AMPLIFY: Amplifying Sensation in Underactive Bladder (Work in Progress)

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INTRODUCTION/OBJECTIVES: Incomplete emptying due to underactive bladder (UAB) is a poorly understood health concern that affects up to 40% of the aged population (Jeong et al. 2012, Osman et al. 2014). UAB may involve reduced motor drive (detrusor underactivity, DU) during bladder emptying and/or reduced sensory drive during filling and emptying. Symptoms may include pelvic pressure, urinary frequency, feelings of incomplete emptying, and/or slow stream, and the management options are often associated with poor quality of life and failure to resolve the symptoms. There is a need to clarify the pathophysiological mechanisms underlying UAB to improve outcomes. This study will quantify and amplify sensory nerve drive in adult women with UAB to establish a prognostic marker for rationally guided treatment.
METHODS: Questionnaire: Participants were administered an abridged CASUS questionnaire before and 7 days after the study visit. Subscales measured in the questionnaire included urinary frequency, bladder sensation, voiding effort, urinary flow, feelings during emptying, and quality of life. Scores were calculated by assigning a numerical value to each response, adding all the responses, and normalizing the sum to the maximum possible score. This resulted in scores from 0 (least severe) to 100 (most severe) with higher scores indicating greater severity of lower urinary tract symptoms (LUTS). Quantitative Sensory Testing: The functional integrity of bladder and urethral sensory nerve fibers was assessed using current perception threshold (CPT) testing. CPT delivered electrical stimulation via catheter electrode to activate nerve fibers that evoke sensory perception. CPT values were established using a forced choice paradigm by the method of levels, where random pairs of A/B stimuli were presented until a consistent threshold amplitude was measured at 5, 250, and 2,000 Hz within the bladder and urethra. Continuous Electrical Stimulation: Stimulation was delivered via catheter electrode to target selectively reduced sensory feedback from the bladder or urethra. Stimulation location was determined by the largest percentage change in the participant's CPT from normative data. Urodynamic Studies (UDS): UDS were performed after the stimulation session (15 min for urethra or 30 min for bladder) to assess bladder sensation and emptying function.
RESULTS: Data has been collected in 5 participants. Compared to baseline, the average total CASUS score decreased by 11 points seven days after the study visit (55±11 vs 44±12). The subscales measuring frequency and sensation increased by 2 and 3 points, respectively (44±8 vs 46±8 and 48±17 vs 51±19). The subscale measuring effort decreased by 14 (62±24 vs 48±30), flow decreased by 19 (51±15 vs 32±8), emptying decreased by 16 (50±25 vs 34±21), and impact on quality of life decreased by 17 points seven days after the study visit (72±10 vs 55±27). Compared to normative asymptomatic women (Kenton et al. 2007), the current amplitude to elicit sensation was 359±194% higher in the bladder and 3,130±3,244% higher in the urethra. Compared to their pre-stimulation clinic UDS, first sensation in cystometry decreased by 164 ml, max cystometric capacity decreased by 45 ml, pressure flow voiding efficiency increased by 26%, max flow rate increased by 13 ml/s, and max detrusor pressure increased by 12 cmH_2O.
CONCLUSIONS: CPT testing confirmed poor sensation in the urethra and bladder in participants with symptoms of an UAB. Early findings suggest targeted electrical stimulation can acutely improve bladder symptoms and function. Future analyses will compare the effects of bladder or urethral stimulation, and future studies will determine if multiple stimulation sessions provide greater benefit.

RESEARCH AREA: Voiding Dysfunction/Urinary Retention, Neurourology, Urodynamics

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