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Title: Understanding the sympathetic effects and intra-individual variability of male voiding and urinary retention

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Introduction:

Neurological control of bladder storage and emptying involves central stimulation of the voiding reflex arc. Autonomic control of blood pressure (BP) and heart rate (HR) involves central activation of the brain vasomotor centre. There is evidence for a connection between the central control centres for bladder function and for BP and HR. For example, in patients with spinal cord injury overactive bladder contractions can be associated with autonomic dysreflexia. Amongst individuals who are neurologically normal, changes in BP with bladder filling and emptying are reported. However, research amongst the neurologically normal is limited and this relationship requires further documentation. Changes in central neural control of bladder function are difficult to measure directly. It has been theorised that changes in BP occurring with changes in bladder volume may provide an indirect measure of these central changes.

Urinary voiding efficiency can be measured by urine flow rate and post void residual volume. Intra-individual variation in voiding efficiency occurs. Flow rates vary with changes in voided volume and with ageing in men. Residual volume varies amongst men with urinary symptoms. Amongst asymptomatic individuals, research investigating intra-individual variation in urinary flow rate and post-void residual volume is currently limited. It is possible that changes in the degree of central activation of the pontine micturition centre may underpin intra-individual variation in urinary flow. These changes might also cause detrusor underactivity.

Aims:

To further explore the relationship between changes in bladder volume and BP and HR amongst individuals who are neurologically normal

To document intra-individual variation in urinary flow and post-void residual volume amongst participants without lower urinary tract symptoms.

Impact:

This pilot study may provide proof of concept for the theory that central control of bladder function and BP and HR are linked. This could lead to improved understanding and future research of intra-individual variation in urinary flow rate and detrusor underactivity. Results may indicate a need to further explore the clinical significance of the effects of bladder volume on BP measurements.

Method:

The study involved 4 participant groups A, B, C and D. BP and HR recordings were taken immediately before and after bladder emptying in all groups. Groups A, B and C involved participants with varying degrees of bladder distension and discomfort.

Group A participants had bladder distension within normal physiological limits and reported uncomfortable levels of bladder fullness prior to voiding. Participants were recruited from the Hagley Outpatients Flow Rate Clinic and from urodynamic clinics at Christchurch Hospital. Group B participants had bladder distension within normal physiological limits and reported reasonable levels of bladder fullness prior to voiding. Group B participants were recruited from the Hagley Outpatient Flow Rate Clinic. Group C involved participants with extreme levels of bladder distension. Participants were men presenting to the Emergency Department (ED) with acute urinary retention. Participants in Groups A, B and C were all men aged 60 years and over with lower

urinary tract symptoms, who had no relevant neurological problems and who passed at least 150mL of urine during bladder emptying.

Intra-individual variation in urinary flow rate was explored in Group D. Participants included male volunteers of all ages with no lower urinary tract symptoms and no relevant neurological problems. Volunteers were recruited from the Urology Department, the University of Otago Christchurch Clinical School and the Summer Studentship programme. In addition to recording BP and HR, participants self monitored their urine flow rate and bladder residual volume for each void over 24 hours using standing uroflowmetry and bladder ultrasound.

Postural hypotension was controlled for where possible. Data analysis was completed using Microsoft Excel 2008

Results:

Data was recorded for 52 Flow Rate Clinic patients, 10 urodynamic clinic patients, 6 ED retention patients and 8 volunteers. After exclusions, the final group numbers were: Group A 18, Group B 19, Group C 6, Group D 8 participants.

For each group the mean change in BP and HR, comparing post-void with pre-void were:

Group A: systolic BP -19.6mmHg, diastolic BP -8.5mmHg and HR -2.7bpm.

Group B: systolic BP -7.1mmHg, diastolic BP -1.8mmHg and HR -1.3bpm.

Group C: systolic BP -18.5mmHg, diastolic BP -11.8mmHg and HR -5.2bpm.

Group D: systolic BP -2.3mmHg, diastolic BP -1mmHg and HR 1.7bpm.

In Group D considerable intra-individual variation in flow rate was seen but no pattern of flow rate variation could be identified with regards to time. Intra-individual variation in residual volume was documented but was of no clinical relevance.

Conclusion:

This study demonstrates that amongst neurologically normal individuals mean systolic blood pressure decreases with bladder emptying. These results support the theory that there is a link between the brain vasomotor and micturition centres. This study also documented variation in male intra-individual urinary flow rates amongst participants without lower urinary tract symptoms. No pattern in flow rate variation with regards to time over 24 hours was identified. Intra-individual variation in residual volume was documented but was of no clinical relevance.