the latency of the second response varied independently of intensity. These two responses behaved differently during repetitive stimulation with clicks; the first response remained constant while the second decreased in amplitude and disappeared. The second response would reappear promptly, however, by adding extra sounds, by decreasing or increasing the click intensity, by cutaneous stimulation, or by the animal's own movements.

Sound transmission through the middle ear did not change during the first response (measuring cochlea output elicited by tone of constant intensity) but an attenuation of sound transmission occurred during the second response. The lack of attenuation during the first response was due to the brief duration of this response.

Sudden strong tones evoked activity in middle ear muscles after a latency of 5 - 10 msec. This activity consisted of a 20 - 30 msec. discharge, a silent period, and a sustained activity. The silent period was most pronounced in muscle tensor tympani. After termination of a tone activity persisted in both muscles and returned only gradually to spontaneous activity levels.

Intercollicular decerebration modified middle ear muscle responses to click and continuous sounds: the second long latency response to clicks was abolished and the after discharge to tone bursts no longer occurred.

These results demonstrate that descending influences from diencephalic centers modify brainstem mechanisms regulating reflex middle ear muscle activity. These higher controls most likely account for the variability of middle ear muscle responses described in humans and in waking animals.

UNE ÉTUDE ÉLECTRO-MYOGRAPHIQUE DE L'ACTIVITÉ MUSCULAIRE DE L'OREILLE MOYENNE ENGENDRÉE PAR VOIE DE CLICK CHEZ LES CHATS

Des clicks ont engendré, chez des chats éveillés, une activité des deux muscles de l'oreille moyenne qui, d'après l'électro-myogramme, consistait en une première réponse de courte durée (période latente de 4, 5 à 10 msec),

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en une pause et en une deuxième réponse durant jusqu'à une seconde (période latente de 34 à 56 msec, égale pour les deux muscles et sans dépendance d'intensité). Par des mesures de la transmission sonore de l'oreille moyenne, on n'a constaté des modifications que pendant la deuxième réponse, et il a été possible de prouver que c'était la courte durée de la première réponse qui l'a rendue ineffective.

Une décérébration intercolliculaire a éliminé la deuxième réponse et, contrairement à la première réponse, celle-là doit donc être basée sur des structures de l'hémisphère cérébral frontal.

Par l'effet de clicks répétés, la deuxième réponse a présenté une accoutumance tandis que la première réponse était stable et, d'une façon générale, la deuxième réponse se conduisait de façon fluctuante d'un instant à l'autre. Chez les animaux éveillés, les deux muscles de l'oreille moyenne ont répondu à des tops sonores par une activité électro-myographique qui, après une période latente de 5 à 10 msec, consistait en une activité d'une durée de 20 à 30 msec, en une «pause» à activité réduite et, ensuite, en une nouvelle activité qui se poursuivait après la fin de l'excitation sonore. La durée de la répercussion dégressive était d'environ 0,5 seconde, augmentant à une intensité sonore croissante. A la décérébration a disparu la répercussion qui, probablement, dépendait des mêmes structures de l'hémisphère cérébral frontal que la deuxième réponse au click.

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DISCUSSION:

Keidel: What was the latency of your generalized muscle reactions to clicks?

Salomon: Our latency in cats was about 40 - 50 msec, but the ones I quoted from Borsanyi show latency down to 10 msec. We were not able to pick that up because we were not using an analyzer — on a single response there are too many disturbances for recording a 10 msec response. In this respect I recall Rushworth's work on acoustic click stimulus to face muscle responses and he found there face muscles responses in two groups — 10 msec and 40 - 50 msec. He was using single responses and had added them on the scope; by taking many pictures he was able to detect the responses.

Keidel: The reason why I ask you is that there is a great interest about those latencies for all people working with objective audiometry; there is a first degree-response around 30 msec and a second response about 6 - 10 msec — would you think it is the same?

Salomon: we used unrestrained awake cats and there we always have a lot of background activity in the somatic muscles, so I do not think we can pick it up.

Terkildsen: What is your opinion as to the existence of an electro myographically silent contraction in the tensor muscle.

Salomon: The tensor does not respond in humans after 10 msec. I have never seen a contraction without a myographic response and a shift in the cochlear microphonics.

Djupesland: We made some observations concerning the question Dr. Terkildsen put to us. We operated 155 patients and we saw contractions in the stapedious muscle in all of them, but never without a general muscle contraction. We made also myographic investigations putting a hook in the tensor tympani and got the same results.