Role of Transient Receptor Potential Vanilloid 3 (TRPV3) in Lower Urinary Tract Function, Sensation, and Pathology

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Pathologies associated with lower urinary tract symptoms (LUTS) represent a significant burden of disease. Despite their prevalence, many of these diseases lack a definitive molecular understanding. Animal models have shown various transient receptor potential (TRP) cation channels are involved in bladder function, mechanosensory transduction, and nociception. Pharmacological targeting of specific channels, however, failed to alleviate LUTS, suggesting that the relevant TRP channel has not yet been identified or that multiple channels must be targeted simultaneously. TRPV3 has previously been identified as having a role in sensory signaling in the peripheral and central nervous systems and has been shown to be involved in bladder sensory signaling in rats. The goal of this study was to evaluate the role of TRPV3 in bladder function and sensory signaling in a mouse model.

Using immunohistochemistry and RT-PCR, we studied TRPV3 expression in bladder sensory neurons in the dorsal root ganglia (DRG) in wild type (WT) mice and in a mouse model of lower urinary tract dysfunction (LUTD). TRPV3-KO mice served as negative controls. Functional studies were performed to compare lower urinary function between WT and TRPV3-knock out (KO) mice. Behavioral trials were used to evaluate micturition frequency and cystometry measured pressure and intermicturition interval during bladder filling.

Compared with age-matched controls, mice with LUTD exhibited a two-fold increase in TRPV3 mRNA expression. Cross-sections of DRG showed an increase in the number of TRPV3-positive neurons (n=8). Compared to WT (n=12), the voiding frequency in TRPV3-KO animals (n=14) was reduced by 40.7%. Cystometry recordings showed a 59% increase in the intermicturition interval in WT versus KO mice (n=6/group).

These results show that TRPV3 is present in the urinary bladder and its sensory pathways in mice while also providing evidence of its role in normal and pathological bladder functioning.