

**THE ROLE OF THE CORTEX AND CORPUS CALLOSUM IN THE PATHOPHYSIOLOGY OF THE SECONDARY BILATERAL SYNCHRONY IN THE CAT (ABSTRACT)\*. Thesis. São Paulo, 1996.**

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The role of the cortex and corpus callosum in the pathophysiology of the secondary bilateral synchrony was studied in 100 adult cats divided into 3 sections in which we performed: 1- mapping of the transcallosal evoked potentials and serial intra- and interhemispheric cortical sections (groups I, II and III); 2- uni- or bilateral hemispheric cortical application of penicillin and callosal stimulation and section (groups IV and V); and 3- electrical and pharmacological stimulation of the cortex and analysis of the cortical epileptogenic threshold.

The transcallosal evoked potentials were studied in 10 cats in which 138 points of the cortex were stimulated by means of bipolar electrodes (1 Hz, 0.5 msec, 4 mA) according to a pre-existing cartesian map (group I). The evoked potentials were recorded contralaterally in both the antero-posterior and medio-lateral directions, starting at the homologous site. The locations where the maximal contralateral evoked potentials were homotopic (symmetric) or heterotopic (asymmetric) were defined.

The effects of serial cortical sections on the homotopic and heterotopic evoked potentials were studied in 10 animals (group II). Two types of experiments were carried out: 1- sections medial and anterior to the stimulated points were performed; and 2- serial sections were performed in the antero-posterior direction.

The effects of callosal sections in the homotopic and heterotopic evoked potentials were examined in 15 cats (group III). In 5 cats, anterior callosotomies were performed after stimulation of symmetric sites; in 5, posterior callosal sections were performed and complemented by an anterior callosal section while stimulating asymmetric sites; and in 5 cats, anterior callosotomies were performed after stimulation of asymmetric sites.

The results obtained after callosal stimulation in relation to the frequency, synchrony and morphology of epileptic bilateral activity were studied in 12 cats (group IVA). Callosal stimulation was carried out after topical bilateral application of 200 IU of penicillin and continuous electrocorticographic monitoring.

The electrocorticographic picture obtained after an unilateral hemispheric application of 800 IU of penicillin and the results of anterior and posterior callosal sections were studied in 7 cats (group IVB).

The electroclinical correlation derived from the topical hemispheric application of 2000 IU of penicillin was studied in 12 cats chronically implanted with a sud-dural cannula (group V).

The epileptogenic threshold for secondary bilateral synchrony was studied in 24 animals submitted to a sub-threshold application of penicillin (100 IU) over both hemispheres. Several sites were stimulated according to a cartesian matrix (3 mA, 0.5 msec, 0.5 or 60 Hz) (group VI).

The secondary bilateral synchrony obtained after cingulate gyrus injections of kainic acid was studied in 10 cats chronically implanted with cannulas in the cingulum. Both the behaviour and electrocorticogram were continuously recorded after the injection of 100 µg of kainic acid (group VII).

The cortical stimulation in group I gave rise to contralateral evoked potentials with three main components: one negative (mean latency of 4 msec, 0.1 mV of mean amplitude and resistant to high frequency stimulation) and always present, one positive (mean latency of 10 msec, mean amplitude of 0.08 mV and that disappeared with high frequency stimulation) and also always present and another negative one present in 60% of the cases (mean latency of 15 msec, mean amplitude of 0.04 mV and also abolished by high frequency stimulation). The higher potentials were recorded from the anterior and middle marginal and suprasylvian gyri. The symmetric (homotopic) potentials were higher and more conspicuous in the homotopic contralateral areas; the asymmetric potentials occurred in anterior areas of the contralateral hemisphere after the stimulation of more posterior sites. The intracallosal stimulation gave rise to bilateral and synchronous evoked potentials.

After sections medial to the stimulated site the homotopic evoked potentials disappeared in all animals while the asymmetric potentials were only reduced in size. Sections immediately anterior to the stimulated site caused the disappearance of asymmetric evoked potentials (group II)

Posterior callosotomies caused the disappearance of the homotopic potentials and reduction of the heterotopic ones while stimulating posterior asymmetric sites. On the other hand, anterior callosal sections abolished the heterotopic evoked potentials but had no effect on the homotopic ones in this situation (group III).

The varied callosal stimulations patterns were ineffective in modifying the morphology, synchrony or frequency of the penicillin induced generalized discharges (group IVA).

The unilateral hemispheric topical application of penicillin gave rise to epileptic discharges after 10 minutes and to clear secondary bilateral synchrony after 40 minutes. This synchrony was markedly reduced after anterior callosal section but was only abolished after complete callosal section (group IVB).

The unilateral subdural injection of penicillin gave rise to epileptic discharges over the anterior and middle convexity after 10 minutes. After 20 minutes, the whole hemisphere disclosed spiking, prevailing in the more anterior regions with eventual secondary bilateral synchrony. The majority of the animals suffered from status epilepticus for several hours (group V).

The topical application of sub-threshold amounts of penicillin substantially reduced the epileptic threshold to cortical stimulation. Secondary bilateral synchrony could then be more easily obtained, especially after stimulation of the mesial regions (group VI).

Kainic acid injections into the cingulum gave rise to seizures, electrographically characterized by spikes and spike-and-wave discharges over both convexities within the first post-injection hour. This led to status epilepticus in all animals and to death in 50% of them (group VII).

These results allowed further insight on the role of the cortex and corpus callosum in the secondary bilateral synchrony in the cat and hopefully would help to rationalize the use of callosal sections in humans.

**KEY WORDS:** secondary bilateral synchrony, pathophysiology, cerebral cortex, corpus callosum, cat.

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