

## THE VALUE OF A FREQUENCY-VOLUME CHART WITH POST-VOID RESIDUALS IN A NORMAL POPULATION OF INSTITUTIONALIZED OLDER PEOPLE

### Hypothesis / aims of study

Earlier research in nursing home residents has shown that a nocturnal urine volume  $\geq 625$  ml is a risk factor for nocturnal urinary incontinence (UI) in nursing home residents (1). Nocturnal bladder overdistention could thus be an etiopathogenetic mechanism for nocturnal UI in older people. If this nocturnal or intermittent overdistention syndrome exists, one could expect that it also coincides with intermittent or nocturnal residual urine or retention (2).

In this study the use of an extended frequency-volume chart with documentation of the post-void residual urine volume after each micturition was evaluated to explore the link between intermittent overdistention of the bladder and nocturnal polyuria (NP).

### Study design, materials and methods

A multicentre prospective study was conducted between April 2014 and February 2015 in 5 nursing homes amongst 73 older residents, recruited by convenience sampling. For each resident the ICIQ-mLUTS/fLUTS, SF-36, a Katz Index of Independence in Activities of Daily Living and Mini-Cog were obtained. A frequency-volume urine chart with post-void residuals (FV<sub>PVR</sub>) was kept for 24 hours: voided volume (VV) (ml), incontinence (g) and post-void residual (PVR) (ml; BladderScan® BVI 9400). Nocturnal Polyuria index (NPI)  $>33\%$  was used to define NP. Bladder capacity (BC) was calculated as the sum of voided volume and PVR. Bladder Nocturnal Distention Index (BNDI) was defined as the ratio of maximum nocturnal BC to maximum diurnal BC.

### Results

**Demographics:** The mean age of the 73 studied residents was 84+/-7 years and 69% were women. All of them scored negative for dementia (Mini-Cog). The median total score on the Katz Index was 3 [IQR: 2-5]. Scores on the fLUTS and mLUTS were 10 [6-14] and 10 [5-12], respectively.

**Symptoms:** Data about UI obtained from the FV<sub>PVR</sub> showed that 59% was continent, 22% had nocturnal and diurnal incontinence, 18% pure diurnal and 1% pure nocturnal incontinence. Median incontinence volume in the incontinent residents was 72g [IQR: 12-412g]. Nocturia was seen in 60 of the 73 residents (82%) and 31 residents (43%) gets up twice or more at night for voiding. The prevalence of UR in the residents, depending on the definition of UR, was 79% (PVR $>50$ ml), 53% (PVR $>100$ ml), 29% (PVR $>150$ ml) and 15% (PVR $>200$ ml). The median post-void nocturnal residual volume of 45 ml [IQR: 26-80 ml] was significantly higher than the median post-void diurnal residual volume of 35 ml [IQR:18-60 ml] ( $p=0.04$ ). The prevalence of NP was 64% (median NPI: 54% [IQR: 43-68%]). Comparing the NP group to the group without NP (median NPI: 26% [IQR: 23-30%]) no significant differences were detected between the groups in age, gender, functional status, QoL (all items of the SF-36), bothersome LUTS, duration of the night, UI and total urine volume. Voiding characteristics of and differences between both groups are described in Table 1.

**Bladder overdistention:** A positive correlation was found between the BNDI and maximum nocturnal PVR ( $r_s: 0.538, p<0.001$ ). The ratio nocturnal/diurnal maximum VV correlated with the BNDI ( $r_s: 0.276, p=0.018$ ), but there was no correlation with maximum nocturnal PVR alone. The BNDI was significantly higher ( $p=0.006$ ) in the NP group (129% [IQR:76-181%]) compared with the non-NP group (54% [36-138%]) (Figure 1). Moreover, 66% of the residents with NP had a BNDI $>100\%$ . Lastly, no significant correlation was found between BNDI, QoL and functional status for all residents and between LUTS in men. In female residents the total fLUTS score was positively correlated with BNDI ( $r_s: 0.332, p=0.019$ ).

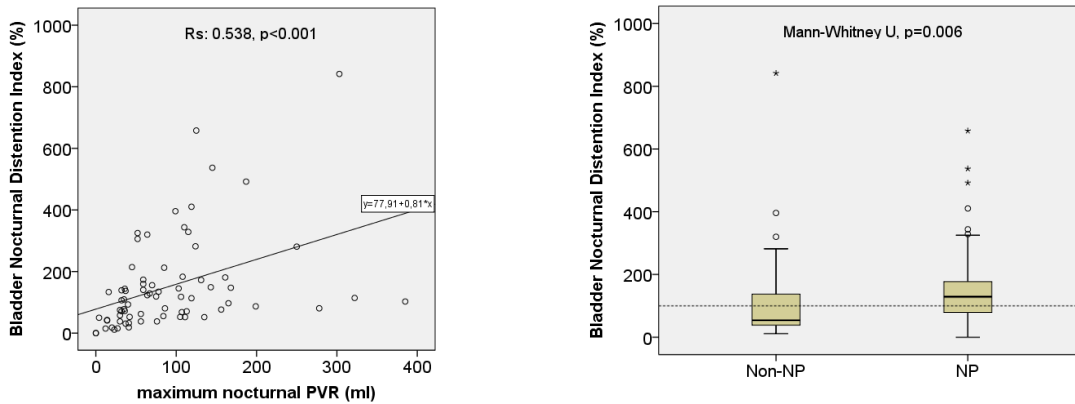
**Table 1: Voiding characteristics of residents without and with NP**

Variable	Non-NP (n=26) Median [IQR]		NP (n=47) Median [IQR]		p-value (Mann-Whitney U) Non-NP vs NP	
	Diurnal	Nocturnal	Diurnal	Nocturnal	Diurnal	Nocturnal
Urine volume (ml)	1080 [711-1389]	339 [208-436]*	660 [401-810]	680 [516-1020]#	<0.001	<0.001
No. of voids	6 [5-7]	1 [0-1]*	6 [4-7]	2 [1-3]*	ns	0.003
Average VV (ml)	180 [142-225]	161 [100-281]	119 [90-179]	240 [153-340]*	0.001	0.047
Max. VV (ml)	265 [244-364]	213 [160-300]*	200 [150-250]	275 [200-475]*	<0.001	0.024
Average PVR (ml)	51 [23-75]	39 [22-71]	29 [17-51]	55 [26-87]*	0.041	ns
Max. PVR (ml)	86 [42-200]	58 [32-101]*	52 [32-105]	75 [36-131]#	ns#	ns
Average BC (ml)	238 [179-329]	236 [175-340]	170 [123-207]	324 [210-428]*	<0.001	ns
Max. BC (ml)	364 [270-461]	265 [214-385]*	242 [184-315]	411 [275-527]*	<0.001	0.022

Bladder capacity = voided volume + PVR

\*p-value<0.05 between diurnal and nocturnal voiding characteristics(Wilcoxon)  
#Borderline not significant, p<0.06

Figure 1: BNDI by maximum nocturnal PVR and in residents with non-NP and NP



#### Interpretation of results

In this study, we describe the voiding patterns of 73 cognitive intact institutionalized older people with moderate functional impairment. Only 41% of residents had UI, but nocturia and NP were present in 82% and 64%, respectively. Interestingly, we found that residents with NP had larger nocturnal VV and BC, but lower diurnal VV and BC than residents without NP.

In the absence of a formula for bladder (over)distention and cut-off values for specific populations, a BNDI was calculated. The BNDI derived from a FV<sub>PVR</sub> urine chart could be a quantitative method of comparing maximum nocturnal BC with maximum diurnal BC and could be considered as a measure of nocturnal bladder (over)distention. These results could suggest that 66% of the residents with NP had nocturnal bladder (over)distention (BNDI>100%), whereas half of the residents with NP had a maximum bladder capacity of more than 1.29 times their maximum diurnal BC. The positive correlation between PVR and BNDI suggests that the use of a frequency-volume chart or bladder diary including the measurement of PVR after micturition could increase clinical value as the PVR appears to contribute significantly to the BNDI, independently of the VV.

#### Concluding message

In our population of institutionalized older people, nocturia, NP and importantly also PVR was found to be highly prevalent. Residents with NP had higher nocturnal VV, higher maximum nocturnal BC and higher BNDI. Of note, the value of our proposed BNDI as a measure for (over)distention should be further validated using urodynamics in a population with and without nocturnal symptoms. Nevertheless, this is the first study that shows a positive correlation between nocturnal bladder (over)distention (as defined by BNDI) and UR in a population of institutionalized older people. This underscores the potential to further study the PVR within FV<sub>PVR</sub> in older people with nocturnal LUTS in order to investigate whether our hypothesis on nocturnal bladder (over)distention could be an etiopathogenetic mechanism for nocturnal UI in older people.

#### References

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2. Denys, MA., Decalf, V., Goessaert, AS., Petrovic, M., Van Kerrebroeck, Ph EV., & Everaert, K. (2015). Lower urinary tract symptoms in an older population: novel concepts for future research. Accepted in Minerva Urologica e Nefrologica

#### Disclosures

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