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FUNCTIONAL AND MORPHOLOGICAL EFFECTS OF URINARY DIVERSION IN RAT

Hypothesis / aims of study

Urinary diversion is the therapeutic approach of last choice to treat bladder dysfunction or carcinoma (1,2). We developed a new urinary diversion model in rat and examined the functional and morphological effects of acute and chronic urinary diversion on bladder, urethra, and vagina.

Study design, materials and methods

Female Sprague Dawley rats were distributed into age-matched normal control (n=6), sham urinary diversion (n=12), and urinary diversion group (n=12). Urinary diversion was performed by diverting urine from the ureters to the vagina. Briefly, rats were anesthetized by an intraperitoneal injection of a mixture of ketamine (100mg/kg body weight) and xylazine (10mg/kg body weight). The animals were positioned in a dorsal recumbent position. A lower ventral midline incision was made. The ureters, after being identified, were ligated distally. Two small holes were made using a drill in the uterus neck. The ureters were brought through the holes and anastomosed with sutures. The abdomen was closed in two layers. Antibiotics were administered prophylactically for 72 hours. Sham animals underwent sham laparotomies and isolation of ureters. No surgery was performed in normal control animals. One week or 8 weeks later, conscious cystometry (CMG) and leak point pressure (LPP) were tested and bladder, urethra and vagina were harvested for histology examination. Digital image analysis was used to quantify the areas of three primary tissue components: smooth muscle, urothelium, and collagen in equatorial cross-sectional areas of bladder.

Results

All the animal were alive during the investigated period. The bladder weight decreased significantly after 1-week or 8-week urinary diversion. Histology examination showed thickened mucosa, lamina propria, infiltration of lymphocytes, and ulcers of vagina in some of 1-week and 8-week UD rats. As a percentage of the total cross sectional area in bladder, smooth muscle and urothelium area decreased, and collagen area increased in 1-week and 8-week UD rat compared with control and sham rat (figure 1). Urethra showed decreased striated muscle in 8-week UD rat. Functionally, LPP were similar among the control, sham and UD group. CMG measurement showed decreased intercontraction interval and voided volume per micturition in the UD group compared to control and sham group. The compliance is significantly decreased in UD rat. However, there were no significant differences in peak micturition pressure in UD rat.

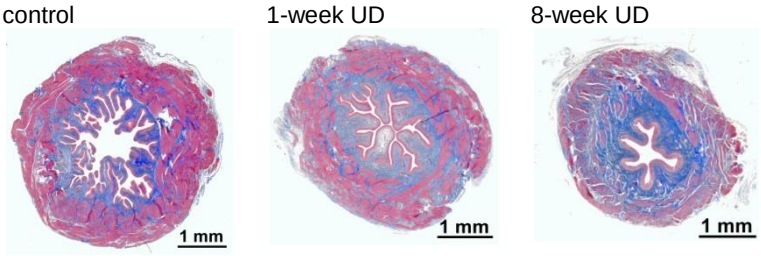

Figure 1. Representative images of Mansson trichrome staining at equatorial levels of urinary bladders in control, 1-week UD and 8-week UD rats.

Interpretation of results

The results showed that LPP were similar among the control, sham and UD group, which suggested disuse of the uretha did not decrease the urethral resistance although the thickness of striated muscle decreased within 8-week urinary diversion. However, disuse of the bladder lead to bladder dysfunction, including decreased bladder weight, bladder volume, and compliance.

Concluding message

The results of this study indicate that there are morphological and functional changes in the bladder, urethra and vagina after urinary diversion. However, this model is durable and may provide a useful model for studying the mechanisms of urinary diversion and undiversion.

References

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3. J Urol (1980) 123; 956-958.

Specify source of funding or grant	**AMDCC (U01-DK61018)**
Is this a clinical trial?	**No**
What were the subjects in the study?	**ANIMAL**
Were guidelines for care and use of laboratory animals followed or ethical committee approval obtained?	**Yes**
Name of ethics committee	**the Cleveland Clinic Institutional Animal Care and Use Committee**