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A Method for Simultaneous Brain Stimulation and Electrocardiographic Recording in Unanesthetized Free-moving Cats *

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A new method for simultaneous brain stimulation and electrocardiographic recording in unanesthetized free-moving cats has been described in order to avoid the effect of anesthetic or curare-like agents. I was found that the E.K.G. recordings in chronic preparation using the implantable electrodes of E & M Instruments Co. Inc., U.S.A., were free of artefacts and do not showed modifications of the electrocardiogram from day to day.

With our preparation electrocardiographic ischemic-like changes or ectopic beats as an effect of electrical stimulation of the brain was never observed in spite that such a changes has been previously described by several authors.

Changes in the heart cycle induced by electric stimulation in diverse brain regions or by acute brain injury has previously been reported (1, 2, 4-6, 9-11). These alterations have been considered as a support of the existence of central regulatory mechanisms acting upon the heart.

The experimental studies mentioned above has been performed in acute preparations under anesthesia or in animals immobilized by Flaxedil. Interaction of anesthesic agents and catecholamines to produce cardiac arrhythmias has been showed by KATZ and EPSTEIN (8). On the other hand concentration of Flaxedil in the heart is higehr that in the striate muscle (3). Flaxedil produced also a consistent augmentation of duration of afterdischarges from cerebral cortex (7).

On these grounds acute preparations seems to be inadequate to study the neural control of cardiac function. Improvements in the techniques are essential in order to determinate in wich extent the cardiac arrhythmias previously reported are a function of anesthesic agents or muscle relaxants.

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The aim of the present study in to develop technique for simultaneous brain stimulation and electrocardiographic recording in unanesthetized free-moving cats.

Materials and Methods

The experiments were carried out in cats and the preparation of the animals were performed in two stages. In the first one and under nembutal anesthesia electrodes for E.K.G. recording were implanted in the subcutaneous tissuess of posterior angles of the right and left scapula and xiphisternun regions through a small stab wound. The cable electrodes were carried subcutaneously until emerged through a wound at the back of the neck, and soldered to a female plug attached to a special designed harness (Fig. 1 and 2). Recording electrodes were the implantable electrodes of E. & M. Instrument Co., Inc., U.S.A. In order to avoid wound infections a long acting penicillin was used. Subcutaneous leads were well tolerated and do not showed tendency to change their position.

The animals were rested for at least one week and after this period the electrocardiogram were recorded during several days by means of a «Cardioline Epsilon 2» apparatus. This procedere were made with the purpose to test if the implantation of electrodes for intracerebral stimulation are able to induce some modifications in the cardiac rythms.

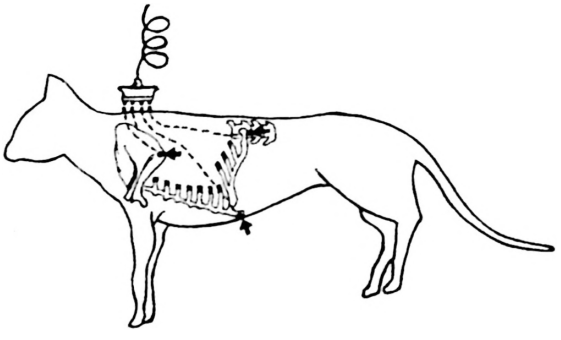

Fig. 1. *Each black arrows represen the place of recording electrodes.*

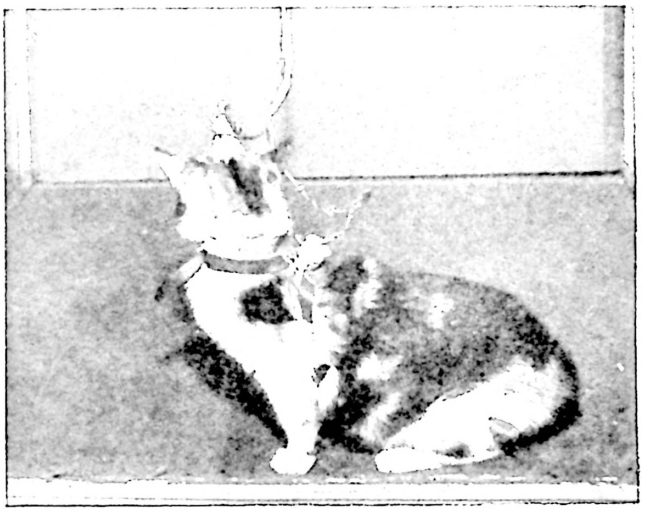

Fig. 2. *Harness designed to attach the female plug for subcutaneous leads.*

The second stage were performed fifteen days after the first one with the aim to implant the electrodes for brain stimulation. Under nembutal anesthesia bipolar nichrome electrodes were placed stereotactically in several Diencephalic and Limbic Structures. Wires from the electrodes were soldered into a female plug which was fastened to the skull with acrylic plastic.

In preparation for an experiment the cat was placed in a box of 1 m^3 with glass walls and the electrocardiogram were recorded to test any alterations induced by implantation of intracerebral electrodes.

Results and Discussion

Only in one cat a permanent wandering pacemaker were observed after implantation of the electrode in zona incerta. Histological examination to study the extent of the injury caused by the wire were per-

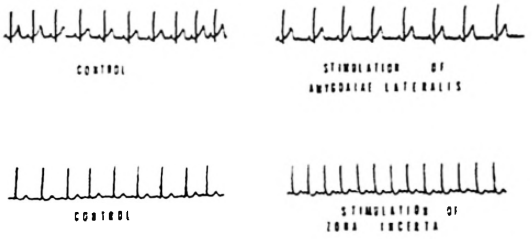

Fig. 3. *Modifications of E.K.G. induced by stimulation of Amygdala and Zona Incerta.*

formed. Neither hemorrhage nor abcess were found around the tip of the electrode and the brain reaction showed no difference with the rest of the wires. It can be assumed that the modification observed in the electrocardiogram were induced by chronic irritation of the Zona Incerta, because under stimulation of this point the intensity and duration of the wandering pacemaker were increased.

The electrocardiograms recorded with our technique can be seen in Fig. 3, before and after brain stimulation. The records were free of artefacts in spite of the animals were moving around.

The technique reported here provides a useful method for simultaneous brain stimulation and electrocardiographic recording in freemoving cats. The data obtained that will be published elsewhere showed significant differences with those have been reported previously. In our animals electrocardiographic ischemic-like changes or ectopic beats as an effect of electrical stimulation of the brain was never observed. The fact that in our study the stimulation of Diencephalic of Limbic structures failed to bring about the alterations described by previous authors may be attributed to methodological differences and suggest that anesthesic and curare-like drugs play some role in the development of such type of experimental arrhuythmias.

On the other hand, the above described technique has yielded the opportunity to establish a correlation between electrocardiographic modification and behavioural response especially in Limbic System.

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