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PROTECTION AGAINST IRRADIATION WHEN WORKING WITH RADIOACTIVE CAPSULES

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PROTECTION AGAINST IRRADIATION WHEN WORKING WITH RADIOACTIVE CAPSULES

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From the physical laboratory (Head -- Docent M. N. D'yachenko) of the Khar'kov Institute of Medical Radiology (Director -- Docent Ye. A. Bazlov).

The use of radioactive capsules of radium and cobalt in therapeutic practice requires the fulfillment of numerous preparatory operations, to a greater or lesser extent involving the irradiation of personnel. The most laborious and difficultly protectible, and consequently the most dangerous, are the preparations of vaginal and uterine applicators for administration to gynecological patients, as well as the treatment of these preparations after their removal with subsequent sorting, sterilization, and packing of the capsules in the containers.

At Khar'kov Institute of Medical Radiology a new method of carrying out these procedures has been worked out and special protective devices are used, which provide a diminution of the daily doses, received by the personnel, below the permissible limits.

The new method consists in the following:

1. Packing of the preparations is carried out according to two methods: initially, outside the sphere of action of the radiation, gauze cases for the preparations are prepared; then the radioactive capsules are introduced into them. This reduces the irradiation time of the personnel by many times in the presence of packing. The preparations are introduced into the cases, special protection being used.

2. The manual treatment of the applicators after their extraction is replaced by chemical dissolution of

the gauze cases in a special protective apparatus.

3. All the treatment operations of the capsules are carried out in a single protective table, a sterilizer. This excludes the necessity of separately rinsing, boiling, and sorting the capsules and of transferring them in unprotected form from place to place. All the indicated processes are carried out, without resetting the capsules.

The cases for the preparations are prepared from gauze or bandaging, winding two to three layers of them on a special model, the diameter of which is equal to the diameter of the radioactive preparation, with subsequent impregnation with thin tsapon-lak (a solution of washed off X-ray film in acetone).

Two to three minutes after impregnation, the tsapon-lak somewhat dires on top, so that it no longer adheres to the hands; then one end of the case is wrung out, in order to form a bottom; the half-finished article is rolled with a ruler on a smooth slab or glass and is removed from the model for final drying. The prepared case consists of elastic gauze tubes of the necessary dimensions with the aperture, closed at one side -- tubes a and b in Fig. 1.

In the presence of five to six models the preparation of a single tube by the production line method takes three to four minutes.

The prepared casing is placed in a socket of a lead cylinder with the open end upwards. At the projecting open end of the tube is placed, without any delay, a band of strong thread, to the ends of which a label is attached, and a special funnel is placed in the aperture of the tube (Fig. 2). All this is conducted in a protective table, on which the container with the radioactive preparations is placed.

The preparations are removed with a long forceps or manipulator from the container and are released through the funnel. Under these conditions, the preparation gets into the gauze casing, which is drawn out and bound with thread with a label; the excess part of the end of the tube, into which the funnel is inserted, is cut off with scissors, and the package is ready. The preparation is removed by the thread with the label from the depression of the lead cylinder, placed in a container, and given over for sterilization.

The treatment of the preparation after its removal from the patient is carried out in a special working place (Fig. 3). In it is located: a protective apparatus for the chemical unpacking of the applicators, a protective table

(sterilizer) and two protective screens, one of them with a deflector consisting of a set of leaded glasses.

The protective apparatus for the chemical unpacking of the applicators is shown in Fig. 4. It consists of a lead container, containing a flask with acetone, 200 ml in capacity. A glass test tube with a perforated bottom is immersed through the opening in the cover into the acetone. The applicator is released into the test tube of the container, using forceps or a manipulator, and is left there for one to two minutes. During this time the tsapon-lak is dissolved in the acetone, and the preparations, freed from the gauze, settle at the bottom of the test tube, while the gauze rags are removed from the test tube by the thread with the label. The test tube with the capsules are extracted from the container with the aid of a manipulator and are immersed in the cuvette of the protective table (sterilizer).

The protective table (sterilizer) is shown in Fig. 5. In it the capsules are sorted, the sterilization is conducted with a solution, and they are rinsed and boiled.

There are five apertures in the cuvette of the table -- a socket, in which the capsules are distributed and whence they are cast off into the corresponding sockets of the table. Within the table the capsules slide along an inclined plane under a massive lead cover, which turns the yield of irradiation upward through the socket.

The sliding drawer with five detachable reticular boxes, into which the capsules go, is filled with sterilizing solution. Upon the completion of the treatment of the preparations, the sterilizing solution is poured off through the outflow hose and the capsules are washed in running water.

Water under pressure is supplied from a faucet along a special hose into each socket of the table and flows out along the overflow hose. Then the overflow hose is turned off, the box is filled with water, and an electric circuit for boiling is turned on.

After boiling, the water is released through the overflow hose, the hot capsules are quickly dried, they are then unloaded from the reticular boxes of the sliding drawer into corresponding containers for deposit in a storage place.

All the operations, requiring the extraction of the capsules from the containers (sorting in the cuvette of the table, and after boiling, unloading from the table into containers), are conducted under the protection of the screen with the deflector shown in Fig. 3. Thus, the entire treatment of the capsules is conducted under reliable

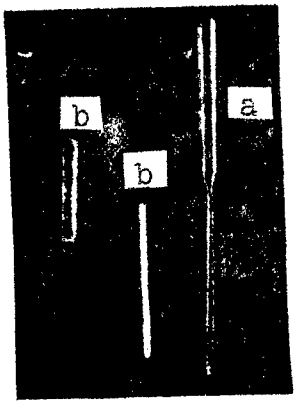

Fig. 1. Preparation of the cases

a -- mandrel;
b -- gauze tube.

Fig. 2. Preparation of the casings for the packing.

Fig. 3. Working place for unpacking and treating the capsules after unloading.

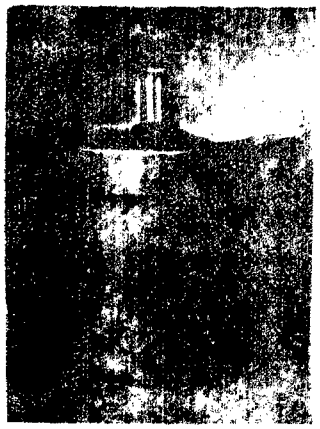

Fig. 4. Protective apparatus for the chemical unpacking of the applicators

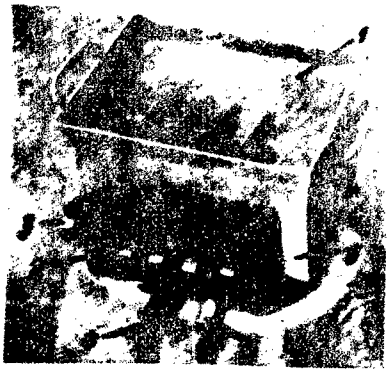

Fig. 5. Protective table (sterilizer)

1 -- cuvette for sorting the capsules; 2 -- sliding box; 3 -- removable reticular boxes; 4 -- overflow hose; 5 -- boiler; 6 -- lead protection.

protection.

The table is not protected on the side of the sliding drawer, and consequently it is positioned on the working place, as is shown in Fig. 3, i. e., it is turned with the sliding drawer away from the operator, toward the blank wall.

A screen with a deflector can also be used for the protection of the physician when administering preparations to patients.

The use of the described method of protection in the clinic of the institute has lowered the daily doses obtained by the manipulation room nurse from 0.1-0.2 to 0.02-0.3 r per day when administering preparations with a total activity of up to 400 mg-equiv. r to eight gynecological patients and removing the preparations from them.

The indicated doses are also basically created in the presence of other, still insufficiently protected operations, for example, in the presence of the sterilization of prepared packages, the administration of preparations to patients, etc.

Work is being conducted on the further perfection of the processes and on protection for the diminution of the exposure to radiation of the personnel.

The organization and coordination of work with radioactive preparations has great significance for the lowering of the total daily dose received by personnel. Everything possible should be done and prepared prior to bringing into the manipulation room a container with radioactive capsules.

The work with the capsules should be rapid, and without delays and errors. The paths of movement of the capsules from operation to operation should be as short as possible, thus ensuring the continuity of the alternation of operations.

The gynecological section of Khar'kov Institute of Medical Radiology, directed by Doctor of Medical Sciences S. I. Pavlenko, conducts the following measures for ensuring the indicated conditions.

1. The preparations are administered to the patients and extracted in a single manipulation room of sufficient cubic capacity, in which two working arm-chairs are equipped: one -- for administration, and the other -- for the removal of the preparations. This excludes the necessity of transferring the radioactive capsules from one room to the other.

2. The preparation and administration of the preparations to a single patient is carried out soon after their removal from other patients; a group of patients is chosen as close to these conditions as possible, so that all the removed preparations will be used anew. This excludes the necessity of depositing the radioactive preparations in the storage room and receiving them anew in the course of the week.

3. The arrangement of the equipment of the manipulation room provides the continuity of the sequence of operations and the shortest route of motion of the preparations under the protection of appropriate devices.

4. Alternation of the work of the personnel is established with replacement every three months. Before the beginning of work with radium, the manipulation room nurse passes through a preparatory course, and is trained in work with inactive capsules.

We consider it expedient to introduce our work experience into other clinics of the country.

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FOR REASONS OF SPEED AND ECONOMY

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