

NOVEL NOMOGRAM OF OVERACTIVE BLADDER WITH INTEGRATION OF OVERACTIVE BLADDER SYMPTOM SCORE AND URGE PERCEPTION INDEX OF BLADDER HYPERSENSITIVITY

Hypothesis / aims of study

In analysis of a bladder diary with the patient's self-reported urinary perception grades, we developed a novel quantitative measure of bladder hypersensitivity, which we refer to as the urge perception index (UPI) (1). In this study, we longitudinally monitored the treatment effects in the change of OAB-symptom score and UPI of bladder hyper-sensitivity for aims of [a] to identify the best threshold value of UPI to distinguish OAB vs. non-OAB, and [b] to develop a novel nomogram for diagnostic tool for OAB with integration of OAB symptom score and UPI of bladder hypersensitivity.

Study design, materials and methods

Total of 110 patients (OAB, n=70 and non-OAB, n=41) were enrolled in this study, and were asked to complete a bladder-diary with self-reported grading of urinary perception and the overactive bladder symptom score, OABSS (2). Out of the 110, 47 patients, who underwent treatment of anti-muscarinic agents (n=23), mirabegron (n=20), or neuromodulation (n=4), had both pre- and post-treatment evaluations. As such, total 157 completed data-set (including all of the UPI, OABSS, and QOL) were analyzed. For the simultaneous analysis of both severity of symptom and bother related to OAB, the perception of bother specific to each OABSS was asked (OABSS-VAS). To assess the QOL related to OAB symptoms, the VAS measure about QOL was also asked (VAS-QOL). In the bladder diary, the grade of urinary perception was defined by a score from 1 to 5 as follows; 1= Sensation of bladder filling without desire to void (convenience void), 2= Desire to void (voiding can easily be delayed for more than 30 min), 3= Strong desire to void (voiding cannot be delayed for more than 15 min), 4= Urgent desire to void (voiding cannot be delayed for more than 5 min) and 5= Urge urinary incontinence episode. The grade of urinary perception at each void was recorded in the bladder diary. UPI was defined as a quotient of voided volume/urinary perception grade at each void. We defined the averages of UPIs in the 3-day bladder diary as (average) UPI-value. We longitudinally monitored the UPI-value and the score of OABSS before and after the treatment.

Results

[1] **UPI-improvement:** UPI-value significantly improved from pre 68.7 ± 40.3 to post 85.4 ± 62.4 ($p=0.0054$) by the treatment in the 47 patients. [2] **ROC (Receiver Operator Curves) analysis for UPI to predict OAB (Figure 1):** When analyzed 110 patients, ROC identified the best threshold UPI value of 82.3 for predicting OAB. Area under the curve (AUC) for UPI to predict OAB was 0.884. When using a single best UPI-threshold of 82.3, it diagnosed OAB in 78% of pre-treatment status. [3] **Development of Symptom/Hypersensitivity Nomogram (Figure 2):** Based on the significant improvement of OAB-severity in either symptom or QOL despite suffering yet from bladder hypersensitivity, we identified the demand of a new diagnostic nomogram with integration of symptom (by OABSS) and bladder-hypersensitivity (by UPI) (without single use of hyper-sensitivity alone). In Figure 2, we first plotted the OABSS total scores in Y-axis and UPI values in X-axis, defining pre-treatment plot as black circle and post-treatment plot as gray circle. Since the single threshold UPI-value of 82.3 to distinguish OAB from non-OAB were not perfectly clear, we carefully determined to create an equivocal-zone for "suspicious for OAB (or suspicious for Non-OAB)" which may represent the intermediated or transit condition between OAB and non-OAB during the ongoing treatment. Consequently, the novel Nomogram was able to classify "suspicious for OAB" in total of 98% ($n=45$) of pre-treatment as either OAB (59%, $n=27$) or equivocal-OAB (39%, $n=18$), while "suspicious for Non-OAB" in total of 63% ($n=29$) of post-treatment as either equivocal OAB (46%, $n=21$) or OAB (17%, $n=8$). [4] **OABSS-improvement:** There were significant symptomatic improvements in each score of OABSS-Q2 (nocturia, $p=0.0019$), OABSS- Q3 (urgency, $p<0.0001$) and Q4 (incontinence, $p=0.0069$), respectively. We found also significant improvement in OABSS total scores (pre-treatment 8.80 v.s. post-treatment 6.84, $p<0.0001$). [5] **QOL-score improvement:** There were also significant improvement in QOL in each score of OABSS-VAS scores (OABSS-VASQ1 (daytime frequency, $p=0.0037$), OABSS-VASQ2 (nocturia, $p=0.007$), OABSS-VASQ3 (urgency, $p=0.0079$), OABSS-VASQ4 (incontinence, $p=0.0038$)), respectively. We found VAS-QOL score also showed significant improvement (pre-treatment 76.6 v.s. post-treatment 55.6, $p<0.0001$). [6] **Relation of changes of UPI with Symptom or QOL:** In analysis of relation between UPI and clinical variables, there were significant linear correlations of Δ UPI value (post-treatment UPI value minus pre-treatment UPI value) with Δ OABSS total scores (post-treatment OABSS total scores minus pre-treatment OABSS total scores) ($r=0.30$, $p=0.0402$) and Δ symptom score of urgency (post-treatment symptom score of urgency minus pre-treatment symptom score of urgency) ($r=0.32$, $p=0.0284$). In addition, we found significant linear correlations of Δ VAS-QOL measure (post-treatment VAS-QOL measure minus pre-treatment VAS-QOL measure) with Δ OABSS total scores ($r=0.58$, $p<0.0001$), Δ symptom score of urgency ($r=0.61$, $p<0.0001$), and Δ UPI value ($r= -0.32$, $p=0.0316$).

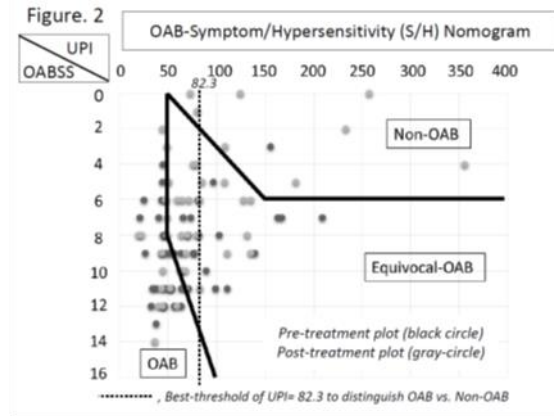
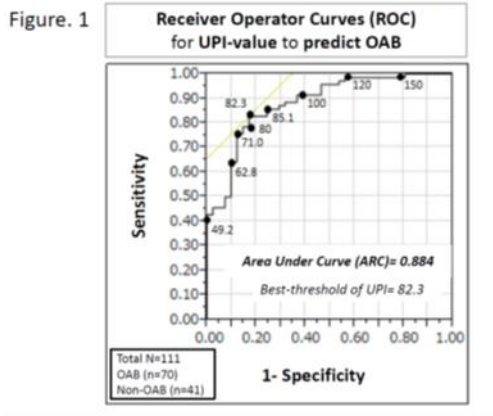
Interpretation of results

Overall response of UPI value had significant correlations with the change of OABSS scores as well as with QOL score. UPI, the integrated parameter of patient-reported bladder perception and voided volume, could be a promising tool for quantifying bladder hypersensitivity and monitoring the treatment effect through analysis of a bladder diary. ROC analysis identified the best threshold UPI of 82.3 to distinguish OAB vs. non-OAB with diagnostic ability of AUC as 0.884. Our newly developed OAB-Symptom/Hypersensitivity Nomogram can quantitatively represent the severity of OAB by integration of the symptom and bladder hypersensitivity. This nomogram allows the novel classification of the OAB-severity quantitatively by not only symptom but also hypersensitivity. Using the values of OABSS and UPI in individual patient can be plotted on the nomogram that determines whether the patient status could be OAB, non-OAB or equivocal. The individual plotting of both pre- and post-treatment in this

nomogram may represent the outcome or effectiveness of the treatment. Further study with increased number of patients may be needed for justification of the threshold lines in the nomogram for defining the equivocal zone between OAB and non-OAB.

Concluding message

We identified the best threshold UPI of 82.3 to distinguish OAB vs. non-OAB with diagnostic ability of AUC as 0.884. We developed a novel nomogram (OAB-Symptom/Hypersensitivity Nomogram) for quantitative diagnostic tool of OAB by integration of the OAB-symptom score and UPI of bladder hypersensitivity. These may impact on quantified classification of the individual severity of OAB as well as monitoring of the effectiveness by the OAB-treatment.



References

1. J Urol 2013;189:1797, (2) Urology 2006; 68: 318.

Disclosures

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