

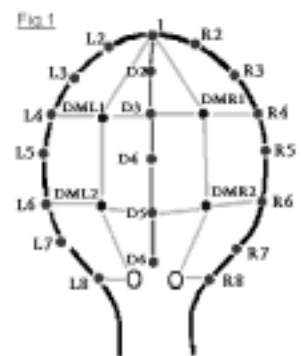
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Title: REGIONAL DIFFERENCES IN BLADDER ENLARGEMENT AND IN VITRO CONTRACTILITY AFTER OUTLET OBSTRUCTION IN THE RABBIT

Aims of the study:

Bladder outlet obstruction (BOO) leads to bladder enlargement and consequent decreases of contractile function in vivo and in vitro. Recent studies in rabbits have shown that the alterations in contractile response vary throughout the bladder dome [1]. The purpose of this study was to identify regional differences in the change of bladder size in vivo and contractile responses to stimuli in vitro after 2 weeks of BOO.

Methods:

Male New Zealand White rabbits underwent a cystometry and then were surgically obstructed. Then the bladder was filled with 40ml saline and the entire bladder surface was marked with 2-0 silk knots. Knots were placed on the top of the dome ("knot 1"), and approximately 1cm apart along the ventral ("V") and dorsal ("D") midline, along the lateral vessels ("R" and "L"), and in the areas between the adjacent knots, and numbered from the top to the base. The distance between the knots was measured at 20, 40, and 80ml volume. After 2 weeks, the cystometry and the measurements at the different volumes were repeated, and strips were taken from known dorsal and ventral areas of the bladders. Contractile responses of bladder strips to field stimulation (FS), carbachol, and KCl were determined and compared to strips from unobstructed controls. Data are presented as means \pm SEM. Statistical analyses were done using t-test or Bonferroni analysis, as appropriate. *Indicates a significant difference at $P < 0.05$.

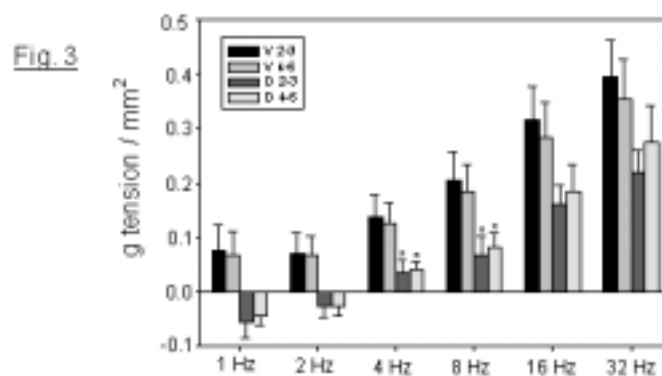
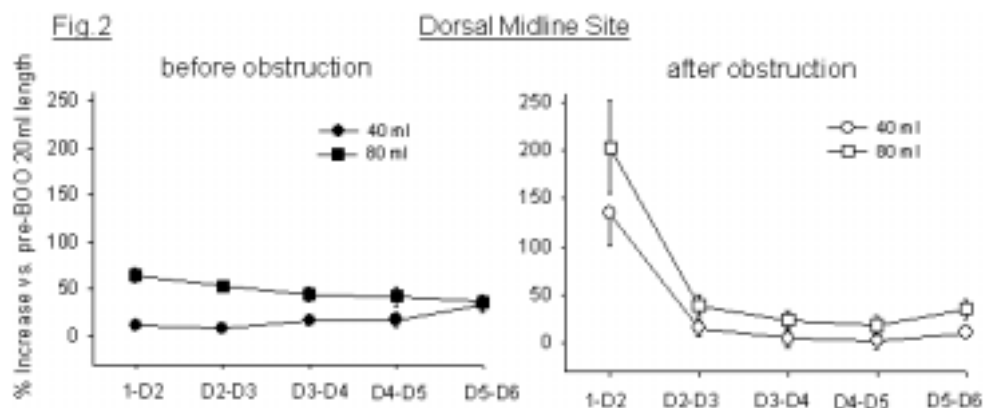


Results:

Partial bladder outlet obstruction caused significant increases in bladder weights at 2 weeks ($14.0 \pm 0.8\text{g}$, $n=10$), compared to controls ($4.6 \pm 0.1\text{g}$, $n=5$). The volume of residual urine was significantly increased in 8 out of 10 rabbits ($33 \pm 9\text{ml}$ before, $107 \pm 22\text{ml}$ after BOO). Two rabbits developed a low compliance/ low capacity bladder ($98 \pm 13\text{ml}$ before, $16 \pm 10\text{ml}$ after BOO). There were no changes in the cystometry results after 2 weeks BOO except in the 2 rabbits which had developed a low compliance bladder.

Cystometry results	Micturition pressure (cm H ₂ O)		Volume at micturition (ml)	
	before BOO	after BOO	before BOO	after BOO
Obstructed normal compliance (n=8)	15 ± 2 (7 - 19)	18 ± 1 (13 - 23)	78 ± 19 (31 - 168)	61 ± 17 (11 - 165)
Obstructed low compliance (n=2)	7 (no micturition in 1)	21 ± 14 (13 & 28)	120 ± 12 (108 & 131)	13 ± 4 (17 & 8)

Before obstruction the in vivo expansion during bladder filling occurred simultaneously throughout the bladder wall. After 2 weeks of obstruction the upper dome expanded to a significantly higher degree than the lower dome. This phenomenon was more pronounced on the dorsal compared to the ventral side (fig. 2). The response to all stimuli was significantly reduced in bladder strips from obstructed rabbits. In the control group, the contractile response to all stimuli was similar in the ventral and dorsal strips. The obstructed bladders showed a significantly decreased response to FS in the dorsal strips, compared to the ventral strips. The strips taken from the dorsal midline (D2-3, D4-5) showed a relaxation response to FS at 1 and 2 Hz frequency, and contracted at higher frequencies, whereas all ventral strips (V2-3, V4-5) contracted (see fig. 3). The responses of dorsal strips from the obstructed bladders to ATP, carbachol, and KCl were significantly decreased compared to the ventral strips.



Conclusion:

Functional remodelling after outlet obstruction is a process that does not occur simultaneously throughout the bladder wall. Filling expansion and in vitro contractile responses of control rabbit bladders are symmetric throughout the bladder wall. However, there are significant regional differences in mechanical and pharmacological properties of the obstructed bladder. Strips taken from the dorsal midline of the rabbit bladder may relax in response to nerve stimulation after outlet obstruction, while they contract when taken from other

areas of the same bladder. These significant regional differences should be taken into account when obstruction studies are done.

Source of Funding:

National Institutes of Health and Veteran's Administration

Levin R.M., Shofer F.S., Wein A.J.: Cholinergic, adrenergic and purinergic response of sequential strips of rabbit urinary bladder. J Pharmacol Exp Ther. 1980 Mar;212(3):536-40.