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BLADDER BEHAVIOUR IN RESPONSE TO DIURESIS: NORMAL BLADDER VS. OVERACTIVE BLADDER

Hypothesis / aims of study

When urine output is increased, the frequency of micturition is increased. This is a general understanding of bladder behaviour in response to diuresis. However, our previous study (1) showed that in addition to micturition frequency, voided volume was also increased, suggesting that the bladder is capable of increasing its capacity in the diuretic condition. In the present study, using a frequency volume chart (FVC), we investigate the responses of micturition frequency and bladder capacity to diuresis in healthy normal volunteers as well as in patients with overactive bladder (OAB). In addition, this study also evaluates whether bladder behaviour in response to diuresis can differentiate OAB from normal bladder.

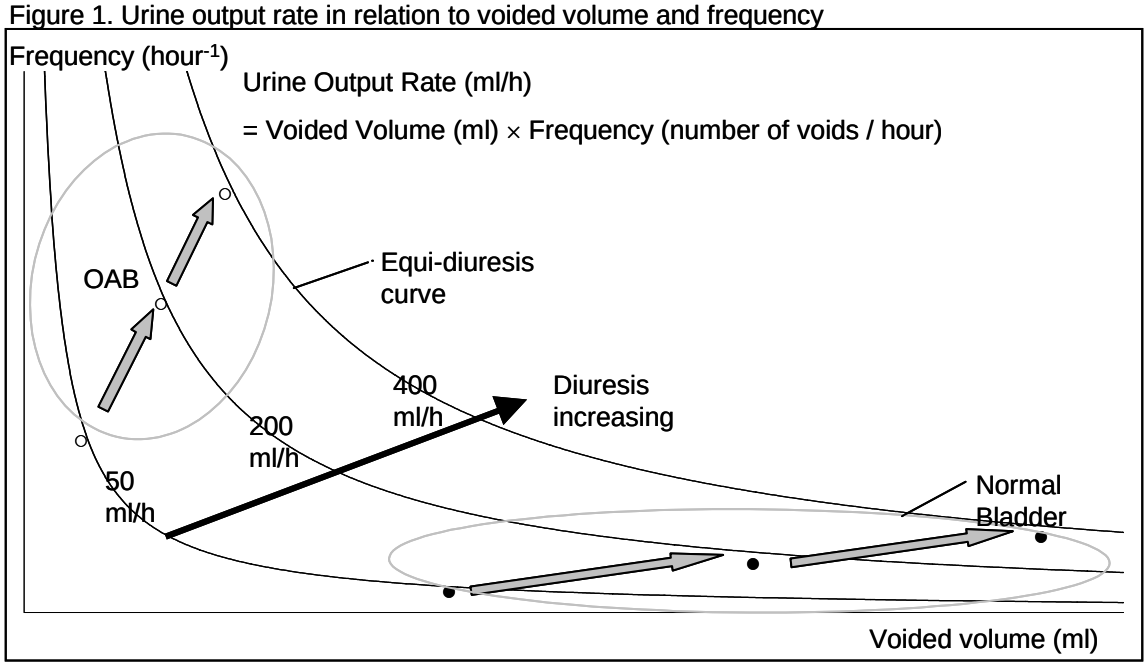
Study design, materials and methods

Forty female normal volunteers (26 to 86 y. o.) without lower urinary tract symptoms and 31 female OAB patients (39 to 77 y. o.) were studied. The eligibility criteria of OAB in this study included urgency and frequency (more than 8 times void per 24 hours). All subjects were asked to complete a 3-day FVC in the daytime. Hourly urine output rate was calculated by dividing the volume voided by the interval between 2 successive micturitions. Thus, the following three parameters were used for this study: 1) voided volume (ml) as bladder capacity at voiding, 2) micturition frequency (number of voids / hour: h^{-1}) and 3) urine output rate (ml/h). The bladder responses to diuresis were assessed by using the frequency and volume plots.

Results

In response to diuresis, both bladder capacity and micturition frequency increased in each subject including normal volunteers and patients with OAB; however, the rates of response were not equal. The normal bladder demonstrated a volume-dependent response to diuresis, whereas the OAB showed no such response, but rather a frequency-dependent response.

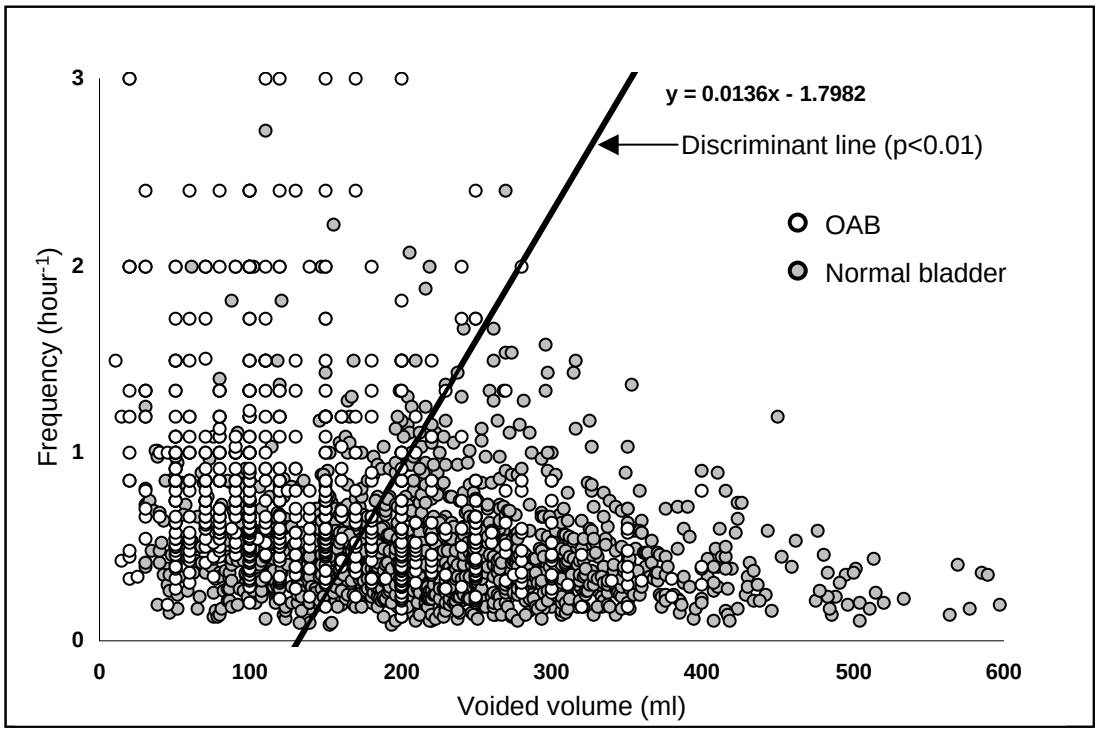
Figure 1. Urine output rate in relation to voided volume and frequency



Interpretation of results

The differences between the 2 types of responses to diuresis are more apparent when data on bladder behaviour are presented as a nomogram (Figure 1). Using a formula of Urine output rate (ml/h) = Voided volume (ml) × Frequency (h^{-1}), hyperbolic curves were generated for a continuum of urine output rates. Tracings of bladder responses to diuresis in normal subjects diverged sharply from those of patients with OAB. The response from normal subjects was clearly volume dependent: frequency and volume plots hugged the x-axis of the nomogram, showing increased voided volume as the primary adaptation to diuresis. In contrast, the response in patients with OAB was clearly frequency dependent: frequency and volume plots hugged y-axis of the nomogram, which represents increased frequency of micturition. Thus, normal bladders appear to have a high-volume/low-frequency response to diuresis, whereas OABs have a low-volume/high-frequency response. Using linear discriminant analysis, the frequency and volume plotted area of normal bladder was significantly different from that of OAB ($p<0.01$) when all the subjects' micturitions were plotted in the same frequency-volume plane (Figure 2).

Figure 2. Comparison of data from subjects with OAB vs. those with normal bladder



Concluding message

Although the mechanism by which that bladder capacity is increased with an increase in diuresis remains to be clarified, this response may be the characteristic of normal bladder behaviour. OAB behaviour lacks this response to diuresis; instead, micturition frequency increases. The frequency and volume plots, therefore, seem to be useful for discriminating normal bladder and OAB behaviour. In conclusion, the micturition data derived from FVC can reflect diurnal bladder behaviour. The clinical implication of this study is that FVC would be able to represent a nomogram for the evaluation of OAB.

Reference

(1) Neurourol Urodyn 15: 429-431, 1996