Voiding and Muscle Contractility Dysfunction in a Rat Model of Detrusor Underactivity

Eric J. Gonzalez1, Michael R. Odom2, Johanna L. Hannan2, and Warren M. Grill1

1Duke University, 2East Carolina University

Introduction
- Detrusor underactivity (DUA) is an understudied and inadequately managed health concern.
- DUA is defined as a contraction of reduced strength and/or duration that results in prolonged and/or incomplete bladder emptying.
- The current animal models are limited and impede the development of new therapeutic approaches.
- We characterized voiding function of an obese prone rat model of DUA and measured the contractility of bladder and urethral tissues.

Methods
- Obese resistant rats
  - 308 g, 152 mg/dl glucose
- Obese prone rats
  - 567 g, 153 mg/dl glucose
- 60% fat feeding

Uroflowmetry
- Obese prone rats have increased frequency and decreased void volume and flow rate (n=4).

Cystometry
- Obese prone rats have decreased voided percentage, void pressure generation, EUS bursting time, and increased EUS activity (n=9-10).

Treatment - Neuromodulation
- Burst patterned electrical stimulation of the pudendal motor nerve increased bladder emptying (n=4).

Conclusions
- Obese prone rats exhibited characteristic underactive voiding function changes.
- Reintroducing urethral bursting activity increased bladder emptying, perhaps through the pudenda-vesical reflex.

Overall Summary
- ↑ contractility
- ↓ frequency
- ↓ void volume
- ↓ flow rate

Bladder Contractility
- Obese prone rats have decreased myogenic cholinergic activity in the bladder (n=8-9).

Proximal Urethra Contractility
- Obese prone rats have decreased myogenic and increased neurogenic activity in the proximal urethra (n=8-9).

Middle Urethra Contractility
- Obese prone rats have increased myogenic and neurogenic activity in the middle urethra (n=7-9).

Awake Uroflowmetry
- Urinary frequency
- Voided volume
- Urine flow rate

Anesthetized Cystometry
- Bladder pressure
- Urethral EMG
- Neuromodulation

Bladder and Urethral Muscle Contractility
- Carbachol
- Electric field stimulation

↑ fill activity
↑ contractility
↓ pressure
↓ void volume
↓ flow rate

DK100024
DK120632
p<0.0001
p=0.0175
p=0.0011
p=0.0404
p=0.002
p=0.008
p=0.0001
p=0.011
p=0.0001
p=0.0001