ELECTROCARDIOGRAPHIC, RESPIRATORY AND BLOOD PRESSURE CHANGES AFTER BLOOD-SALINE INJECTION IN THE ORBITO-FRONTAL REGION OF DOG'S BRAIN

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Summary: Cerebrovascular episodes were simulated by injecting 5 ml of blood/saline in the orbito-frontal region of dog's brain and its effects on E.C.G., arterial pressure and respiration were observed. Extrasystoles, P wave amplitude increase, S-T segment depression, and T wave changes were frequently observed after injection.

Heart rate as calculated from E.C.G. tracings, and arterial pressure both showed an initial fall and a later rise after these injections. Respiration was always inhibited. The initial effects could be due to an immediate rise of intracranial tension, and the delayed effects, due to the direct involvement of orbito-frontal lobes.

Key Words: orbito-frontal lobes electrocardiographic effects simulation of cerebrovascular episode.

INTRODUCTION

Smith and Tomlinson (12) found sub-endocardial hemorrhages in cases of intracranial lesion but did not lay any significance on the site of lesion. Anand and Dua (1) reported circulatory and respiratory changes induced by electrical stimulation of limbic system, and suggested that the electrocardiographic changes as a result of cerebrovascular accidents could be due to disturbances affecting cortical area 13 on the orbital surface of frontal lobe. Korteweg et al (5) found that the hypothalamic stimulation gave different effects depending upon the site of stimulation. Cropp and Manning (2) reported E.C.G. changes simulating myocardial ischaemia and infarction associated with spontaneous intracranial hemorrhage. Melville et al (7) suggested that hypothalamic stimulation might be involved in some of the arrhythmias in patients with cerebrovascular accidents. Menon (8) found evidence of a massive anterior infarct on the E.C.G. in a case of infarction of most of the anterior portion of the temporal lobe, but on necropsy the heart was found to be normal. He is of the view that the site of the primary lesion in the brain is of no significance. McKean and Hitchcock (6) gave an intrathecal hypertonic saline injection in patients of carcinoma, and reported transient E.C.G. abnormalities which appeared within five minutes and were most marked in the first minute.

It is thus accepted that cerebrovascular accidents produce E.C.G., respiratory and blood pressure changes but the role of site of lesion is disputed. This study is an attempt to find out...
the effects of simulated cerebrovascular accidents involving the orbito-frontal region.

MATERIALS AND METHODS

Fourteen, healthy mongrel dogs weighing 8-15 kg were anaesthetised with chloralose (80-100 mg/kg). Cerebro-vascular accident was simulated by injecting 5 ml of blood/saline in the orbitofrontal lobe at a place which was 3-5 mm deep from the surface. Injection was made by a syringe through a hole burred in the skull after opening the frontal air sinus.

A 12-lead electrocardiogram, arterial blood pressure and respiration were recorded in every animal before injection in the orbitofrontal lobe. After the injection, continuous records of respiration and blood pressure were taken. The electrocardiogram was taken immediately, 15 min, 30 min, and 60 min after the injection. In two dogs a 90 min record was also taken. The site of injection was confirmed by autopsy in each animal. Respiration was registered by a Marey’s tambour via an endotracheal tube inserted after anaesthesia, and arterial pressure was recorded from the femoral artery using a mercury manometer.

![Image: Immediate effect of blood injection in the orbito-frontal region upon electro-cardiogram of dog](image)

**Fig. 1:** Strips from a continuously recorded electrocardiographic tracing. Note the increase in R-R intervals and S-T segment depression after injection of blood in the orbito-frontal lobe.

**Fig. 2:** Twelve lead E.C.G. tracing of the orbito-frontal lobes. Note the increase in R-R intervals and S-T segment depression after injection of blood in the orbito-frontal lobe.

Elevated R wave and aVR and aVF. R wave amplitude increased by 4-24 mm and in V2-V6 by 4-24 mm.
Electrocardiographic Effects of Orbito-frontal Lobes 157

RESULTS

Electrocardiographic changes—(Fig. 1 and 2): An initial decrease in the heart rate followed by a persistent increase by 5-75 beats/min was seen in majority of dogs. All animals showed sinus irregularity. 57% showed occasional extra-systoles in different leads. The polarity of P wave did not show a change in majority of dogs although the wave became bifid in few animals. The amplitude of P wave showed a slight but consistent increase in almost all leads in majority of animals. Changes in the duration of P wave were inconsistent. The P-R interval showed a persistent decrease of 0.02-0.06 sec in most of the dogs. Changes in the intrinscoid deflection and QRS interval were negligible.

The Q wave showed markedly variable changes, but were confined mostly to leads II, aVR and aVF. R wave amplitude decreased in 43% of dogs in leads II, III and aVF by 4-14 mm and in V2-V6 by 4-24 mm. Majority of dogs did not show a change in S wave. A slight elevation of J point in the augmented leads and a depression of 0.5-2.0 mm in the standard
and precordial leads was also observed. About 60% of dogs showed a depression of ST segment in III and precordial leads by 0.5-2.0 mm. In a number of animals, the T wave polarity was changed in lead I, aVL and aVF. Although the changes in the amplitude of T wave were seen in all the dogs, but they were markedly variable. The QTc did not show a change.

Changes in respiration and arterial pressure (Fig. 3): The rate of respiration decreased by 2-16/min in most of the dogs, and the respiration became irregular in almost all the dogs.

![Fig. 3: Effect of injection of blood in the orbito-frontal lobe on arterial blood pressure and respiration. Upper tracing represents carotid artery pressure and lower tracing represents the intratracheal pressure.](image)

The depth of respiration increased in 70% of dogs. The expiration became forceful in 43% of dogs. An immediate fall in the B.P. by 3-25 mm Hg was followed by a rise of 15-44 mm Hg in as many as 86% of dogs.

**DISCUSSION**

Slight to marked electrocardiographic, respiratory and blood pressure changes were seen. An initial decrease in the heart rate occurred, a finding similar to that of Anand and Dua (1) who got a slowing of the heart upon stimulation of limbic system. This decrease was followed by an increase in the heart rate. Korteweg et al (5) and Melville et al (7) also got increase in heart rate which was not immediate. Extrasystoles were also recorded. The initial changes in heart rate and extrasystoles were probably due to sudden increase in the intracranial tension but it is probable that the delayed changes were due to sympathetic stimulation. Another possibility is that the injection of blood simulated subarachnoid haemorrhage, a condition in which extrasystoles are more common. A delayed increase in the amplitude of P wave was probably due to pulmonary oedema, a condition described by Russel (10) in cases of cerebro-vascular accidents. The mechanism is not very clear from the similarity with Weinberg and B. B. polarity changed in 86% of dogs and Robson (13) and Millar almost marked when the frontal lobe. (11) have noticed tall T wave increase and decrease in the autonomic disturbances probably (13) have reported a frequent difference could be due to the they took their records hours.

Decrease in the rate of Anand and Dua (1) have noted a lobe. In this study a slight in all animals. Fulton (3) a stimulation of orbital surface changes appear to be due to to be due to autonomic disturbance.

2. Cropp, G.J. and G.W. Manion associated with spina.
7. Melville, K.I., B. Blum, H. by hypothalamic stimulation
as well as a depression of ST segment, the T wave polarity, and the amplitude of T wave. The QTc did not show a significant change.

Respiration decreased by almost all the dogs.

Decrease in the rate of respiration recorded by us is in conformity with the findings of Fulton (3) and Kaada (4) who have described inhibition of respiration after frontal lobe involvement.

Anand and Dua (1) have recorded a rise in arterial pressure on stimulation of the frontal lobe. In this study a slight fall in blood pressure followed immediately by a rise was obtained in all animals. Fulton (3) and Kaada (4) reported both a fall and rise in blood pressure upon stimulation of orbital surface of frontal lobe. The initial respiratory and blood pressure changes appear to be due to an increase in intracranial tension but the delayed changes seem to be due to autonomic disturbances which may include vagal inhibition and sympathetic excitation.

REFERENCES


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