A PROCEDURE FOR INTRAVENOUS UROGRAPHY IN RABBITS

A. G. Glukharev and K. F. Tovstoles

Department of Urology (Chief – Doctor of Medical Sciences G. S. Grebenshchikov)
of the S. M. Kirov Order of Lenin Military Medicine Academy, Leningrad
(Presented by Active Member AMN SSSR, V. V. Parin)
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One of the methods of determining the functional state of the kidneys which is widely used at the present time both clinically and experimentally is intravenous urography.

Descriptions of intravenous urography in experimental conditions are not numerous, and are chiefly found in works which are not very familiar to a wide circle of readers [1-4].

The purpose of the present article is to generalize the data of these experiments, and to share our experience in intravenous urography carried out on rabbits more than 350 times with the use of various contrast substances.

The kidneys are situated unsymmetrically in the rabbit; the left is at the level of the third and fourth lumbar vertebrae, while the right is at the level of the last thoracic and the first lumbar vertebrae. The right kidney is covered anteriorly by a lobe of the liver and part of the stomach, due to which its image on x rays shows less contrast. This peculiarity must be taken into consideration and, if possible, to carry out the experiment on one of the kidneys, preferably on the left.

It is best to take rabbits weighing less than 2 kg. The intestine of the animals must be specially prepared prior to the investigation. P. G. Divnenko [3] recommends that the rabbit be given 60-70 g of finely chopped carrots mixed with 0.3 g of purgen and 0.5 of carbolen three times a day for the two days prior to the investigation. We, in turn, switched the rabbits to grain feed (oats) 1-2 days prior to carrying out intravenous urography. The intestines of such a rabbit are filled with a uniform mass, while gas formation is diminished, which improves the quality of the x rays.

We used the following contrast substances: 40% sergosin solution; 37.5, 50, and 75% uroselectan "B" solutions; 25 and 50% falitrast solutions; and 35% cardiotrast solution. Here it is necessary to recall that different contrast substances are secreted by different parts of the nephron. Thus, whereas sergosin is excreted primarily by glomeruli, cardiotrast and falitrast are given off by canalicular secretion. This should be taken into consideration when selecting the contrast substance. We obtained the clearest images of kidneys on x rays when using 35% cardiotrast solution and 75% uroselectan "B" solution. Shadows of the kidneys are seen somewhat more faintly but quite clearly on x rays made with the administration of 40% sergosin, 50% uroselectan "B," and 50% falitrast; 37.5% uroselectan "B" and 25% falitrast give very faint, hardly distinguishable kidney shadows.

We carried out intravenous urography with the administration of heated contrast substances and substances at room temperature. We did not note any differences in the behavior of the animals or in the quality of the pictures.

Rabbits tolerate cardiotrast best of all, and sergosin worst of all. For rabbits weighing 2-3 kg, it is best to administer 8 ml of contrast substance. Smaller quantities give low-contrast pictures, while larger quantities are poorly tolerated by the animals and, sometimes, death even occurs.

Prior to the investigation, the rabbit is tied to a board by its paws, abdomen up, by means of tapes. The most convenient dimensions of the board: length 70 cm, width 40 cm.

It is desirable to make the pictures on film measuring 18 × 24 cm in order to include not only the kidneys, but all of the urinary tract as well. The cassette with the film is placed between the back of the rabbit and the board, pushing it under from the head end (with the fur), and removing it from the tail end. The rabbit tied in this manner with the cassette already in place is placed under the tube of the x-ray apparatus, after which the administration of the contrast substance is begun.

It is best to administer the substance with a 10-gram syringe through a thin needle into the marginal vein of the ear. Prior to injection, the hairs are pulled out over this vein for better visibility. Insertion of the needle into the vein should be made as distally as possible, since manifestations of phlebitis are frequently observed at the site of entry of the needle – the veins are obliterated and become unsuitable for further work.

It is best to have a helper when injecting the contrast substance, who will secure the rabbit's head or will apply a fixing collar. This is necessary, because, due to the painfulness of injecting the substance, the rabbit jerks his head and the needle pulls out of the vein.

A contrast substance must be injected very slowly (8.0 ml in 2-3 min). Rapid injection is not as well tolerated by rabbits, and they may have more complications; at the same time, the contrast quality of the picture becomes considerably worse with rapid injection.

Among the later complications, the appearance of phlebitises and necroses at the site of injection with the further tearing of the necrotic areas should be pointed out. These complications occur more frequently when sergosin and falitrast are used.

Exposure should not exceed 0.5 sec, so that the focusing distance has to be reduced to 20, or even 15 cm on some x-ray machines. Increasing the exposure beyond that indicated above reduces the sharpness of the x rays due to the frequent breathing of the rabbit and its movement. Taking this peculiarity into account, a lens hood should not be used.

The excretion of the contrast substances begins immediately after the injection and, in normally functioning kidneys, continues to 60 min, and sometimes for an even longer time.

We made pictures immediately after the injection of the substance, in 1, 2, 5, 10, 15, 20, 25, and 30 min. We feel that it is expedient to take x rays immediately following the injection of the contrast substance, after 5-10, and after 25-30 min, because these intervals fully reflect the functional state of the kidneys and give good high-contrast pictures.

In distinction from intravenous urography in humans, where we have all urinary tracts well filled with contrast, in a rabbit, we essentially get a nephrogram. The pelvis does not always fill out with the contrast substance, while the ureters, as a rule, usually fill up only in their upper half.

The contrast of the kidney shadows on x rays obtained during intravenous urography of rabbits set up under identical conditions varies greatly – from barely noticeable contours of the kidneys to clearly outlined shadows with easily distinguishable pelvises and upper portions of the ureters. Therefore, it is not always possible to draw definite conclusions concerning the function of the kidneys from the clearness and contrast quality of their shadows on x rays. This is possible only when urography is done repeatedly and the data obtained are compared. When urography is carried out a single time, the beginning and end of the excretion of the contrast substance are reliable indicators of the functional state of the kidneys in rabbits.

We used this method for investigating kidney function in rabbits during intoxication by preparations containing arsenic, and during subcutaneous trauma of the kidneys in combination with radiation sickness. The results obtained showed that the data of intravenous urography reflect the changes arising in the kidneys, and can be used for judging the functional capability of the latter.

SUMMARY

More than 350 intravenous urographies were performed on rabbits. Various contrast media were used (cardiotrast, falitrast, uroselectan "B," and sergosin).

The best results were obtained with cardiotrast and uroselectan "B." The contrast medium has to be administered slowly, since its rapid injection leads to complications and reduces the contrast of radiograms. Radiograms taken directly after the administration of the contrast medium, in 5-10, and in 25-30 min, give a distinct picture of the functional condition of the kidneys. In rabbits mainly a nephrogram is obtained. Intravenous urography is a rather simple procedure in rabbits; it does not require any biochemical tests, and may be used in any clinic or laboratory equipped with an x-ray unit. This investigation should be done repeatedly, since the data obtained in these animals are variable.

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