

DISTURBANCE OF THE URODYNAMICS OF THE UPPER URINARY TRACT AS A RESULT OF HORMONAL IMBALANCE

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Considerable functional disturbances of the urodynamics, consisting of hypotonia, hypokinesia, and dyskinesia of the pelvis and upper third of the ureters were detected by television excretory pyeloscopy and motion-picture urography in female rabbits after prolonged administration of progesterone and estradiol dipropionate. These findings suggest a role of hormonal imbalance in the pathogenesis of disorders of the urodynamics that are the possible causes of development of pyelonephritis, nephrolithiasis, hydronephrosis, and other diseases of the kidneys in women.

KEY WORDS: progesterone; estradiol; pyeloscopy; motion picture urography; dyskinesia of the urinary tract.

Among the various factors inducing functional disturbances of the upper urinary tract, especially in women, hormonal discorrelation occupies an important place. In the experiment we show the development, for example, of uretero hydronephrosis in pregnant rhesus monkeys after extraction of the fetus, leaving the placenta in situ [3]. The level of estrogens and gonadotropic hormones in these animals corresponded to that during normal pregnancy. An increased concentration of estrogens in women during pregnancy was found to be accompanied by dilatation of the upper urinary tract [2].

The writers' clinical observations with the aid of television excretory pyeloscopy and motion-picture urography showed that the tone of the calyces, pelvis, and ureters is lowered in some women with hormonal imbalance.

This paper describes the reproduction of a disturbance of the hormonal balance in animals and the investigation of the urodynamics of their upper urinary tract.

EXPERIMENTAL METHOD

Female chinchilla rabbits weighing 2-3.5 kg were given daily intramuscular injections of 1% progesterone solution (15 animals) or a 0.1% solution of estradiol dipropionate (15 animals) in a dose of 0.2 mg/kg. The control group consisted of 10 animals. The degree of saturation of the animals with estrogens was monitored by determining the number of epithelial cells in 1 ml of urine [1]. The state of the urodynamics of the upper urinary track was estimated by television excretory pyeloscopy and by motion-picture urography. Altogether 36 motion-picture urograms taken at different times (from 2 weeks to 3 months after the beginning of administration of the hormone) were analyzed. The contrast material for urography was urotrast or verographin in a dose of 2-3 ml/kg body weight.

EXPERIMENTAL RESULTS

The motion-picture urographic investigations of the control rabbits showed that the mean size of their

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kidneys was 3×2 cm and the diameter of the ureters throughout their length was 1-1.5 mm. A rapid excretion of the dye by the kidneys was observed 1-2 min after its intravenous injection; the contrast material passed quickly along the ureters and the cystoids were emptied after 3-5 sec. The bladder was filled with the contrast material after 3-5 min, but after 7-10 min the dye had disappeared completely from the calyces and pelvis. The number of epithelial cells in 1 ml of urine varied from a few to 250.

Starting from the third week (when 1 ml of urine contained from 4000 to 7500 epithelial cells), dilatation of the pelvis and upper third of the ureters to 2.5-3.5 mm, or in some animals to 5 mm, was observed in the animals receiving progesterone. Hypotonia and hypokinesia of the dilated pelvis and ureters were revealed and the intervals between emptying of the cystoids of the ureter reached 30-40 sec. These disturbances reached their maximum after 6-8 weeks (1 ml urine contained from 10,000 to 20,000 epithelial cells) and the kidneys were enlarged at the same time to 4.5×3.5 cm. It is interesting to note that dilatation of the ureters occurred in the upper third and, to a lesser degree, in the middle third; in the lower third they remained normal.

In the animals receiving estradiol dipropionate, the disturbance of the urodynamics of the upper urinary tract began in the 3rd-4th week after the beginning of administration of the compound (1 ml urine contained from 1000 to 2500 epithelial cells), but except in two rabbits the dilatation of the upper third of their ureters was less marked than in animals receiving progesterone, reaching 2-2.5 mm. Hypotonia and hypokinesia on the pelvis and ureters and delayed evacuation of the contrast material from the kidneys and along the ureters also were observed in these rabbits. The severest disturbances of the urodynamics occurred in the 8th-10th week, but they were not so marked as in the animals receiving progesterone, despite the high saturation of the animals with estrogens (1 ml urine contained from 10,000 to 15,000 epithelial cells).

An increased level of estradiol and of progesterone in the body can thus disturb the urodynamics of the upper urinary tract and give rise to hypotonia, hypokinesia, and dyskinesia of the pelvis and the upper third of the ureters. This suggests a role of hormonal imbalance in the pathogenesis of the corresponding disturbances in women. Such a hormonal imbalance creates favorable conditions for the development of pathological changes in the kidney: pyelonephritis, nephrolithiasis, hydronephrosis, and so on.

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