

EFFECT ON DEPTH OF ANESTHESIA ON SERUM ELECTROLYTE LEVELS IN DOGS

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The object of this research was to study the composition of the blood electrolytes in dogs at different levels of anesthesia.

EXPERIMENTAL METHOD

Experiments were carried out on 10 mongrel dogs of both sexes, weighing from 15 to 20 kg. The dogs of the first group (5 animals) were anesthetized with thiopental and ether, and those of the second group (5) with thiopental and nitrous oxide. No premedication was given to exclude its influence on the experimental results.

One of the femoral veins was isolated in all the dogs. A wide-bore needle was introduced into its peripheral end and used for taking blood samples by withdrawal of the stilet, while another needle introduced into its central end was used for the injections of thiopental.

Intravenous anesthesia was induced by means of a 2.5% solution of thiopental sodium. The animals were intubated without the use of muscle relaxants. The "Krasnogvardeets" type of anesthetic machine was used. In the course of anesthesia, to exclude the effect of hypercapnia on the experimental results, the animals were transferred to artificial respiration. The depth of anesthesia was determined by the electroencephalogram (EEG) and clinical signs.

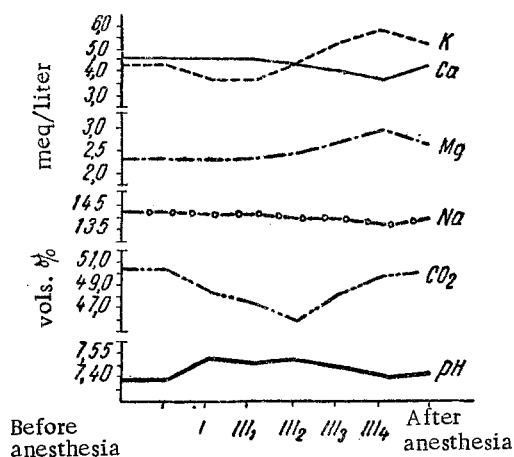


Fig. 1. Mean concentrations of electrolytes (Na^+ , K^+ , Ca^{++} , Mg^{++}), pH and blood CO_2 levels at different levels of anesthesia in the dogs of the first group (anesthetized with thiopental and ether).

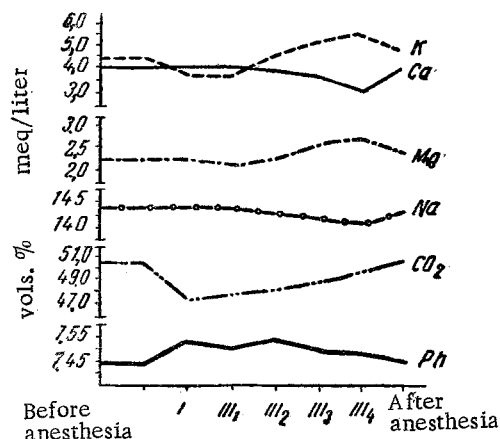


Fig. 2. Mean concentrations of electrolytes (Na^+ , K^+ , Ca^{++} , Mg^{++}), pH and blood CO_2 levels at different levels of anesthesia in the dogs of the second group (anesthetized with thiopental and nitrous oxide).

The following clinical levels of anesthesia were studied: analgesia, III₁, III₂, III₃, and III₄. Blood samples for determination of the serum electrolytes were taken before intravenous anesthesia and at each of the above-mentioned levels of anesthesia.

The level of anesthesia was deepened in each animal from analgesia to III₄. The duration of each level of anesthesia was approximately 15 min.

EXPERIMENTAL RESULTS

It will be clear from Fig. 1 that in analgesia and at level III₁ of anesthesia the potassium concentration in the first group of animals fell while the concentrations of magnesium, calcium, and sodium were unchanged. At level III₂ the potassium concentration showed a slight tendency to rise. The magnesium concentration rose very slightly and the calcium and sodium fell slightly. At level III₃ the mean potassium level fell by 12.7% and the sodium by 2.7%. At level III₄ the potassium concentration rose on the average by 33.3% and the magnesium by 25%. The mean calcium concentration fell by 21.2% and the sodium by 4.8%.

The pH and CO₂ concentration of the blood moved towards slight respiratory alkalosis.

In the experiments in which the dogs survived after termination of the anesthesia, the electrolyte levels returned to near normal.

In the animals of the second group a 2.5% thiopental sodium solution was injected intravenously in a larger dose than in the first group, for it is difficult to maintain anesthesia in dogs with nitrous oxide. To deepen the anesthesia small additional doses of thiopental sodium were therefore given periodically. The gases were administered in a proportion of 1 : 3 – oxygen at a rate of 2 liters/min and N₂O at a rate of 6 liters/min.

It is clear from Fig. 2 that in analgesia and at level III₁ of anesthesia the potassium concentration fell. The concentrations of calcium, magnesium, and sodium remained unchanged. At level III₂ the potassium concentration had a tendency to rise; the calcium and sodium levels fell slightly and the magnesium showed a moderate increase. At level III₃ the mean potassium concentration rose by 19.5% and the magnesium by 13%. The calcium concentration fell on the average by 11.3% and the sodium by 2.7%. At level III₄ the changes in the electrolyte concentrations were much more marked: the potassium concentration rose on the average by 28.2% and the magnesium by 21.7%. The mean calcium concentration fell by 25% and the sodium by 4.1%.

As in the preceding series of experiments the changes in the pH and carbon dioxide concentration reflected a slight respiratory and metabolic alkalosis.

SUMMARY

Experiments were staged on 10 dogs under thiopental-ether and thiopental-nitrous oxide anesthesia at various depths without relaxants. Electrolytes K, Na, Ca, Mg, H and CO₂ were investigated.

It appeared that the least changes in the electrolyte level occurred in analgesia and at III₁, and the greatest – at III₃ and III₄. The largest change affected the K-ions, the least – Na. No considerable changes were observed in the pH and CO₂ levels. Electrolyte shifts depended mainly on the depth of anesthesia, but not on the type of anesthetic agent used.