

COMPARATIVE DATA ON CHANGES IN HIGHER NERVOUS ACTIVITY IN DOGS WITH FALSE AND TRUE PREGNANCY

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Much work has been devoted to the question of false pregnancy. Changes in the sexual apparatus, mammary glands and even behavior in animals with false pregnancy resemble in many respects those associated with true pregnancy [1, 3-9]. As far as we know, no special investigation of higher nervous activity in false pregnancy had been carried out.

Comparison of unconditioned and conditioned reflexes during false and true pregnancy is essential for clarifying the mechanism of changes in nervous activity characteristic for this period. Changes which are caused by the action of ovarian hormones should be present in both cases; however, those changes which are caused by stimulation of sexual organ receptors by the developing fetus and placental influences should be absent in cases of false pregnancy.

Dogs form a suitable object for such observations. The duration of false pregnancy in dogs is similar to that of true pregnancy, viz. 63-65 days. The corpus luteum develops and functions during 30-35 days and then undergoes involution.

EXPERIMENTAL METHODS

Experiments were carried out in the course of 3 years, using classical Pavlovian technique; 4 dogs with different types of higher nervous activity were used. All the experimental animals were young and had not had any pregnancies. "Pushka" exemplified the well-balanced type of nervous activity. Of the other dogs one was as nervously strong as Pushka, the remaining two were weaker.

Two and 3 true pregnancies were traced in each dog, and in the case of Pushka a false pregnancy was studied first, then 3 true pregnancies.

The following stereotyped pattern of conditioned stimuli was used in the experiments: bubbling noise, light, metronome with a rate of 120 strokes per minute (M_{120}), metronome with rate of 60 strokes per minute (M_{60} — differentiation), metronome with rate of 120 strokes per minute (M_{120}) and bell. Duration of isolated action of conditioned stimuli was 20 seconds, followed by reinforcement with meat-biscuit powder, with the exception of M_{60} . The dogs' behavior and their reaction to the conditioned stimuli and to food were recorded (motor-food reactions I and II).

EXPERIMENTAL RESULTS

On March 5, 1953, Pushka was covered, but no pregnancy ensued. At the same time, on the 4th day

after this (as in true pregnancy) swelling of the mammary glands was noted, and on the 60-61 day appearance of colostrum was observed. Puska's behavior underwent a change with the onset of false pregnancy which was similar to change observed both in her and in other dogs during true pregnancy. During two and half weeks Pushka was restless in the course of experiments and made attempts to lie down. Isolated conditioned stimuli induced yawning. She did not refuse food.

During the next three weeks the dog was sluggish, lying down most of the time, barely lifted its head in response to conditioned stimuli, rose slowly when given a bowl with meat-biscuit powder and began eating. After the meal she again lay down. At this time she sometimes refused food. Such manifestations were more marked during true pregnancy, particularly refusal of food.

Beginning from the 6th week of false pregnancy Pushka became lively, reacted quickly to conditioned stimuli, took her food at once and only on the day of supposed confinement (64th-65th day) was a little sluggish.

At the onset of false pregnancy the unconditioned salivary secretion began to diminish gradually (Fig. 1), reaching a minimum on the 25th day of false pregnancy (115 divisions on the scale). Prior to false pregnancy the unconditioned salivation amounted to an average of 202 divisions on the scale.

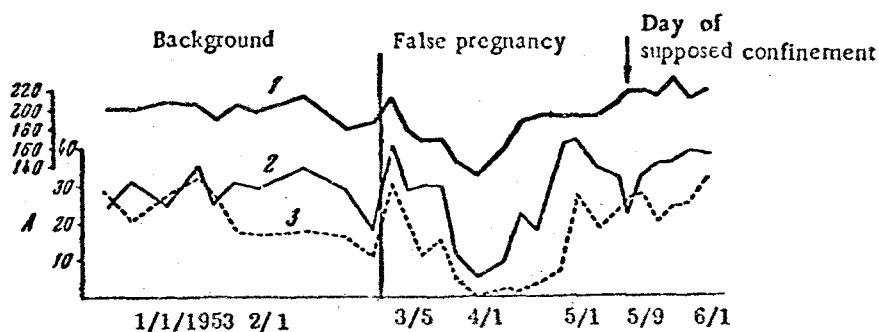


Fig. 1. Changes in magnitude of unconditioned and conditioned reflexes in false pregnancy. Records: 1) magnitude of unconditioned reflexes; 2) magnitude of conditioned reflex to bubbling noise; 3) magnitude of conditioned reflex to a bell.

After the 25th day of false pregnancy the unconditioned salivation began to increase gradually and by the 33rd day had already reached the initial level.

During true pregnancy the magnitude of unconditioned reflexes either remained at the previous level or tended to increase to some extent (Fig. 2).

The increase of unconditioned reflex salivation during pregnancy was even more pronounced in the other dogs. The course of unconditioned salivation prior to pregnancy was always regular, i.e., the maximal secretion of saliva occurred during the first 30 seconds from the beginning of the meal; there was a decrease in salivation by the end of the 1st minute; with the onset of true pregnancy, however, although the magnitude of unconditioned reflexes remained practically at the previous level, the course of unconditioned salivation showed a distinct change. There was a decrease in secretion during the first 30 seconds of feeding and an increase during the following 30 seconds (Fig. 3). These changes were maintained not only up to the time of confinement but were also observed at the beginning of the period following parturition.

A different picture was observed in false pregnancy. Despite the decrease in the magnitude of unconditioned reflexes the course of unconditioned salivation was altered only very slightly and transiently. Such changes were only observed on the 20th-34th day of false pregnancy (Fig. 3).

Changes in conditioned reflexes during false and true pregnancy had both common features and certain differences. Similarities consisted of diminution of conditioned reflexes towards the first half of both true and false pregnancy. For example, the conditioned reflex to a bubbling noise decreased during false pregnancy

from 29 divisions of the scale to 8, reflex to light from 17 divisions to 2. During true pregnancy the conditioned reflex to a bubbling noise diminished from 35 divisions of the scale to 8 and the reflex to light from 26 to 2. Decreases in other conditioned reflexes were likewise quite definite.

The difference in the dynamics of conditioned reflexes consisted of the fact that in false pregnancy restoration was fairly rapid and beginning with the 40th-45th day the level of all conditioned reflexes did not differ from the initial.

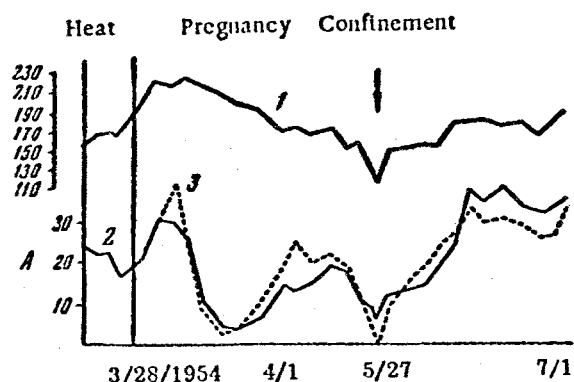


Fig. 2. Change in the magnitude of unconditioned and conditioned reflexes in true pregnancy. Records the same as in Fig. 1.

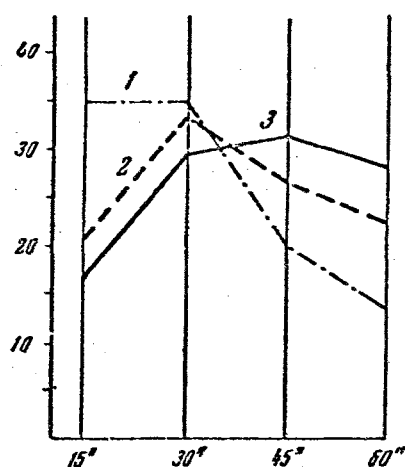


Fig. 3. Change in unconditioned secretion every 15 sec of the 1st minute in a nonpregnant animal (1), during false pregnancy (2) and during true pregnancy (3).

to the cortical part of the analyzers but also to the cortical representation of the unconditioned food reflex. In true pregnancy the change in the course of unconditioned salivation proved to be more profound, which suggests that inhibition of the cerebral cortex was more extensive.

The causes underlying cerebral cortex inhibition may possibly depend on the state of sexual excitation and hormonal influences preceding pregnancy; moreover, in true pregnancy the developing fetus must play an important role.

In true pregnancy, however, conditioned reflexes increased very slightly and did not reach the initial level during the second half. Restoration of conditioned reflexes only occurred after parturition.

Investigation of the changes in higher nervous activity during false and true pregnancy brings out 3 points requiring discussion: first, preservation of the previous level of unconditioned salivation (or even its increase) during true pregnancy and its marked decrease during false pregnancy; secondly, comparable decrease of the magnitude of conditioned reflexes in the first half of false and true pregnancy and thirdly, rapid restoration of conditioned reflexes towards the end of false pregnancy and maintenance of a low level of such reflexes in true pregnancy.

According to data available in the literature [2], the increase of unconditioned secretion during pregnancy is explained by the influence of the corpus luteum hormone on the central nervous system. Our data indicate that this phenomenon cannot be explained by the influence of the corpus luteum hormone alone; the corpus luteum develops and functions both during true and false pregnancy, yet in the latter case the unconditioned reflexes not only did not increase but showed a clear diminution. Evidently, the corpus luteum is not the only factor responsible for the increase of unconditioned secretion in true pregnancy. Other factors, present in true but absent in false pregnancy, must apparently be involved. The stream of afferent impulses from the receptors of the sexual apparatus resulting from the developing fetus must be regarded as one of such factors.

Diminution of conditioned reflexes during the first half of false and true pregnancy suggests some common cause responsible for the phenomenon. Such marked decrease in the magnitude of all conditioned reflexes characterizes a state of inhibition developing in the cerebral cortex. The course of unconditioned salivation which approaches the subcortical type at this time indicates that the inhibition spreads not only

During the second half of pregnancy when the secretion of the corpus luteum hormone diminishes and the fetus grows considerably with consequent increase in afferent stream of impulses from the uterine receptors, distinct differences in the dynamics of conditioned reflexes begin to be apparent in false and true pregnancy.

Furthermore, in true pregnancy, the hormonal influences of the corpus luteum are supplemented by the action of placental hormones. Apparently as the result of these influences the conditioned reflexes remain lowered during the second half of true pregnancy; they return to the initial level only after parturition.

In false pregnancy the whole complex of stimuli associated with the developing fetus and the action of placental hormones is absent and the conditioned reflexes return rapidly to the original level.

SUMMARY

Development of inhibition in the cerebral cortex was noted during the first half of both true and false pregnancies. This is explained by production of lutein by the ovaries. In true pregnancy this inhibition may be enhanced by the afferent impulses coming from the receptors of the uterus when these receptors are stimulated by the developing fetus. It was demonstrated that placental hormones may affect the condition of the higher nervous activity during the second half of pregnancy.

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