Experiments on cats anesthetized with pentobarbital showed that on the creation of a hyperactive focus with a high level of excitation in the orbital or coronary cortex and a series of foci in the opposite neocortex a functional complex is formed, which works to the same program determined by the activity of the hyperactive focus. The latter plays the role of a determinant structure. Depression of activity of the determinant focus by pentobarbital leads to disintegration of the epileptic complex. Division of the rostral portion of the corpus callosum led to disturbance of synchronized operation of the determinant and other foci of epileptic activity. The results confirm the general concept of the role of determinant structures in the activity of the nervous system. KEY WORDS: determinant focus; epileptic complex; strychnine; corpus callosum; ether.

It has been shown [2] that a powerful focus of excitation created by means of strychnine in the cerebral cortex plays the role of a determinant structure [1] which determines the character of activity of other scattered foci of strychnine excitation, potentiates excitation in them, and unites them into a single functional complex and determines the activity of the complex as a whole. This complex could be destroyed by suppression of the determinant focus. Blocking of the other foci constituting the complex, however, had no significant effect on the activity of the complex as a whole. In the investigations mentioned above the determinant and dependent foci were created in the same hemisphere. It was therefore important to discover whether a hyperactive focus created in one hemisphere can possess determinant properties relative to other foci created in the cortex of the opposite hemisphere. It was also interesting to study the role of interhemispheric commissures in functional interaction between determinant and dependent foci forming a complex of epileptic activity.

EXPERIMENTAL METHOD

Acute experiments were carried out on cats. Under pentobarbital anesthesia (25-40 mg/kg, intraperitoneally) the skin and subcutaneous cellular tissue were divided by a midline incision running from the nasal bones to the occiput. The eyes were drained. Through burr-holes in the cranial bones wide access was obtained to different parts of the frontal and temporal zones of the neocortex. Subconvulsive foci were created by application of filter paper (2 mm²) soaked in a 0.025-0.05% solution of strychnine nitrate, in different parts of the coronary, anterior and posterior sigmoid, and orbital gyri. A focus of powerful epileptiform activity was created by application of 3% solution or a crystal of strychnine to the orbital or coronary gyrus of the opposite hemisphere. The foci were blocked by local application of a 6% solution of pentobarbital. The commissures between the hemispheres were divided by means of a spatula introduced through the longitudinal cerebral fissure. Completeness of division was verified histologically. Activity in the foci was inhibited by ether anesthesia (injection of ether vapor into the jet of inspired air). Brain potentials were recorded by a monopolar method with the reference electrode secured to the nasal bones.

EXPERIMENTAL RESULTS

After application of 0.01-0.1% solutions of strychnine to different parts of the coronary, sigmoid, and orbital or ectosylvian gyri of one hemisphere, strychnine potentials of varied amplitude developed (Fig. 1A, zones 2-4). Each focus generated strychnine discharges asynchronously. The creation of a new and powerful
Role of determinant focus in formation and activity of functional complex of epileptiform activity in cortex of both hemispheres. Experiment No. 1: A) formation of foci of increased excitability in areas 2-4 of left hemisphere by subconvulsive strychnization (0.01% solution); application of strychnine discontinued after appearance of activity. B, C) Formation of determinant focus in zone 1 of right hemisphere by application of 3% solution of strychnine and synchronization of epileptiform activity in all foci. Experiment No. 2: D) 40 min after beginning of formation of determinant focus in zone 1 of left hemisphere, synchronization of spike activity in zones 2-4 of right hemisphere with activity of focus 1. E and F) 15 and 40 min respectively after application of 6% solution of pentobarbital to region of determinant focus in zone 1. 1) Left orbital cortex, 2) right coronary cortex, 3 and 4) anterior and posterior right sigmoid gyri respectively. Calibration: 500 μV, 1 sec.

Fig. 1. Role of determinant focus in formation and activity of functional complex of epileptiform activity in cortex of both hemispheres. Experiment No. 1: A) formation of foci of increased excitability in areas 2-4 of left hemisphere by subconvulsive strychnization (0.01% solution); application of strychnine discontinued after appearance of activity. B, C) Formation of determinant focus in zone 1 of right hemisphere by application of 3% solution of strychnine and synchronization of epileptiform activity in all foci. Experiment No. 2: D) 40 min after beginning of formation of determinant focus in zone 1 of left hemisphere, synchronization of spike activity in zones 2-4 of right hemisphere with activity of focus 1. E and F) 15 and 40 min respectively after application of 6% solution of pentobarbital to region of determinant focus in zone 1. 1) Left orbital cortex, 2) right coronary cortex, 3 and 4) anterior and posterior right sigmoid gyri respectively. Calibration: 500 μV, 1 sec.

In individual experiments foci of epileptiform activity in cortical zones of the coronary or sigmoid gyri not symmetrical relative to the hyperactive focus were not completely subordinated to the activity of the hyperactive focus and continued to generate asynchronous epileptiform activity. The absence of synchronization (or its substantially later onset) in the sigmoid foci was observed comparatively often when an area of neocortex symmetrical relative to the hyperactive focus was not subjected to preliminary treatment with a weak solution of strychnine, and only discharges transmitted via the corpus callosum from the hyperactive focus in the orbital cortex of the contralateral hemisphere were recorded in this area. This fact suggested that the symmetrical focus plays a definite role in the synchronization of nonsymmetrical foci.