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EFFECT OF AN ULTRA HIGH FREQUENCY FIELD ON THE COURSE OF
EXPERIMENTAL ECHINOCOCCUS

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- USSR -

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[B]

change:

- A) structure
- B) growth

D.

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EFFECT OF AN ULTRA HIGH FREQUENCY FIELD ON THE COURSE OF
EXPERIMENTAL ECHINOCOCCUS

Following is a translation of an article by
A.M. Aleyev, V.R. Yelantseva and M. Dzhuma-
galiyev entitled "Vliyaniye Polya UVCh na
Techeniye Eksperimental'nogo Ekhinokokkoza"
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The problem of the biological effect of an UHF [Ultra High Frequency] field on living objects still remains unsolved at the present time. G.L. Frenkel thinks that the action of an UHF field is characterized only by its thermal effect. On the other hand, G.Ya. Saburov attaches great importance to its specific particular effect. L.R. Rubin and Ye.I. Pasynkov report that small animals exposed to UHF of sufficient strength perish; the specific effect of an UHF field when not causing death of the animal, leads to profound morphological changes. I.P. Barchenko arrives at the conclusion, based on his investigations, that the UHF field exerts a fatal effect on the eggs, larvae, and other stages of the development of helminthes.

We considered it of theoretical interest and practical importance to test the effect of an UHF field on the survival of echinococcus larvae outside and within the animal organism. In this connection, at our Chair of Biology, we carried out, as the first stage of work back in 1957-1958, a study of the echinococcus larvae survival under the effect of UHF. A portable apparatus for UHF-therapy (UHF-2m), of 250 watt strength, 220 volt voltage, was employed in our experiments. As material for our experiments, we used echinococcus cysts of the liver and lungs of small cattle, delivered from the Alma-Ata Meat-Combine the day of slaughter.

The fresh material was examined. Then, by means of a scalpel, cysts of identical size were freed from adjacent tissues, one of them (control) was incised and examined. The visibility of larvae was determined by means of staining with a weak solution of methylene blue. There are indications in the literature (Z.G. Vasil'kova, O.Ya. Miretskiy) that live eggs and larvae, as well as sexually mature forms of many helminths do not stain with a weak methylene blue solution, while dead ones stain well.

By means of an eye pipette we collected the echinococcus fluid from the bottom of the cyst, placed it on the slide and added a drop of methylene blue. Observation of staining was conducted under small magnification of the microscope within 20 minutes, an hour, and 24 hours. Live scolices did not stain with methylene blue and were clearly distinguished in the colored fluid, where they were swimming freely. We also distinguished live scolices by their slow, pendulum-like movements.

Echinococcus cysts, selected for the experiments were divided into four groups. The first group was placed in the UHF field for 15 minutes, the second -- for 20 minutes, the third -- for 40 minutes. The fourth group served as control. Irradiation was repeated three times. After each irradiation, one cyst was opened, its content stained with methylene blue and compared to the content of a cyst from the control group.

Upon opening the cysts, which had been exposed to UHF irradiation for 15 minutes, the scolices were not stained with methylene blue and did not differ in their appearance from controls after the 1st or 2nd or 3rd irradiation.

Scolices of the second group of cysts (20 minutes irradiation) also did not differ from controls; intense fluctuating movements of the scolices were observed.

Scolices of cysts which had been exposed to 40-minute irradiation were well stained with methylene blue. Their capsular membrane was destroyed, and the scolices swam freely in the fluid. Their wholeness of structure was impaired in the majority of cases; only the hooks remained within the field of vision.

These investigations enabled us to assume that a biological activity of the UHF field does take place in the case of helminths. The action of UHF field on echinococcus cysts outside the organism under a 20-minute exposure is accompanied by a stimulating effect which is attested by the fluctuating movements of the scolices. A 40-minute exposure kills them.

The next stage of our work took place in 1958-1959, when we investigated the survival of scolices within an intact live organism under the effect of an UHF field. In this

connection, it was essential to obtain an experimental echinococcus from the laboratory animals.

In the epidemiology of echinococcus, as is known, the possibility of invasion via respiratory passages is accepted (V.G. Potapov, T.F. Ganzhulevich). We obtained an experimental echinococcus from the lungs of rabbits by introducing via their nasal passages an echinococcus fluid containing scolices, as well as transpleurally, by introducing scolices with a syringe and needle through the thoracic wall and pleura, directly into the pulmonary tissue.

We obtained the material for infecting rabbits from the Alma-Ata Meat-Combine, on the day of slaughter, from the lungs of small cattle in the form of hydatid cysts. The cysts were opened under aseptic conditions. Echinococcus fluid, containing hydatid sand, was used for infecting the rabbit; a microscopic examination of the material revealed the presence of rhythmic scolex movements.

The echinococcus fluid with hydatid sand was collected in a test tube; the scolices settled at the bottom within a short period of time. The sedimentation fluid was poured off and by means of a syringe one ml of fluid was taken from the bottom of the test tube. A sound was attached to the syringe instead of the needle and was then introduced into the rabbits' trachea.

The transpleural method, developed at the Chair, consisted of the following. A rabbit was tied to an operating table, and its fur was shaved off. The echinococcus fluid, in the amount of one ml, with scolices was injected by means of a syringe and a No 9 needle under aseptic conditions into the thorax and pleural cavity, directly into the right lung, along the median axillary line in the 5th-6th intercostal space (at the upper edge of the underlying rib).

Prior thereto, the rabbits had been under strict observation for one month (temperature taken daily, general blood analysis, flat X-ray plate of the thorax and examination of feces).

A total of 12 rabbits was infected: seven of them -- by nasal introduction of scolices, five -- transpleurally. Following infection, the rabbits were under clinical observation (weight, body temperature, rate of respiration, etc.); after five days, the first control X-ray picture of the thorax was taken.

One rabbit perished after infection from accidental causes and four -- from pneumonia. In the survived rabbits the temperature first rose to 39-40°, respiration rate reached 140-150 per minute; there was a slight loss of weight; dry ronchi were elicited which changed to moist rales on the

3rd-4th day, also crepitation and spasmodic convulsions were observed. On the 15th-16th day, the temperature decreased, the appetite returned, respiration became normal, dry rales reappeared in the lungs. Toward the end of the 30-day period all acute symptoms disappeared.

The presence of echinococcus cysts in the lungs was established by means of X-ray (M.I. Nemenov, V.N. Shtern). Of the seven survived rabbits, following introduction of the hydatid sand, the characteristic darkening in the lungs was detected three months later in three animals. Within five months the echinococcus fluid was again injected into the other four rabbits. An X-ray of the thorax, taken in the fall of 1959, showed that the repeatedly infected rabbits had developed in the right lung at the level of 3rd-6th rib shadows of medium intensity of oval form with clearly defined borders.

Of the three rabbits infected during the first introduction of echinococci, two were exposed to the effect of an UHF field and one served as control. Rabbit No 1 was exposed to UHF for 20 minutes, daily for a period of 10 days; rabbit No 2 -- 40 minutes, daily for 10 days.

Within two months after UHF exposure rabbit No 1 perished. On the same day rabbits No 2 and 3 were slaughtered. At the autopsy, in the lungs of rabbit No 1 a cyst, five cm in diameter, was found as well as a large number of small cysts. In the lungs of the control rabbits (No 3) many small cysts together with some large ones were detected. In rabbit No 2, no large cysts were present in the lungs. The small cysts had flabby walls, collapsed in some instances, and often contained no fluid.

In the second group of rabbits, which had been infected twice, three animals were exposed to UHF and one left as control. One of the irradiated rabbits perished within three weeks of pneumonia. The rest were killed simultaneously within two months after irradiation. An autopsy of rabbit No 4 (20-minute irradiation) revealed that the lungs were full of echinococcus cysts of much larger size than in the control animal. In rabbit No 7 (40-minute irradiation), strophic echinococcus cysts were found in the lungs. During the life of this rabbit, at times expectoration of sputum containing scolax hooks was observed.

Thus, we can arrive at the conclusion that the effect of an UHF field on experimental echinococcosis of the lungs, under small exposures (20-minutes), is accompanied by worsening of the course of the disease and an accelerated formation of cysts. A 40-minute irradiation with UHF in our experiments led to a certain retardation of the development of echinococcus cyst and, even, destruction of the wholeness of

the hatch capsules and scolices within the echinococcus cyst and the discharge of scolex hooks with sputum.

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