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EFFECT OF NATURAL AND DRUG-INDUCED SLEEP ON GASTRIC SECRETION IN DOGS

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Drug-induced sleep has been widely applied in therapeutics over the past few years, in particular in the treatment of gastric ulcer. It is known that the disturbances in gastric secretion encountered in ulcerative disease play a certain part in its pathogenesis and in its recurrence. Clinical data on the effect of drug-induced sleep on gastric secretion in ulcer patients are very contradictory, owing to the differences between the test methods used, and because of the use of diverse hypnotics, with different modes of action.

Not enough work has been done on the theoretical basis of the indications or counter-indications for the application of drug-induced sleep to the treatment of functional disturbances of the gastrointestinal tract.

The object of our research was to investigate the effects of natural and drug-induced sleep on the secretory activities of the gastric glands.

EXPERIMENTAL METHODS

The hypnotics used were Barbamyl and chloral hydrate. The research was conducted under the conditions of extensive experiments. The experiments were performed on 10 dogs with Pavlov and Klemensievich-Heidenhain gastric pouches, and with gastroesophagotomies. Barbamyl was introduced rectally at a dosage of 0.04 g per kg body weight, and chloral hydrate at a dosage level of 0.3-0.4 g per kg body weight. In view of the intense local irritation caused by chloral hydrate solution we dissolved it in starch solution. At the given dosage levels, Barbamyl induced sleep lasted for 7-8 hours, and chloral hydrate sleep for 3-4 hours. Immediately after administration of the hypnotic, and before it had had time to act, the dogs were given a carefully measured amount of gastric stimulant (hematogen, raw meat, rye bread).

The experiments involving the use of hypnotics were preceded by experiments designed to determine the normal secretory response of the gastric glands to the stimulants, in wakefulness and in natural sleep. The latter experiments were performed at night, after gastric stimulation in a darkened room, as near as possible soundproof.

* In Russian.

We recorded changes in the amount of secretion, and in its free HCl content and total acidity, as well as in its digestive power (according to Metta). We investigated the effects of both single and multiple doses of hypnotic (intermittent sleep over 5 days), in order to elucidate the action and the after-effects of prolonged drug-induced sleep. During the experiments the dogs were accommodated in specially constructed cradles.

EXPERIMENTAL RESULTS

A considerable diminution in the flow of gastric juice was observed during the first few hours of natural sleep (Figure 1) in dogs provided with a Pavlov gastric pouch, and also with sham feeding. Natural sleep caused no perceptible alterations in the flow of gastric juice in dogs with a Heidenhain pouch. It may be concluded that natural sleep depresses gastric secretion in its complex reflex phase, but has no perceptible effect in its neurochemical phase.

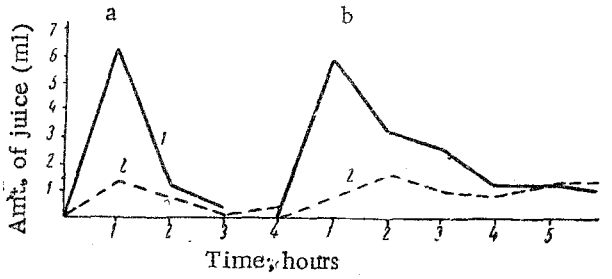

Fig. 1. Gastric secretion of dogs with a Pavlov pouch during wakefulness and during natural sleep. a) Stimulus: 100 g of rye bread; b) stimulus: 200 g of raw meat; 1) when awake; 2) during sleep.

Administration of Barbamyl caused a considerable reduction in gastric secretion during the first hours of sleep, both in dogs with a Pavlov pouch, and after sham feeding of gastroesophagotomized dogs (Figure 2).

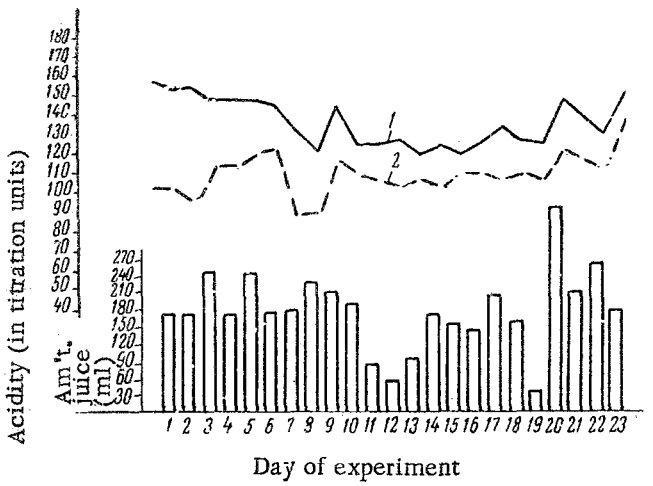

Fig. 2. Gastric secretion in a gastroesophagotomized dog after sham feeding during natural and drug-induced sleep. 1) 10th, 13-18th, and 20th-23rd day: secretion after sham feeding during wakefulness; 11th day: the same during natural sleep; 12th and 19th day: during drug-induced sleep; 1) total acidity; 2) free HCl.

We found certain after-effects of intermittent sleep lasting for 5 days, caused by administration of single daily doses of Barbamyl to dogs with a Pavlov gastric pouch; the amount of gastric juice collected fell during 20-25 days, in the first phase of secretion. In certain cases we found that Barbamyl induced sleep was associated with a fall in the acidity and digestive power of the gastric juice; these variations appear to be connected with differences in the depth of drug-induced sleep in different experiments. No particular changes were seen in the amount of juice secreted by dogs with a Heidenhain pouch, but a prolongation of secretion time was found in all cases. The time taken to secrete a given amount of gastric juice in response to a measured dose of hematogen rose from the normal value of 2 hours to 3 hours during sleep.

Our experiments showed a considerable fall in secretion extending over the entire duration of sleep induced by chloral hydrate in Pavlov pouch dogs, i. e., there is a depression of both the complex reflex and the neurochemical phases.

Administration of chloral hydrate was followed by diminution of secretion of gastric juice in both Pavlov and Heidenhain pouch dogs, as well as in response to sham feeding of gastroesophagotomized dogs.

In general, the higher the dose of chloral hydrate given, the greater was the subsequent fall in gastric secretion; this fall was associated with a steep fall in the acidity of the juice (Figure 3).

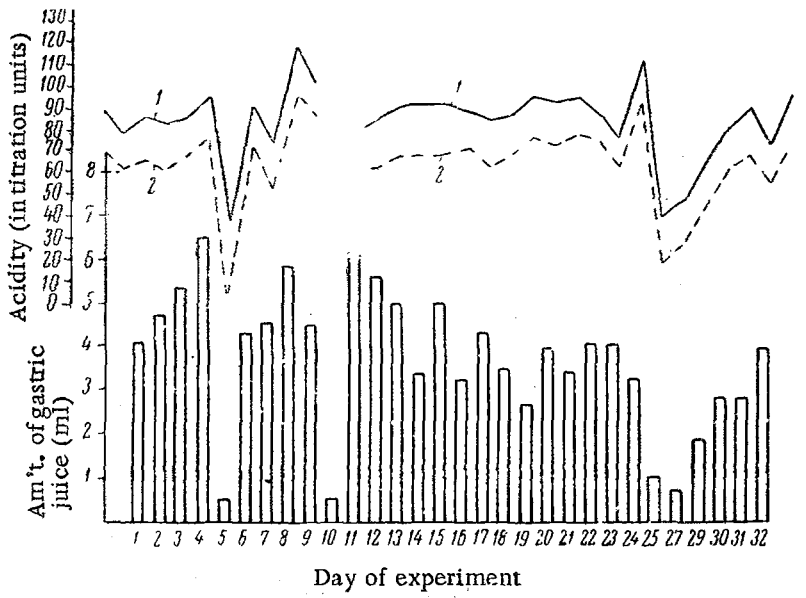

Fig. 3. Gastric secretion during drug-induced sleep, in dogs with a Heidenhain pouch. 1st-4th, 6-9th, 11-24th, and 30th to 32nd days: secretion during wakefulness; 5th, 10th, and 25-29th days: secretion during drug-induced sleep. 1) total acidity, 2) free HCl.

Diminished flow of gastric juice persisted for 20-25th days after 5 days of intermittent sleep induced in Heidenhain pouch dogs by single daily doses of chloral hydrate (Figure 3).

We may thus conclude that the alterations in gastric secretion under the influence of chloral hydrate are the result of a complex combination of its effect on the central nervous system and on the peripheral neuroglandular apparatus of the stomach.

Our results indicate that the amount of gastric juice secreted in the complex reflex phase falls during both natural sleep and during sleep induced by Barbamyl or chloral hydrate. Each of these hypnotics, however, exerts its own specific effect: Barbamyl causes a certain prolongation of secretion time; chloral hydrate causes a considerable fall in the amount secreted by a Heidenhain pouch dog. Barbamyl exerts an after-efect—a diminution in the amount of gastric juice produced in the complex reflex phase of secretion; chloral hydrate shows this effect in Heidenhain pouch dogs.

The results presented above may be of significance in establishing indications or counter-indications for applying drug-induced sleep therapy, in particular with reference to a hyposecretory state of the stomach.