ABSORPTION OF METHIONINE FROM THE GALL BLADDER IN VIVO AND IN VITRO

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The study of absorption of the components of bile from the gall bladder is important for estimating the role of this process in the circulation of the components of bile and also in the pathogenesis of cholelithiasis.

In earlier chronic experiments on dogs with a fistula of the gall bladder the authors demonstrated the role of the bile-forming function of the liver in methionine metabolism in vivo. When methionine-S^{35} is introduced into the digestive tract, it is intensively excreted with the bile, at first in the free form, and later incorporated into the sulfur-containing compounds of the bile. When pathological changes are present in the liver, the excretion of methionine with the bile and the rate of its incorporation into the bile proteins are depressed [2, 3].

In acute experiments on dogs with radioactive sodium phosphate (P^{32}) the authors showed that over a period of 5 h up to 80% of the phosphate introduced into the gall bladder is absorbed from it. These experiments show, in addition, the importance of the parasympathetic nervous system and the receptor apparatus of the mucous membrane of the gall bladder in the absorption process [1].

In the present investigation the authors studied the physiological importance of the gall bladder as a reservoir storing bile when not taking part in digestion, and also its role in the metabolism of amino acids in the body, entering the gall bladder with the hepatic bile.

EXPERIMENTAL METHOD

Acute experiments were carried out on dogs weighing 15-20 kg and anesthetized with morphine, ether, and chloroform. After ligation of the cystic duct, bile was withdrawn through a needle into a syringe, and without removing the needle, methionine-S^{35}, in a volume of 1-2 ml and a dose of 50-100 pulses/min/g body weight, was injected into the gall bladder with another syringe. The place where the gall bladder was punctured by the needle was then crushed with Pean's forceps. All precautions were taken to avoid contamination of the outer wall of the gall bladder and the surrounding tissues with the radioactive solution. Samples of blood were taken from the femoral vein 15, 30, 60, 90, 120, 180, 240, and 300 min after injection of methionine-S^{35}. After the end of the acute experiment the gall bladder was extracted and washed with water. The residual activity was determined in the washings of the gall bladder and also of the syringe and needle used to inject the methionine. The activity of the blood serum was measured in pulses/min/ml. This activity was multiplied by $^1/_{20}$ of the body weight of the animal in grams, taking this value conventionally as the weight of the total quantity of blood serum in the particular animal (no correction was made for the specific gravity of the blood serum). The quantity of methionine absorbed, determined from the total radioactivity of the blood serum, was expressed as a percentage of the total radioactivity of the methionine-S^{35} injected into the gall bladder.

In this way the dynamics of absorption of methionine-S^{35} and the gall bladder could be studied.

The absorption of methionine-S^{35} from the gall bladder was also studied in experiments in vitro. A dog after one of the acute experiments was used for this purpose. The gall bladder was extracted from the animals immediately after death, washed free from bile, suspended on a ligature, and immersed in physiological saline at 38°. Methionine-S^{35} was injected into the gall bladder. Samples were taken from the dialyzate every 30-60 min for determination of the radioactivity. The experiment lasted for 6 h. At the end of the experiment the residual activity in the gall bladder was measured. From the figures for the quantity of methione-S^{35} injected and the quantity remaining in the gall bladder, the percentage of methionine leaving the gall bladder throughout the period of the experiment was calculated.

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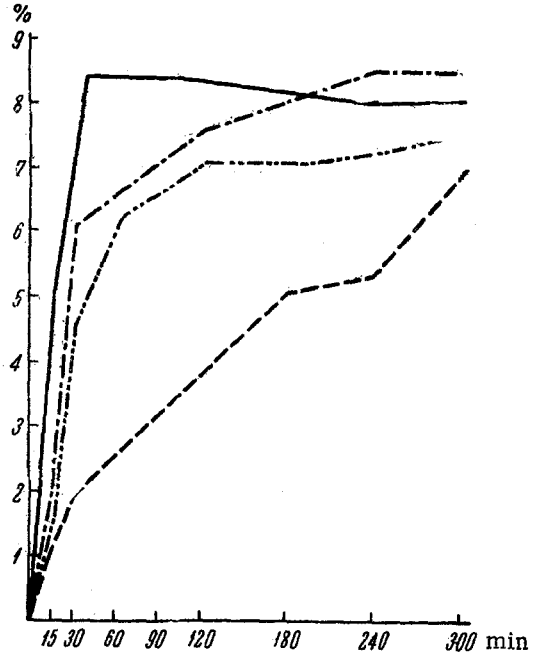

Radioactivity of the blood serum expressed of the total radioactivity of the methionine-S^{35} injected into the gall bladder (results of four experiments).

EXPERIMENTAL RESULTS

The experiments in vivo showed that the absorption of methionine-S^{35} from the gall bladder takes place quickly. Radioactivity was discovered in the blood samples taken 10-15 min after injection of the labeled amino acid into the gall bladder. Subsequently, the radioactivity of the blood increased, reaching a maximum 120-180 min after the injection of methionine-S^{35}. The amount of methionine-S^{35} absorbed from the gall bladder during the experiment lasting 6 h was 74-80% of the amount injected. The results of the investigation of the dynamics of absorption of methionine-S^{35} during a period of 5 h in four different experiments are shown in the figure.

The experiments in vitro showed that dialysis of methionine-S^{35} from the gall bladder also takes place rapidly. Radioactivity was found in the dialyzate during the first 5-10 min after injection of methionine-S^{35} into the gall bladder. Subsequently, the radioactivity of the dialyzate increased. Altogether, during the period of 6 h, 45.2% of the methionine-S^{35} was removed from the gall bladder by dialysis.

The results described show that intensive absorption of methionine-S^{35} takes place in the gall bladder. There is reason to suppose that if free amino acids are present in the hepatic bile, when this bile is stored in the gall bladder the amino acids may be absorbed and enter the blood stream. The possible significance of this process in the pathogenesis of cholelithiasis will be the subject of a future investigation.

LITERATURE CITED

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