🏆 Best in Category Prize - Urodynamics

49

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INNOVATIONS IN SENSATION KINETICS

Hypothesis / aims of study

Urodynamic measurement of patient sensation during the filling phase is currently constrained to the three ICS sensory thresholds (First Sensation, First Desire & Strong Desire) which are poorly characterized and can be contaminated by investigator prompting. Therefore, there is a pressing need to develop more accurate and reproducible methods to characterize real-time sensation during urodynamics. To address this deficiency, a patient-controlled, real-time sensation meter has been employed previously in non-invasive hydration studies to measure patient sensation during filling [1]. In the current study, we aim to evaluate real-time sensation during the filling phase of urodynamics in order to develop novel metrics to define sensation kinetics. These could ultimately be used to sub-categorize different forms of filling phase disorders.

Study design, materials and methods

After IRB approval, individuals undergoing urodynamic testing (for any clinical indication) recorded real-time sensation changes during filling from 0% (feeling of complete emptiness) to 100% (complete fullness) using our previously characterized real-time sensation meter (Figure 1) [1]. Urodynamics were performed according to ICS guidelines. Prior to testing, all patients completed the ICIQ−OAB questionnaire and were instructed on the use of the meter. Patients with incontinence during filling, non-continuous filling or not reaching 100% sensation were excluded from analysis. Sensation data was obtained at 10Hz and time linked to urodynamic data. Infused volumes were normalized as a percentage of cystometric capacity for statistical analysis. Sensation data obtained from our real-time sensation meter were sampled at every 5% cystometric capacity and sensation-capacity curves were generated for each patient. The sensation curves were then divided into equal quartiles (Q1-Q4) and sensation velocity (v_i), defined as Δsensation/Δcapacity, was calculated for each quartile (Figure 2). A sensation index (SI) was calculated for each patient and defined as 4th quartile sensation velocity/1st quartile sensation velocity (v_4/v_1). Patients were grouped via ICIQ-OAB urgency scores (question 5a: 0 – 4) and analysed for changes in sensation velocity between quartiles. Analysis was also performed across urgency groups for each filling quartile. Sensation indices were compared between urgency groups.

Results

A total of 49 consecutive patients used the sensation meter during urodynamics with 28 meeting criteria for analysis. Patients were grouped by urgency scores as follows: n=5,9,9,5, corresponding to urgency scores of 0,1,2,3, respectively. No patients had urgency scores >3. There were no differences in cystometric capacity or First Sensation between the 4 groups. Within group comparison (Figure 3), demonstrated that patients with elevated urgency (urgency group 3) had an increase in sensation velocity through the 4 filling quartiles (β=0.39, p=0.0004) which was not seen for other urgency groups. Between group comparison (Figure 4) demonstrated a decrease in 1st (β=-0.25, p=0.005) and 2nd (β=-0.12, p=0.03) quartile sensation velocities, but no change in sensation velocities for the other quartiles. Sensation index trended toward significance over urgency groups 0 to 3 (p=0.06).

Interpretation of results

The current study investigates the use of a previously characterized real-time sensation meter to augment the filling phase of urodynamic studies, thereby allowing for higher resolution data collection of patient sensation than methods in current clinical practice. Other groups have developed qualitative methods for assessing patient sensation during filling, however, our data collection allows for detailed quantitative analysis of sensation kinetics in patients which was not previously possible [2]. The sensation meter eliminates investigator contamination/prompting of standard sensory thresholds. With sensation data time-linked to urodynamic data, our method of determining sensation velocities and the derivative sensation index is easily reproducible.

Our findings show that patients with elevated chronic urgency (based on ICIQ scores) have accelerating sensation during filling (J-shaped sensation-capacity curve (example, Figure 2)) which was not seen for patients with lower chronic urgency scores. In contrast, patients without chronic urgency had high sensation velocities in the first and second quartiles of filling and then remained steady (r-shaped sensation-capacity curve). These findings suggest that bladders of individuals without chronic urgency are able to recognize the sensation of filling but then have sensory accommodation to this filling. The sensation index that we describe in this study allows for an objective comparison of sensation velocity during the first and fourth quartiles of filling. These new metrics for sensation kinetics could represent a novel means to sub-characterize different types of storage disorders and could potentially allow for more targeted therapies.

Concluding message

Addition of continuous real-time sensation data during urodynamics permits a detailed and quantitative analysis of patient sensation kinetics during filling. Patterns in sensation kinetics may be useful in distinguishing filling phase pathology, ultimately allowing for more targeted therapy.

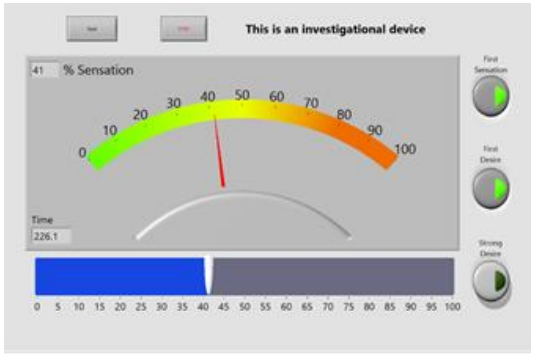

Figure 1

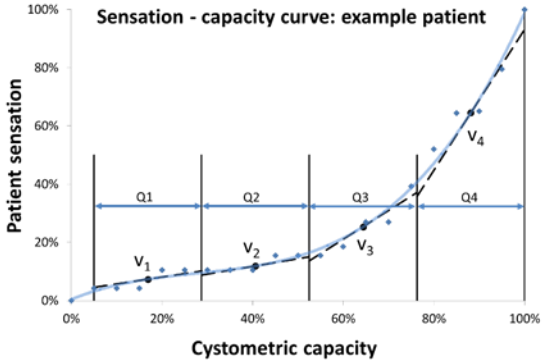

Figure 2

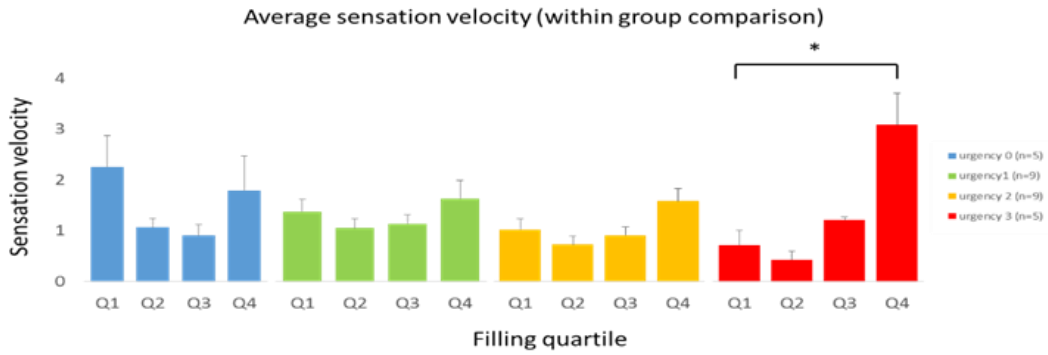

Figure 3

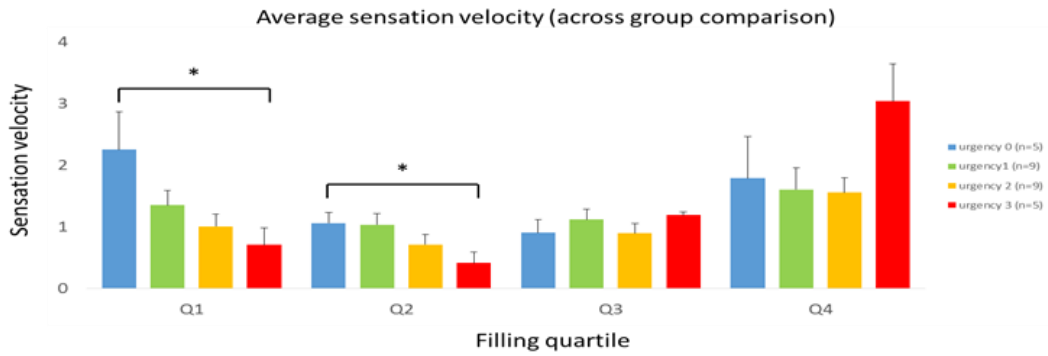

Figure 4

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Disclosures

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