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Roentgenographic Visualization of Lymph Nodes and Vessels in the Human and in Laboratory Animals by Injection of Thorium Dioxide.*

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We have previously reported the roentgen visualization of lymph nodes and vessels in laboratory animals by subcutaneous and intraperitoneal injections of thorium dioxide (thorotrast).[1] We were able to visualize clearly many different lymph nodes and vessels in these living animals by means of the roentgen ray. Many of them are living in apparent good health over one year after injection.

After being convinced that laboratory animals were in no way harmed by the subcutaneous and intraperitoneal injection of thorium dioxide, we began our experiments on the human in an effort to visualize man's lymph nodes and vessels.

Case No. 1, a colored female, age 41, with an extensive carcinoma of the cervix and body of the uterus, was injected subcutaneously over the abdomen and into the tissues of the cervix. A radiographic examination made immediately after the injection showed the thorium dioxide in the subcutaneous tissues of the abdomen and also in the cervix. No ill effect from the injection was experienced by the patient and none observed by us.

The patient, again examined 2 days later, had not experienced any symptoms which might be attributed to the injection of thorium dioxide. A radiograph made at this time clearly showed 2 lymph nodes situated in the pelvis, both circular in shape, one large and the other small. The small node had absorbed the thorium in an irregular manner; one-quarter of this gland had failed to absorb any thorium, possibly as a result of metastatic cells blocking that portion, and showed as a dark area in contrast to the remaining portion of the gland which had absorbed thorium and was light.

Case No. 2, a colored female, aged 50, with an extensive carcinoma of the uterus, with metastasis, was injected intraperitoneally

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[1] Menville, L. J., and Ané, J. N., *J. Am. Med. Assn.*, 1932, **98**, 1796.

with thorium dioxide and radiographed immediately, to ascertain if the thorium dioxide had entered the peritoneal cavity. The patient felt no ill effect from this injection. Two days later by another roentgen observation we demonstrated some of the abdominal and diaphragmatic lymph vessels, leading to the chest, and also several abdominal lymph nodes. At this examination the patient stated that, several hours after the injection of the thorium dioxide, she experienced slight abdominal cramp, which might have been caused by her illness; however, it had not been necessary to take medication for its relief, and she was now free from pain.

These experiments demonstrate that it is possible to inject thorium dioxide into the subcutaneous tissues and peritoneal cavity of man without producing harmful results; and that by such injections it is possible to visualize human lymph nodes and vessels by means of the roentgen ray.

In experiments already reported[2] it was shown that the absorption of thorium dioxide when injected intraperitoneally in rats was, first, by means of the abdominal lymphatics, then by the diaphragm and by the intercostal lymph nodes and vessels, terminating in the right and left lymphatic ducts.

Recently we reported[3] that when thorium dioxide is injected into the peritoneal cavity of dogs it is absorbed by the abdominal lymphatics, the diaphragm, the substernal lymph nodes, and the anterior and posterior mediastinal glands; also the substernal lymph vessels. These experiments clearly demonstrate that thorium dioxide is readily absorbed from the peritoneal cavity and that its route of absorption is upward.

In the experiments herein reported, dogs, rabbits, and rats were injected interpleurally with thorium dioxide. The dogs were injected under the fluoroscope, affording an unusual opportunity to observe the route taken by the thorium, which first quickly filled the different fissures on the side injected. The thorium was seen to leave the needle, and quickly and clearly fill the fissures and then follow the pleural route.

Though all of our animals were injected on the right side, in less than one hour after injection lymphatic vessels were demonstrated on both the right and left sides of the thorax and the diaphragm.

The first portion of the lymphatic system of the chest to be

[2] Menville, L. J., and Ané, J. N., PROC. SOC. EXP. BIOL. AND MED., 1932, **30**, 28.

[3] Menville, L. J., and Ané, J. N., read before Radiological Society of North America, Nov. 30, 1932. Not yet published.

visualized after the interpleural injection was the substernal glands, less than one hour after injection.

The animals were not injured by the interpleural injection of thorium dioxide. Those first injected several months ago are in apparent good health.

These experiments demonstrate that a colloidal substance, such as thorium dioxide, when injected as reported, is first absorbed by the substernal glands, by the lymph nodes and vessels of the thorax and by the lymph nodes and vessels beneath the diaphragm. It is believed that substances other than colloidal in character, such as organisms, if injected into the pleura in a similar manner will be absorbed by the lymphatic system in the same way.

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Excretion of Phenol Red by the Aglomerular Kidney.*

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The fact that the aglomerular kidney can excrete phenol red was first reported by Marshall and Grafflin[1] for the goosefish, and by Marshall[2] for the toadfish. Marshall and Grafflin[3] have described the excretion of phenol red by the aglomerular kidney following the intramuscular injection of varying doses, and the relation between the amount excreted and the urine volume. Their experiments were conducted on summer toadfish. The excretion of the dye was determined for a period of 5 hours. Averaging their figures gives the following results on

a. Effect of varying the amount of phenol red administered:

mg. Phenol Red per kg. body wt.	% excreted 5 hr.	mg. excreted 5 hr.
5	17.5	0.9
50	3.8	1.9
100	1.6	1.6

b. Effect of variations in urine flow:

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[1] Marshall, E. K., Jr., and Grafflin, A. L., *Johns Hop. Hosp. Bull.*, 1928, **43**, 205.

[2] Marshall, E. K., Jr., *Am. J. Physiol.*, 1930, **94**, 1.

[3] Marshall, E. K., Jr., and Grafflin, A. L., *J. Cell. and Comp. Physiol.*, 1932, **1**, 161.