JAMDA xxx (2016) 1–5

JAMDA

journal homepage: www.jamda.com

Original Study

Circadian Variation in Post Void Residual in Nursing Home Residents With Moderate Impairment in Activities of Daily Living

Veerle Decalf MSc [a,*], Anja Huion MSc [b], Marie-Astrid Denys MD [c], Candy Kumps MSc, PhD [a], Mirko Petrovic MD, PhD [d], Karel Everaert MD, PhD [c]

[a] Department of Medical Sciences, Ghent University, Ghent, Belgium
[b] Department of Education, Health and Social work, University College Ghent, Ghent, Belgium
[c] Department of Urology, Ghent University Hospital, Ghent, Belgium
[d] Department of Geriatrics, Ghent University Hospital, Ghent, Belgium

Keywords:
Frequency-volume charts
nocturia
nursing homes
postvoid residual
residual fraction

A B S T R A C T

Background: Despite the conflicting evidence about postvoid residual (PVR) and its variation in time and corresponding voided volume (VV), studies with urinary diaries and systematic measurements of PVR after each void have never been conducted in nursing home (NH) residents.
Objective: To describe the circadian rhythm of PVR and residual fraction (RF, the net quantity of PVR) and to identify the time window with the highest PVR and RF.
Design, setting, and participants: A multicentre prospective study conducted between 2014 and 2015 in 5 Belgian NHs. A convenience sample of cognitively intact residents completed a 24-hour frequency volume chart with PVR.
Results: Participants (n = 73) had a median age of 84 years (interquartile range 82-89) and moderate impairment of activities of daily living; 69% were women.
In residents with nocturia, mean PVR was higher during the night [45 mL (26–80)] than during the day [36 mL (18–61)]. In residents without nocturia no difference was detected.
In spite of the variation between diurnal and nocturnal VV and PVR in residents with nocturia, all residents emptied their bladder as effectively during daytime as during nighttime [mean RF = 20% (12–32)].
Maximum PVR and RF in residents with nocturia (n = 57) showed a circadian variation. The highest PVR and RF were found during the day. The PVR and RF of the first morning void were an indicator of the maximum nocturnal PVR and RF.
Conclusions: PVR and VV should be measured in NH residents during the waking hours (first morning void excepted) to detect the clinically relevant maximum PVR and RF.

Postvoid residual (PVR) is important in the evaluation of lower urinary tract diseases (LUTDs) and can be a sign of bladder outlet obstruction and detrusor underactivity. Currently, there are no clear cut-off values for the normal range of PVR. In older people, even the clinical impact of PVR is unclear, and an association between PVR and urinary tract infections (UTIs) has not been proven yet.[1,2] The International Scientific Committee on the 5th International Consultation on Incontinence (ICI) does not recommend the measurement of PVR in the initial assessment of frail older people with urinary incontinence (UI). However, they state that there is evidence for PVR testing in a selected group of frail older people.[3,4]

In a study with 464 patients aged ≥70 years in an internal medicine department, 24% of the patients had a PVR ≥150 mL.[5] In nursing homes (NHs), 2 studies reported a PVR >100 mL in 27% to 35% of the residents.[6,7]

The intraindividual variation of PVR in older persons is high and depends partially on the time of the day but also on differences in prevoid volumes.[8,9] A study with 93 patients with lower urinary tract symptoms (LUTS) showed that the residual fraction (RF, the net quantity of PVR) correlates stronger with Qmax than PVR does. Moreover, an inversely proportional relationship was observed between Qmax and PVR.[9]

The International Continence Society (ICS) teaching module "Measurement of Post-void Residual Urine" states that PVR can also be

The authors declare no conflicts of interest.

* Address correspondence to Veerle Decalf, MSc, Department of Urology, Ghent University Hospital, De Pintelaan 185, Ghent 9000, Belgium.
E-mail address: veerle.decalf@uzgent.be (V. Decalf).

http://dx.doi.org/10.1016/j.jamda.2016.11.022
1525-8610/

measured after a normal toilet visit instead of after a uroflowmetry but warns that there is no evidence regarding the reliability of the PVR. Although it is advisable to ask if the voiding was similar to a typical micturition in a patient's daily life, unrepresentative results may be obtained when voiding occurs in unfamiliar surroundings. Furthermore, no recommendations exist about the time of the day at which the measurement must be performed.[1] Measurement of PVR in NH residents seems most reliable after an unforced void and in their familiar environment. PVR can be quantified in a noninvasive manner by making use of portable ultrasound devices that can be used by trained nurses.[10]

Despite the conflicting evidence about PVR and its variation in time, no studies with urinary diaries and PVR measurement after each void in frail older people have been published. Studying PVR in frail older people without acute illness is more practically feasible in NHs than in the community.

Knowing the circadian variation of PVR in NH residents allows to determine a time window in which the measurement of PVR, and by extension RF, produces the highest (and thus most diagnostically relevant) values.

Consequently, this study in a population of cognitively intact NH residents was performed (1) to describe the circadian rhythm of PVR and RF and (2) to identify the part of the day with the highest PVR and RF.

Methods

This multicentre prospective observational study was conducted between April 2014 and February 2015. The study population consisted of a convenience sample of 157 residents of 5 Belgian NHs with 775 residents in total. All NHs have single rooms with private facilities.

Nurses of the NHs screened all 775 residents for inclusion in the study. Inclusion criteria were as follows: cognitively intact (no indication of dementia on the Belgian modified Katz Index), >65 years without indwelling urinary catheter, urostomy, fecal incontinence, hemodialysis, preterminal or terminal state of life.[11] Exclusion criteria were as follows: a positive screen on the Mini-Cog (additional screening for dementia in all participating residents), continuous leakage, and global polyuria (24-hour urine production >2.8 L).[12–14]

For study purposes, the scores on the 6 items of activities of daily living (ADL) (ie, bathing, dressing, transfer, going to the toilet, continence, and eating) on the Belgian modified Katz Index were reduced into the scores yes/no for independence in each of the 6 functions. A score of 6 indicates fully preserved function, a score of 4 indicates moderate impairment, and a score of 2 or less indicates severe functional impairment.[15]

In the frequency-volume urine chart with PVRs (FVC_{PVR}), the following parameters were registered for 24 hours: voided volume (VV) (mL), UI (g), PVR (mL), time of going to bed, and time of getting up. In each toilet, a bidet was placed to allow the resident to void in a sitting position. After every void, the resident called the study nurse, who measured VV, leakage, and PVR using a portable ultrasound device (BladderScan BVI 9400, Verathon, Inc) within 30 minutes after voiding. A previous study showed that Bladderscan BVI is an accurate alternative to bladder catheterization for noninvasive estimation of PVR.[10]

In this real-life study, voiding habits were not interfered by toileting rounds, and all residents were allowed free fluid and solids intake. Participants got a nondisruptive nighttime care approach. Data collection was performed by nursing students and the investigators. The nursing students were trained in data collection and the use of the portable ultrasound device.

Measurements derived from the FVC_{PVR} were defined in accordance with the report from the standardization subcommittee of the ICS.[12] Urine production was interpreted as the sum of all voided and incontinence volumes. Bladder capacity (BC) was calculated as the sum of VV and PVR. Low BC was defined as <300 mL and nocturnal polyuria (NP) as a nocturnal urine volume of >33% of 24-hour urine volume. RF is the net quantity of PVR.[9] The following formula was used with PVR and accompanying void:

$$RF = \frac{PVR}{PVR + VV} \times 100\%$$

SPSS Statistics v.23.0 (IBM Corp, Armonk, NY) was used for data analysis. Missing values in questionnaires or FVC_{PVR} were not estimated or replaced, except in case of one missing value in the FVC_{PVR} during daytime. Those missing values were replaced with the mean of the corresponding diurnal values (n = 14). Results are reported in terms of median and interquartile range. Nonparametric tests were used to compare unpaired (Mann-Whitney *U* test) and paired continuous variables (Wilcoxon test). Statistical significance was defined as a P value < .05.

We obtained the local ethics committee approval (2014/0293), and all participating residents gave their written informed consent.

Results

Breakdown of Participants

From the 157 informed residents, a written informed consent was obtained from 115 residents, and 94 of them completed the study successfully. The reasons for not ending or being excluded from the study are presented in Figure 1.

Resident Characteristics

The median age of the 73 studied residents was 84 years (range, 82–89), and 70% (n = 51) were women. The median total score on the Katz Index was 3 (range, 1–4), indicating a moderate impairment in ADL. From the 73 participating residents, 556 voids were recorded.

Comparison of Diurnal and Nocturnal FVC_{PVR} Characteristics

Nocturia was a prevalent symptom [≥1 void/night: 78% (n = 57), ≥2 voids/night: 41% (n = 30)], which could be explained by the presence of NP (n = 42), a low BC (n = 6), or a combination of both (n = 9). A comparison between nocturnal and diurnal FVC_{PVR} characteristics in residents with and without nocturia is presented in Table 1.

All residents had a higher mean nocturnal VV and BC compared with daytime values.

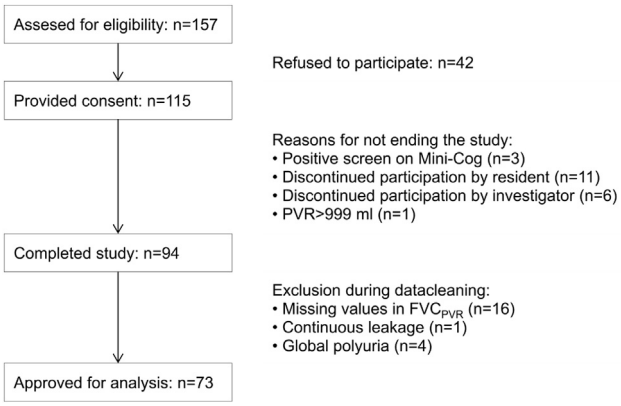

Fig. 1. A flow chart of the study's progress, detailing participant numbers during inclusion, data collection, and data cleaning.