

ON THE EXCRETION OF STRONTIUM-90 FROM THE BLOOD STREAM INTO THE GASTROINTESTINAL TRACT IN RATS

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The question of the amount of resorption and site of assimilation of radioactive strontium from the intestines has been the subject of many studies. As for the site and magnitude of the excretion of this element into the gastrointestinal tract, we have encountered no experimental investigations on this topic, other than the work of D. I. Bel'chenko [1].

The purpose of this investigation was to determine the level of excretion of strontium-90 in various organs of the rat gastrointestinal tract in the case of intravenous administration of the isotope.

EXPERIMENTAL METHOD

The work was conducted on 48 white rats, divided into three groups. Among the animals of the first group, the level of excretion was determined under normal conditions, while among the rats of the second and third groups, laparotomy was performed before the poisoning, and an artificial impermeability was created between different portions of the digestive tract by the application of ligatures.

After definite periods of time, the rats were killed and the activity of the isotope was determined in samples that were prepared from whole portions of the gastrointestinal tract, taken together with their contents, according to the method of I. I. Denisov et al. [2].

The activity was expressed in percent of the amount of strontium-90 administered. From three to six rats were investigated at each period.

RESULTS

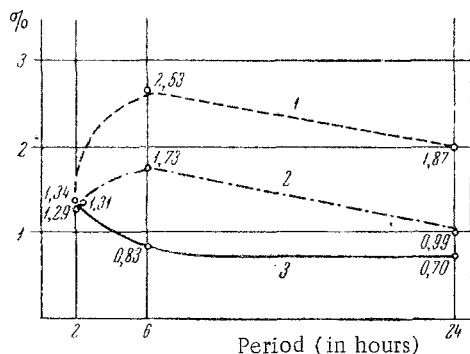


Fig. 1. Strontium-90 content (in % of amount introduced) in various portions of the gastrointestinal tracts of rats after the creation of artificial impermeability (second experiment): 1) stomach; 2) small intestine; 3) large intestine.

In the rats of the first group, the maximum content of the isotope in the stomach (0.33%), detected during the early periods after administration (1-2 h), gradually decreases to 0.11% by the end of the first day. In the small intestine, the level of strontium-90 is a maximum after two to six hours (2.74%) and decreases to 0.49% after 24 h, while in the large intestine it increases from 0.64% an hour after administration to 3.43% after 24 h. The question arises of what may be the cause of the high strontium-90 content in the small intestine: increased excretion or transfer of the isotope from the higher-lying divisions of the gastrointestinal tract. An additional experiment was conducted with a second group of rats, upon which laparotomy was performed and four ligatures were applied — between the stomach and the small intestine, at the boundary of the jejunum and ileum, between the small intestine and the caecum, and also between the caecum and the colon.

After the creation of artificial impermeability, the nature of the accumulation of strontium-90 in the divisions of the gastrointestinal

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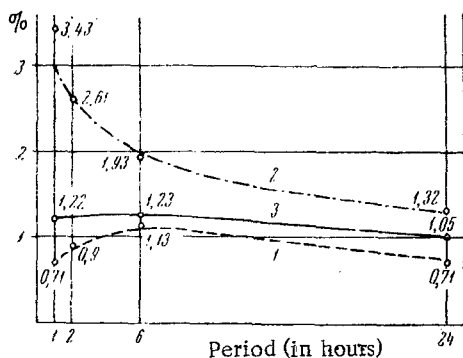


Fig. 2. Strontium-90 content (in % of amount introduced) in various portions of the gastrointestinal tracts of rats after the creation of artificial impermeability (second experiment): 1) stomach; 2) small intestine; 3) large intestine.

walls of the gastrointestinal tract, in the last experiment we determined the strontium-90 content in six rats at each period: in three rats portions of the gastrointestinal tract with contents were taken for preparation of the samples, while in three only the walls of the stomach and intestines, washed free of contents, were used. The experimental results are cited in the table.

The greatest excretion of strontium-90 was noted in the small intestine, especially during the early periods after administration of the isotope. It was excreted considerably less in the stomach.

In evaluating the results obtained, we must also consider the fact that strontium-90 is not only excreted into the lumen of the gastrointestinal tract, but is also assimilated from it. The process of assimilation occurs more intensively in the small intestine, which explains the decrease in the level of the isotope in this portion of the gastrointestinal tract by the end of the day.

Thus, in acute experiments on rats it was established that after a single intravenous injection of strontium-90, its most intensive excretion occurs in the small intestine during the first two to six hours after administration. Excretion of the isotope in the large intestine under these conditions is 1.5-3 times lower than in the small intestine, and in the stomach two to four times lower.

SUMMARY

The experiments were carried out on 49 albino rats subdivided into three groups: in rats of the first group excretion was determined under normal conditions, in rats of the second and third group laparotomy was carried out

Strontium-90 Content (in % of Amount Introduced) in Portions of the Gastrointestinal Tract at Various Periods after Intravenous Administration

Portion of gastrointestinal tract	After 1 h	After 2 h	After 6 h	After 24 h
Stomach				
with contents	0,71 ± 0,05	0,90 ± 0,03	1,13 ± 0,05	0,71 ± 0,05
without contents	0,13 ± 0,02	0,44 ± 0,01	0,22 ± 0,40	0,23 ± 0,08
amount of excretion	0,58 ± 0,03	0,46 ± 0,02	0,91 ± 0,01	0,48 ± 0,03
Small intestine				
with contents	3,43 ± 0,17	2,61 ± 0,61	1,93 ± 0,18	1,32 ± 0,36
without contents	0,60 ± 0,16	0,85 ± 0,12	0,63 ± 0,08	0,33 ± 0,08
amount of excretion	2,83 ± 0,01	1,76 ± 0,49	1,30 ± 0,10	0,99 ± 0,24
Large intestine				
with contents	1,22 ± 0,12	1,58 ± 0,28	1,23 ± 0,32	1,05 ± 0,30
without contents	0,46 ± 0,17	0,69 ± 0,05	0,42 ± 0,15	0,38 ± 0,08
amount of excretion	0,76 ± 0,05	0,89 ± 0,23	0,81 ± 0,17	0,67 ± 0,02

before poisoning and ligatures were applied, without damaging the mesenteric vessels, to provide artificial obstruction between various portions of the digestive tract.

It was found that in the case of a single intravenous injection of strontium-90 to rats its most intensive excretion took place in the small intestine within two to six hours of injecting the isotope.

LITERATURE CITED

1. D. I. Bel'chenko, Byull. Éksper. Biol., No. 8 (1963), p. 68.
2. K. M. Bogdanov, I. I. Denisov et al., Byull. Radiats. Med., No. 1 (1960), p. 96.

All abbreviations of periodicals in the above bibliography are letter-by-letter transliterations of the abbreviations as given in the original Russian journal. *Some or all of this periodical literature may well be available in English translation.* A complete list of the cover-to-cover English translations appears at the back of the first issue of this year.
