

## METHODS

### INVESTIGATION OF THE FRAGILITY OF THE VESSEL WALLS IN IRRADIATED DOGS BY A MODIFIED CUP TEST

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In studying the pathogenesis of the hemorrhagic syndrome in radiation sickness, investigation of the state of the vessel walls in irradiated animals are of great importance. It is essential to develop a sufficiently sensitive method of estimation of the fragility of the vascular wall (precapillary and capillary), since the accepted methods (Konchalovskii — Rumpel — Leede tournequet test, Nesterov's cup test, pinching method, etc.) are unsuitable for this purpose.

We have devised a modified cup test which enables the changes in the fragility of the vessels in irradiated dogs to be studied over a period of time.

The apparatus for measurement of the fragility of the vessels consists of an ordinary 5 ml syringe, to which is attached a short rubber tube, which in turn is connected to a small glass tube, constricted at one end (the edge of the opposite end of the tube is slightly thickened). The glass tube is connected to the rubber tube by its constricted end. So that the rubber tube does not slip off the tip of the syringe, a small blob of solder is fixed to the tip, and the rubber tube is firmly attached to the tip by strong thread or wire above the blob of solder.

The measurement of the fragility of the vessels is done by 2 persons. One everts the dog's lip and firmly applies the glass tube to the mucous membrane of the lip (Fig. 1). The other operator then moves back the plunger of the syringe from the 3 ml to the 5 ml division (in this position the plunger is fixed by the fingers) and switches on a seconds counter. After a certain time the glass tube is removed and the place to which it was applied is carefully examined in order to see whether hemorrhages develop there. The hemorrhages look like tiny red pin-points.

If hemorrhages are present the cup test is performed on a neighboring area of mucous membrane for a shorter time. The measurements are repeated until the shortest time necessary for the development of hemorrhages in the mucous membrane at the point of application of the glass tube is found.

If after the first application of the tube no hemorrhages appear, the time for application of the glass tube to the mucous membrane is gradually lengthened until hemorrhages are found in the mucous membrane.

For reasons of economy of time, it is more convenient to do the cup test at the following "standard" time intervals: 1, 2, 3, 4, 5, 10, 15, 30, 45, 60, 90, and 120 seconds. If the cup test result is still negative after 120 seconds, no further measurements should be made and the value given as "over 120 sec".

The shortest interval of time in the course of which hemorrhages appear at the point of application of the glass tube to the mucous membrane (with a standard degree of rarefaction of air in the tube system) gives the value of the cup test.

In healthy dogs the value of the cup test is usually from 5 to 90 seconds.

In the experimental animals the investigations of the cup test were carried out during a period of 3-10 days before irradiation, and then every day after irradiation. The dogs were subjected to total  $\gamma$ -irradiation from a cobalt source ( $\text{Co}^{60}$ ),



Fig. 1. Investigation of the fragility of the capillaries in a dog by the modified cup method.

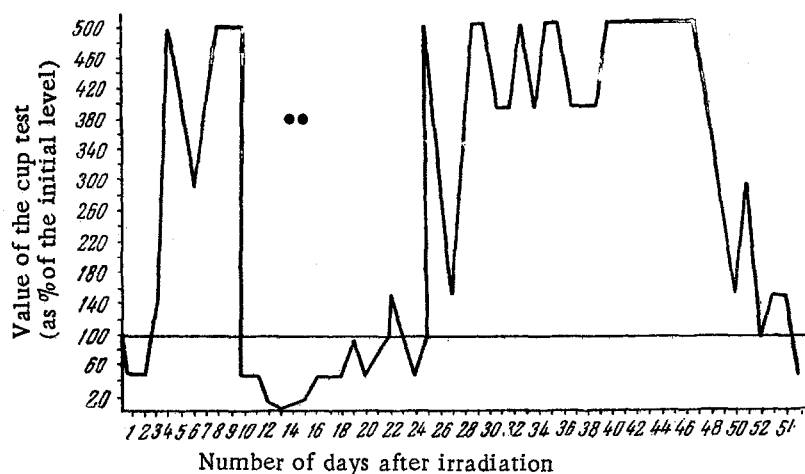


Fig. 2. Changes in the cup test in a dog irradiated with a dose of 200 r. The values of the cup test which exceed 120 seconds are conventionally taken as 500%. The dots indicate the presence of hemorrhages in the skin or mucous membranes on the corresponding days.

with air doses of 100, 200, 300, 400, 500, 600, 700, 1000 and 5226 r. The conditions of irradiation in all cases were the same, apart from the exposure.

Depending on the dose, the exposure varied from 13 minutes 33 seconds (100 r) to 12 hours 9 minutes 12 seconds (5226 r).

The results of the investigation of the cup test in irradiated animals are shown in Figs. 2 and 3.

The distinctive reaction of the vessel wall of the irradiated animals should be noted. The resistance of the vessel wall in the first few days after irradiation increases irrespective of the dose of irradiation (within the limits of the test doses). The increase in the resistance usually reaches its maximum on the fourth day after irradiation. The appearance of hemorrhages is preceded by a fall in the value of the cup test far below its initial level.

It is interesting to note the presence of the following tendency: the higher the dose of irradiation, the shorter the period of increased resistance of the vascular wall.

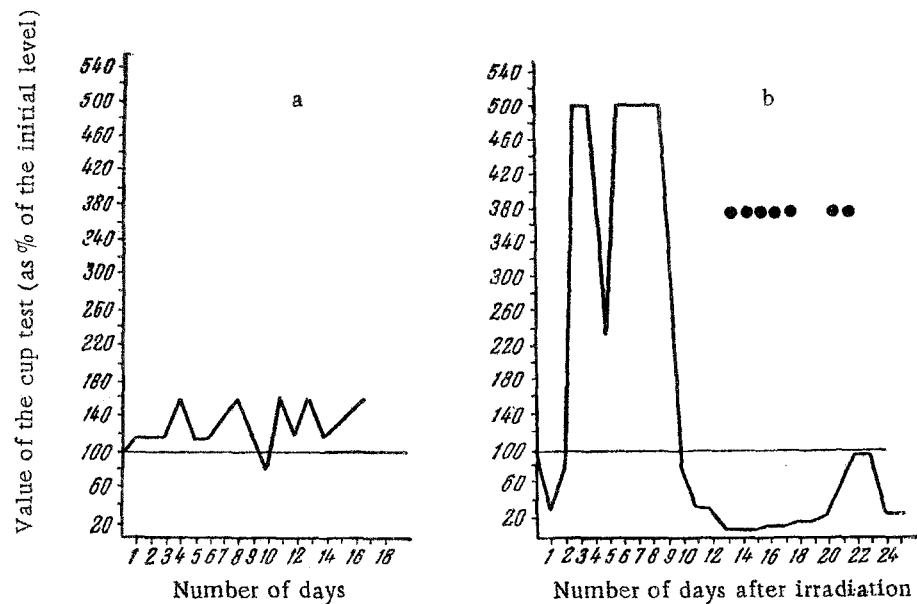


Fig. 3. Changes in the cup test in a dog irradiated with a dose of 300 r. a) Control ; b) irradiated dog. Remaining legend as in Fig. 2.

#### SUMMARY

A modified cup test is suggested for investigating the fragility of the vascular wall in dogs. The method permits a follow-up under dynamic conditions of the actual strength of the vascular wall in irradiated dogs, which is impossible with any other method of examination (the tourniquet method of Konchalovskii-Rumpel-Leede, Nesterov's cup test etc).

A technique of free skin grafting in small laboratory animals is depicted along irradiation, irrespective of the irradiation dose with its notable decrease in the period preceding hemorrhages.