

THE SIGNIFICANCE OF NATURAL FILLING BY THE PRODUCTION OF URINE DURING CYSTOMETRY

Hypothesis / aims of study

An influencing factor that can have a disturbing effect on the urodynamic outcome data is natural filling by the production of urine. On average daily urine production is between 0.7 and 2.1 ml/min [1]. The artificial filling rate of 10-100 ml/min, which is usually accepted, is based upon the premise that, normally, the natural bladder filling disturbs only to small extent the bladder capacity as measured by retrograde filling during cystometry [2]. However, in a retrospective study, Heesakkers et al. suggested natural bladder filling played a substantial role during filling cystometry and had a disturbing influence on calculated urodynamic parameters [1]. In their study, the mean natural filling rate was 6.1 ml/min and it was much higher than expected. In addition, in 42% of the investigations, the measured bladder volume was more than 110% of the infused volume. The aim of this prospective study is to determine what the natural filling rate is and to assess the predictors associated with high natural filling rate during cystometry.

Study design, materials and methods

Between October 2005 and March 2006, we performed conventional urodynamic studies in 101 consecutive patients according to ICS standards. Duet Logic G/2 equipment (Medtronic, Copenhagen, Denmark) was used for the investigations. First, free uroflowmetry was performed and the post-void residual urine (PVR) was measured by catheterization. Next filling cystometry was performed with a filling rate of 50 ml/min. After filling cystometry, pressure flow study was done. To register the PVR, the patients were catheterized once again. We measured the exact infused volume during artificial filling, voided volume and PVR after pressure flow study to examine the difference between the measured bladder volume (voided volume plus PVR) and the infused volume. And also, we measured the exact time span during urodynamic investigations. The total duration was defined as the time spent from the insertion of catheter for cystometry to the cessation of catheterization for the check of PVR after pressure flow study, not just the time for artificial filling. Before urodynamic investigations, we examined the serum creatinine levels, specific gravity of urine, and the mean daily urine output from the 3-day frequency-volume chart in each patient. No instructions were given to the patients either to drink excessively before coming to the urodynamic investigation or refrain from voiding before the investigation. In the cases of development of urine leak during the studies and inaccurate measurement of volume or time span, the patients were excluded in our analysis. Finally, we analyzed the natural filling rates in 34 patients. The natural filling rate was defined as the difference between the measured bladder volume and the infused volume divided by total time span.

Results

The mean age of all 34 patients was 62.5 years (range 34 years to 84 years). The main indications of urodynamic investigations were BPH and Neurogenic bladder. In all patients, the mean volume of artificial filling was 304.4 ml (SD +/- 100.5 ml) and the mean measured volume that is the voided volume plus PVR was 337.2 ml (SD +/- 106.5 ml). The mean total time span was 24.2 min (range 15.0 min to 41.5 min) and 7.2 min for artificial filling. The mean volume of natural filling and the mean rate of natural filling was 32.8 ml (12.1% of artificial filling) and 1.3 ml/min, respectively. Dividing the patients into the three groups according to the proportion of the natural filling to the artificial filling (Group 1; less than 10% of artificial filling volume, Group 2; 10-20%, Group 3; more than 20%), 18 patients (52.9%) belonged to Group 1 and 11 to Group 2 (32.4%). Only 5 patients (14.7%) belonged to Group 3. There was no significant difference between the three groups with regard to age, serum creatinine levels, specific gravity of urine, and the mean 24 hour-urine volume ($p > 0.05$). Also, there was no statistical difference in the mean time span as well as the mean artificial filling volume in the three groups. The mean natural filling rate was 0.76 ml/min in Group 1, 1.71 ml/min in Group 2, and 2.79 ml/min in Group 3, respectively. As the total time span was increased, the artificial filling volume and the measured bladder volume were increased, but not natural filling rate.

Interpretation of results

In our study, the natural filling was not as substantial as the result of Heesakkers. However, the disturbing effect on the urodynamic outcome data was still demonstrated. Although the mean natural filling rate of 1.3 ml/min during our investigations is similar to that in normal physiologic conditions, the influence of natural filling can be more increased according to the prolongation of the time span of the investigation. Therefore, the efforts to decrease the total time spent in urodynamic investigation should be made. And, in the circumstances when the duration is prolonged, more attention was paid to interpreting the data and the presumed volume by natural filling should be considered. Unfortunately, our study could not elucidate the predictors of high natural filling rate during cystometry.

Concluding message

It seems that natural filling by the production of urine plays a substantial role during filling cystometry and has a significant influence on interpreting the urodynamic parameters related to capacity. It should be considered in practicing urodynamic investigations. Especially, when the duration of investigation is increased, more attention should be paid.

References

1. Neurourol Urodyn 2003;22:243-5
2. Neurourol Urodyn 2002;21:167-78

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HUMAN SUBJECTS: This study was approved by the IRB of clinical research institute in Kangwon National University Hospital and followed the Declaration of Helsinki Informed consent was obtained from the patients.