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APPLICATION OF I-CONTAINING LIPOSOMES FOR LYMPHOGRAPHY OF THE MEDIASTINUM

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This work is devoted to the application of the liposomic forms of X-ray contrast agents which contain iodine to contrast mediastinal lymph nodes of laboratory animals. A highly-sensitive SRXFA helps to observe the transfer of small amounts of X-ray contrast agents to organs-targets – the mediastinal lymph nodes.

Unilaminar liposomes (ML) which contain iodine are the most promising X-ray contrast agent (XCA) for clinic roentgenography [1,2]. However, for their use in clinic conditions, each of them must be studied experimentally; in particular, the procedure of ML transfer to the place to be examined must be refined and the amount of the agent which is necessary for an optimal visualization of the structures being contrasted must be established. At present, a trend exists towards reducing the dose of an XCA and, hence, attenuating its harmful effect on the patient. Unfortunately, the conventional X-ray techniques do not allow low concentrations of the agent introduced into the animals under examination to be registered nor an exact quantitative estimation of XCA concentrations in the organs under analysis to be made. In view of this, we have applied the X-ray fluorescence analysis (XFA) technique using synchrotron radiation from the Novosibirsk storage ring VEPP-3 (Institute of Nuclear Physics). The high sensitivity of the technique contributes much to the solution of the problems.

In this work we have checked a new X-ray contrast agent, monolaminar liposomes with 30% content of iodinine water-soluble XCA, where the particles are 0.2–1.0 μm in size. We introduced 0.3 ml of the agent into the pleural cavity of each of the rats to be examined (males, weight 250–300 g). The rats were put to sleep under ether anesthesia in 2, 4, 6, 8 and 18 hours after the injection of the contrast agent.

To control the amount of liquid, radiographs were taken in the vertical position; in addition, after the thorax dissection the amount of the liquid, its color, and the presence of fibrin and the XCA on the pleura were estimated visually as well. Besides we also took radiographs of the mediastinum and lymph nodes by means of the Electronica 100-D and ERGA-02 (40 kV, 80 μA) devices, with multiple direct magnification of X-ray images. The exposure time was 5–15 s. A 6 h period after the introduction of the agent was proved to be optimal for radiography. The record of our examination is given below.

Six hours after the introduction of the XCA there was a little amount of liquid in the pleural cavity, the liquid was colourless and limpid, no fibrin and XCA were observed, and the mediastinal lymph nodes were slightly increased and visually showed weak contrast; besides, on the radiographs obtained with weak contrast we observed round and homogeneous nodes whose boundaries were not clearly seen and even; on the radiographs taken from the extracted mediatinal lymph nodes the nodes are round or beanlike, whilst the edge zone of the nodes shows strong contrast in the form of an ellipsis or semi-ring. On the radiographs taken earlier or later than the indicated time no contrasting of the lymph nodes was observed.

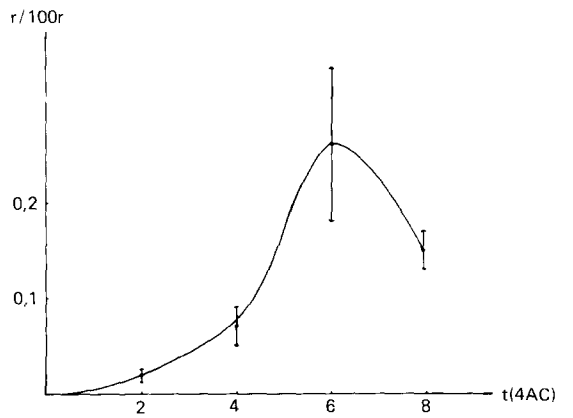

Fig. 1. The dynamics of iodine accumulation in lymph nodes on the basis of SRXFA data

18 hours after the introduction of the XCA neither the liquid in the pleural cavity nor fibrin and the XCA on the pleura were found. When performing X-ray examination of the abdominal cavity, the bowel was contrasted with the XCA.

The next stage was an analysis of the extracted lymph nodes using the SRXFA technique.

Fig. 1 shows the dynamics of iodine accumulation in the lymph nodes on the basis of the SRXFA data. As is seen, the maximum concentration of monolaminar liposomes in the lymph nodes without pathology is observed six hours after the introduction of the ML, which is in accordance with the radiography data.

The results obtained allow the following conclusions to be made:

(1) On introduction into the pleural cavity, the unilaminar liposomes always contrast the lymphatic system of the mediastinum.

(2) The SRXFA technique enables one to estimate exactly the amount of the XCA accumulated in the mediastinal lymph nodes, and the correctness of the estimation is indirectly confirmed by radiography data.

(3) The scanning SRXFA technique can contribute to further study of the distribution of the given XCA, the most convenient time for observation and analysis being six hours after the introduction of the agent.

References

[1] Review information (medicine and health protection). Problems of Creation and Application of X-ray Contrast Agents in Oncology ed A.F. Tsyba (All-Union Research Institute of Medical Information, Moscow, 1985) p 61 (in Russian)

[2] Liposomes Application to Roentgenography and Radiology, collected book (Leningrad State Post-graduate Training Institute for Physicians, named after S.M Kirov, Leningrad, 1984) p. 60 (in Russian).