#365 EFFECT OF BLADDER FILLING STATUS ON BLOOD PRESSURE AND HEART RATE

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Introduction

Urinary voiding function can be measured by urinary voiding flow rate and residual volume. It can be further assessed by urodynamic studies including detrusor pressure and flow measurements. Factors affecting voiding efficiency include bladder muscle contractility, outlet obstruction and neurological dysfunction[1]. Intra-individual variation in voiding efficiency can occur. Flow rates vary with the voided volume and with ageing in men. Residual urine volume also varies.

Autonomic control of blood pressure (BP) and heart rate (HR) involves the pontine vasomotor centre. There is evidence for a functional interaction between the control of bladder function, BP and HR[2]. For example, in patients with spinal cord injury bladder contractions can cause autonomic dysreflexia and significant hypertension, and amongst women with postural orthostatic tachycardia syndrome[3], overactive bladder symptoms are frequently reported. Amongst individuals who are neurologically normal, changes in BP with bladder filling and emptying are reported and can be exemplified in the condition of micturition syncope.

The current study measured the effects on BP and HR of bladder filling and emptying in men with lower urinary tract symptoms (LUTS), and for comparison in a small group of younger healthy males over 24-hours of home monitoring.

Methods and Materials

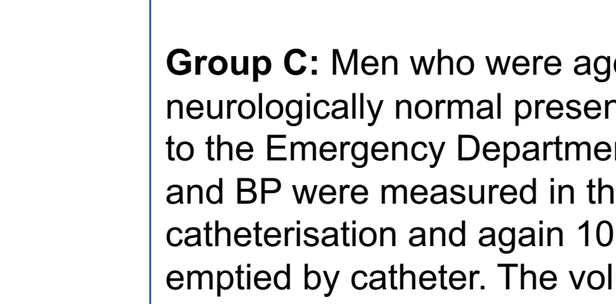
There were 4 groups of men. Those with neurological disease were excluded. All gave informed consent.

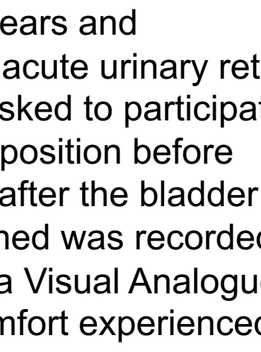
Group A: Men with LUTS were recruited from a Urology Department clinic. The IPSS was recorded for each. The study involved standing for 2 minutes to allow for postural equilibration, then measuring HR and BP with a full bladder, and again immediately after voiding while still standing. BPs were measured using the same automated upper arm cuff. The flow rate and voided volume were measured. Any residual urine was measured by ultrasound.

Group B: Men with LUTS having urodynamics were invited to participate and BP was measured prior to filling. The bladder was then filled in the supine position on the tilt table. The table was tilted to the standing position, and after 2 minutes for postural calibration, the HR and BP were measured. These were measured again immediately after voiding. The residual volume was then calculated from filling volume minus the voided volume.

Group C: Men who were aged > 60 years and neurologically normal presenting with acute urinary retention to the Emergency Department were asked to participate. HR and BP were measured in the supine position before catheterisation and again 10 minutes after the bladder was emptied by catheter. The volume drained was recorded. Participants were asked to record on a Visual Analogue Scale (VAS) the degree of pain/discomfort experienced by the retention, and again after its relief.

Group D: A group of younger men recruited from the Urology Department undertook 24-hour home monitoring of HR and BP before and after each void. The voided volume and residual volume were measured by each participant using the bladder scanner.





Results

Group A: Men with LUTS. Data was collected from 52 patients (mean age 72.3 years). Table 1 shows mean BP and HR according to bladder status. After voiding there was a significant fall in both systolic and diastolic BP. The change in systolic BP correlated with the voided volume, r = -0.392 ($p < 0.01$), but no significant relation was found between systolic BP change and patient age. The fall in diastolic BP was smaller, while the HR remained relatively unchanged.

Group B: Urodynamics. This group included 10 patients undergoing urodynamics. The mean age was 71.4 years. During filling, in the standing position, the mean change in systolic BP from bladder empty to bladder full was 27 (range 2-69) mmHg. On voiding, the mean decrease in systolic BP from full to empty was -8.4 (range 6 to -55) mmHg. The fall in systolic BP was wide ranging and not statistically significant.

Group C: Acute urinary retention. Data was obtained for 6 patients presenting with acute urinary retention to the Emergency Department. The mean pre-catheterisation pain score using the VAS was 6.7 (2-10). The post-bladder catheterisation pain score was 0 for all. Table 2 shows mean BP and HR before and after catheterisation.

Group D: Asymptomatic young male volunteers. There were 8 healthy male volunteers with mean age 26.1 years. The number of voids in 24 hours ranged from 3 to 8. Mean pre-void systolic BP was 126.4 mmHg and post-void systolic BP was 124.0 mmHg. Only minor variation in flow rates was noted.

Table 1. Group A mean BP and HR according to bladder status n=51

	Bladder full (range)	Post-voiding (range)	Difference (SD)
Systolic BP (mmHg)	156.7 (220-108)	148.8 (218-107)	-7.9 (15.3)*
Diastolic BP (mmHg)	86.7 (110-65)	83.5 (106-66)	-3.2 (7.1)*
HR (beats per minute)	80.0 (139-45)	77.6 (105-41)	-2.4 (14.6)
Voided volume (mL)	212 (8-704)		

* $p < 0.001$, for paired t-test, pre-void compared with post-void.

Table 2. Group C mean BP and HR before and after catheterisation n=6

	Acute retention	After bladder drainage	Difference (SD)
Systolic BP (mmHg)	156.8	138.3	-18.5 (11.7)*
Diastolic BP (mmHg)	87.2	75.3	-11.9 (11.7)
HR (beats per minute)	81.3	76.2	-5.1 (6.3)

*$p < 0.05$

Discussion

The BPs and HRs all decreased with bladder emptying. Furthermore, the drop in systolic BP correlated significantly with the voided volume. In the younger asymptomatic volunteers (Group D), differences in BP and HR were relatively small. It is thought that cardiovascular sympathetic activity increases with age while parasympathetic activity decreases with age. It is possible that older individuals may be less able to adapt to changes in BP leading to more pronounced BP changes with bladder emptying. Based on the findings of this study it is clear that the relationship between bladder volume and BP requires further investigation.

One clinical implication of this study is that bladder filling status may need to be standardised when monitoring BP in older adults and considered amongst many other potential variables. Guidelines for the management of hypertension in adults recommend that multiple measurements are required for a comprehensive BP assessment and that primary prevention of cardiovascular disease is based on a patient's absolute risk profile rather than BP status alone. Based on these recommendations the clinical significance of changes in BP with changes in bladder volume is unclear. Further research is required to determine the clinical significance of this relationship.

Conclusions

This study has confirmed that bladder distension and discomfort can influence BP. This may have an effect on how BP measurement is considered as part of the risk assessment of cardiovascular disease. Further research is needed.

References

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