Approximation of Detrusor Contractility with Respect to Voided Percentage Based on a Watts Factor–Inspired Equation in Multiple System Atrophy

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HYPOTHESIS / AIMS OF STUDY

- Underactive bladder is common in multiple system atrophy (MSA), and the presence of large post-void residuals (PVR) is a core clinical feature, suggesting that the evaluations of detrusor contractility is important.
- The bladder contractility index (BCI), defined as Pdet at Qmax + k·Qmax (k = 5 for males, k = 1 for females) did not show a strong correlation with voided percentage (voided volume divided by total bladder volume) in female patients.
- Although detrusor contractility can also be evaluated using the Watts factor (WF), WF calculation is difficult to compute . WF= [(pdet + a)(vdet + b) − ab] / 2π.
- Because WF can be expressed as A·vdet + B·pdet + C·pdet·vdet + D (A, B, C, and D are coefficients), it may be feasible to approximate detrusor contractility with respect to voided percentage.

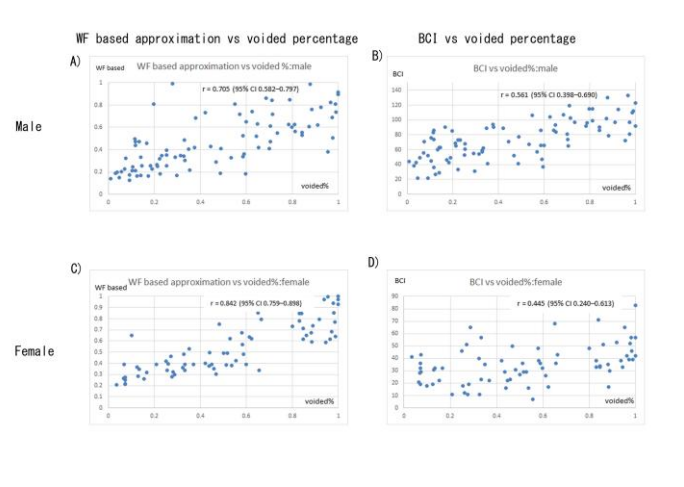
Methods

- We retrospectively reviewed 161 patients with MSA (male: n = 88; female: n = 73) who underwent urodynamic studies including pressure–flow analysis.
- Because voided percentage ranges between 0 and 1, we assumed that the logit-transformed voided percentage could be approximated by a WF-inspired equation.
- logit(voided percentage) = A·vdet + B·pdet + C·(pdet·vdet) + D

  Pdet=Pdet at Qmax, vdet=$Q/2(3V/4\pi)^{\frac{2}{3}}$
- Multivariable linear regression analysis was performed to determine the optimal coefficients.

Results

- Male: logit(voided percentage) = −2.142005 + 0.004291·pdet + 5.361758·vdet + 0.191002·(pdet·vdet)
- Female: logit(voided percentage) = −1.491055 − 0.006559·pdet + 6.214230·vdet + 0.140522·(pdet·vdet).



- The correlation between WF based equation vs voided percentage was significantly higher than BCI vs voided percentage in both gender.

Interpretation and Conclusions

- WF-based contractility approximation showed a stronger correlation with voided percentage than BCI in both sexes.
- The improved association may be attributable to two key modifications: (1) replacing Qmax with vdet incoporating bladder volume, and (2) inclusion of the interaction term pdet·vdet reflecting detrusor mechanical power rather than pressure alone.
- In advanced MSA, detrusor underactivity predominates, and voided percentage may largely reflect contractile performance rather than urethral resistance.
- Therefore, a formula incorporating a power-related component may better approximate detrusor contractility than pressure-based indices alone.