VARIATION IN THE GLABELLAR AND SUPRAORBITAL REFLEXES IN THE NORMAL INDIVIDUAL

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UDC 612.833.74

The characteristics of temporal parameters of the glabellar and supraorbital reflexes were investigated by analysis of 650 electromyograms recorded in 13 healthy subjects. Fusion and omission of individual components of the reflexes were shown to be possible. Neither the strength of tapping (from 5.2 to 14.8 mm Hg) nor the state of the eyes (open or closed at the time of tapping) had any effect on the length of the latent period.

Increasing importance is attached nowadays in clinical medicine to the quantitative characteristics of reflexes. However, this gives rise to difficulty because under normal conditions there is considerable variation in the quantitative parameters of human reflex activity, and this variation has received very little study. This is particularly true of the glabellar and supraorbital reflexes, so frequently used in clinical medicine.

The object of this investigation was to study variation in these reflexes by quantitative measurement of their latent periods.

Two components are described in the electromyogram (EMG) of the glabellar reflex in man: I) a monosynaptic component of miotic origin; II) a polysynaptic component, largely dependent on supranuclear influences. The latent period (LP) of component I varies from 11 to 18 msec and of component II from 23 to 60 msec [1, 3, 4]. Component I is absent during sleep [5].

EXPERIMENTAL METHOD

The glabellar and supraorbital reflexes were evoked by means of an apparatus described previously [2], which unexpectedly applied a tap of measured strength (14.8 and 5.2 mm Hg) either to the glabella or over the lateral part of the left or right eyebrow. The EMG was recorded by means of bipolar tin electrodes applied to the outer angle of the right and left eyes*. A type UBP-02 amplifier was used and recordings were made with a type S1-18 dual-beam oscilloscope, under driven sweep conditions. The beams were triggered by means of a device which released the beam at the same moment as the stimulus was applied. The EMG was recorded photographically for 100 msec and the accuracy of measurement was ±1 msec.

Stimuli to evoke the glabellar and supraorbital reflexes were applied in successive series. Between the series, consisting of 5-10 stimuli, the subject rested for a few minutes. The stimuli within the series were applied at intervals of between 30 sec and 1 min.

Altogether 13 healthy persons aged from 18 to 40 years (5 women and 8 men, all right-handed) were tested. The blinking reflexes were tested not only with the eyes open (340 EMG) but also with the eyes closed (310 EMG), because in clinical practice it is sometimes necessary to test these reflexes in patients whose state of consciousness is abnormal and who are lying with their eyes closed.

*The position of the electrodes is reflected in the amplitude of the electromyographic response but does not affect the LP of the response [2].

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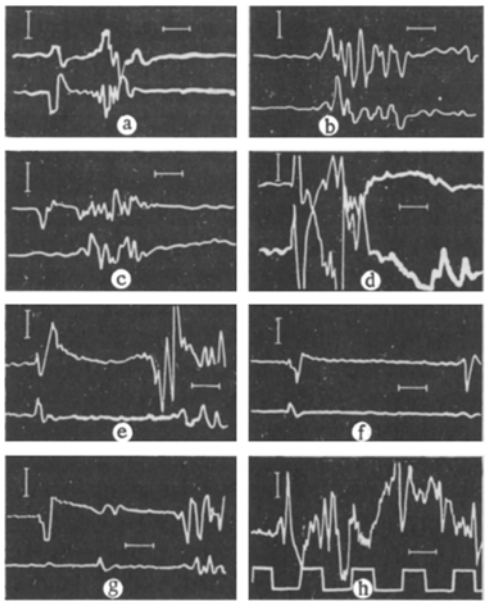

Fig. 1. EMG of the glabellar reflex recorded simultaneously from the orbicularis muscle of the right (above) and left (below) eyes. Calibration pulse (20 msec, 50 μV) shown in Fig. 1h. a) typical EMG of glabellar reflex. LP of compoment I 15 msec, component II 32 msec; b) omission of component I on both sides; c) omission of component I on the left; d) component II begins before end of a group of waves belonging to component I (fusion of components I and II); e) omission of component II on both sides. Appearance of component III with LP = 55 msec; f) omission of components II and III. Appearance of component IV with LP = 78 msec; g) appearance of a separate component I with LP = 13 msec, component II with LP = 35 msec, and component IV with LP = 66 msec; h) fusion of all 4 components of glabellar reflex; LP of component I = 10 msec.

EXPERIMENTAL RESULTS

The Glabellar Reflex

Component I. LP of component I was constant for each subject and it varied, when this method was used, from 10 to 16 msec in different subjects, usually from 11 to 14 msec. No difference was found between the LP of component I depending on the strength of stimulation or whether the reflex was evoked with the eyes open or closed. Component I was omitted episodically (Fig. 1a, b, c), i.e., in nearly every subject it was possible to record EMGs in which the LP of the response was between 10 and 18 msec. Component I was omitted either unilaterally or, much more often, simultaneously on both sides. Component I was in fact omitted in about 10% of all EMG's of the glabellar reflex recorded with the eyes both open or closed.

Sometimes component I could not be distinguished from component II, because the latter began before component I finished (Fig. 1d). This fusion of components I and II (usually on both sides simultaneously) was observed in 83 of the 394 EMG's, i.e., in 21% of cases regardless of the strength of stimulation or whether the eyes were closed or open. When component I could be distinguished from component II, the duration of I varied between 5 and 7 msec. If components I and II were fused, LP of component I was unchanged, but LP of component II was closer to it, so that it tended to fill the time interval between them.

As a rule LP of component II was between 20 and 38 msec. Sometimes, however, a second (in its appearance on the curve) group of waves occurred on the EMG with a latent period not of 20-38 msec but of 45-60 msec (Fig. 1e) or even 60-80 msec (Fig. 1f).

Absence of a response with LP between 20 and 38 msec was observed episodically in nearly all subjects; it was omitted regularly in 2 subjects, in one of whom component II was omitted in every case, and in the other in about 50% of cases; in both subjects responses appeared with latent periods of 45-60 or 60-80 msec. Absence of component II was observed in approximately 10% of the 394 EMG's.

Component II of the glabellar reflex usually had an equal LP on both sides, but occasionally on one side it could be delayed by up to 4 msec.

Supraorbital Reflex

This differs from the glabellar reflex in having component I only on the side of stimulation. It was not possible to determine the difference between LP's of the glabellar and supraorbital reflexes in every subject. In different subjects, irrespective of the strength of stimulation, component I of the supraorbital reflex was omitted episodically (in 10% of EMG's) on the side of stimulation, more often if evoked with the eyes open (15%) than closed (3%).

Occasionally (in only 8 EMG's) component I appeared on the side opposite to the stimulus, but in that case it was of very low amplitude.

Fusion of components I and II of the supraorbital reflex, i.e., component II beginning before component I had ended, was observed in 17 EMG's.

LP of component II of the supraorbital reflex varied within the same limits as LP of component II of the glabellar reflex, and it was systematically absent in those subjects in whose glabellar reflex component II was absent.

DISCUSSION

The results confirmed data in the literature to the effect that component I of these reflexes is constant whereas component II is very variable. However, constancy of component I was found to be relative: in approximately 10% of recordings from nearly every subject component I was absent on the EMG, while in 21% of cases it could not be separated from component II (component II began before component I of the EMG wave had ended). Because of the large number of EMGs it was possible to distinguish certain ranges of latent period within which component II appeared predominantly. The results suggested that the blinking reflex is expressed on the EMG not by 2, but by 3 or even 4 components (components II, III, and IV in such cases appear consecutively).

It is important to note that neither opening and closing the eyes nor changing the strength of the stimulus had any significant effect on the latent period of the EMG of the glabellar and supraorbital blinking reflexes.

The writer is grateful to S. M. Blinkov for helpful discussions.

LITERATURE CITED

1. A. R. Shakhnovich, The Motor Apparatus of the Eyes under Normal Conditions and in Local Brain Lesions, Author's Abstract of Doctoral Dissertation, Moscow (1966).
2. T. L. Khomeriki, Byull. Éksperim. Biol. i Med., No. 2, 68 (1970).
3. G. Rushworth, J. Neurol. Neurosurg. Psychiat., 25, 93 (1962).
4. E. Kugelberg, Brain, 75, 385 (1952).
5. B. Shahani, J. Neurol. Neurosurg. Psychiat., 31, 574 (1968).