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DOES RELATIONSHIP BETWEEN MAXIMUM FLOW RATE AND BLADDER VOLUME ACCOUNT FOR THE CIRCADIAN CHANGES IN URINARY FLOW IN PATIENTS WITH BENIGN PROSTATIC HYPERPLASIA?

AIMS OF STUDY

In patients with benign prostatic hyperplasia (BPH), the status of micturition is never stable all day. We often hear from the patients that a urinary stream is worse in the early morning compared to the daytime In addition, the study using a home uroflowmeter has shown that there is a circadian variability in urinary flow values in men with BPH obstruction [1] Since maximum flow rate (Qmax) during micturition is known to be dependent on initial bladder volume (voided volume without residual urine), bladder volume at the beginning of voiding seems to be a primary factor in determining the quality of different voiding in a day However, the above circadian change has never been studied in relation to bladder volume (BV)

In the present study, we evaluated both Qmax and BV in patents with obstructive BPH as well as in healthy males The relation between Qmax and BV was further investigated to determine whether this relation is altered in BPH patients, and the altered relation can account for the circadian change in urinary flow

MATERIALS AND METHODS

20 patients with bladder outlet obstruction secondary to BPH were the subjects for this study The diagnosis of obstruction was made by pressure-flow study Mean age of these patients was 70years (range 68 to 78) All patients were hospitalized for the surgical treatment of BPH (TUR-P) The study was performed early in the hospital stays before TUR An uroflowmeter (Micioflow, Life-Tech) was used for the measurement of urinary flow During the first 2 days, these patients were asked to void, as they would do normally Then, they were asked to void with various BV to construct a urinary flow-BV curve for each patient For the measurement of residual urine volume, a BladderScan (BVI-5000, Diagnosis Ultrasound) was used immediately after urination BV was defined as. voided volume plus residual urine volume A total of five healthy male volunteers 27 to 35 years old (mean 29 5) served as normal controls

RESULTS

Relationship between Qmax and BV was adequately fitted by a quadratic equation in each subject Optimal bladder capacity (OBC) that gives the highest Qmax was defined as the intersection of the axis of the quadratic curve with the volume axis (Fig1A and 1B) OBC was significantly smaller in patients with BPH than that in healthy males (Table1)

The shape of the quadratic curve differed considerably between the two groups The curves for healthy males had the rather flat top (a near-plateau), indicating that Qmax was maintained over a wide range of BV (Fig.1A) In contrast, in BPH patients the curve was changed to a typical quadratic curve with the distinct peak (Fig 1B) Thus, Qmax was decreased immediately when the BV exceeded the OBC

A circadian change in Qmax was noticed in BPH patients Qmax was significantly lower during the midnight to morning period, when compared with the daytime period (Table2). During daytime, these patients urinated at the BV near the OBC, which maintained the high Qmax (Fig 2) However, from midnight to early morning, the BV was consistently observed to be larger than the OBC in individual patients, which resulted in a decrease in Qmax (Fig.2).

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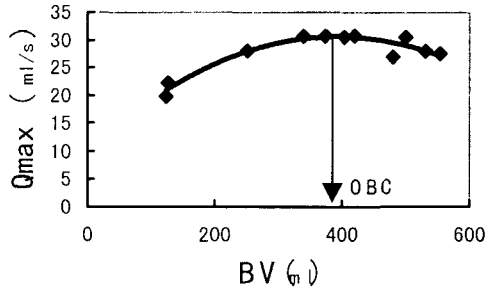
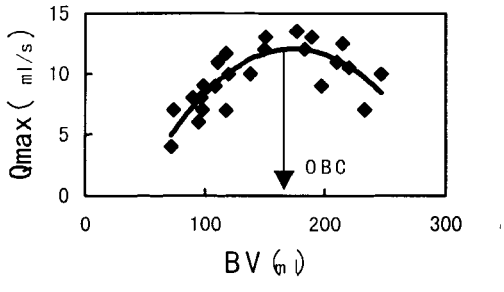
CONCLUSIONS

The present study demonstrates that in patients with BPH obstruction a typical quadratic relation exists between Qmax and BV Thus, Qmax reaches the highest value at OBC, which corresponds to a peak of the quadratic curve. However, Qmax is decreased with a further increase in BV. Since the OBC is decreased in BPH patients (257ml as mean), the amount of urine stored in the bladder seems to frequently exceed this OBC This may occur easily during night because a urine production increases at night in the elderly [2] Thus, the observed decrease in Qmax during the midnight to morning period was primarily due to an increase in BV

Fig 1 Correlation between BV and Qmax

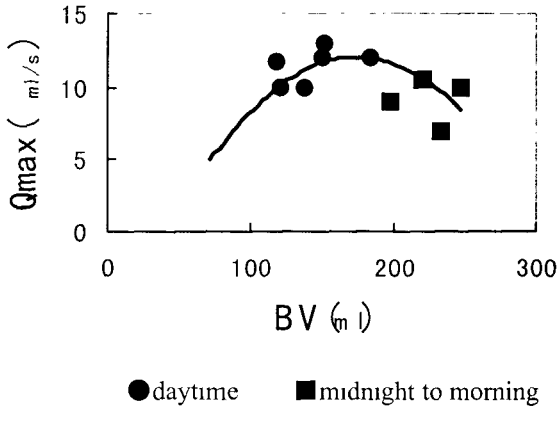


A) healthy male (R=0 96)



B) BPH patient (R=0.8)

Fig.2 Circadian change in BPH patient



	healthy males	BPH patients	significance
OBC(ml)	424 5±62.0	257 2±75.8	P<0 01

Table 1

	Daytime	midnight to morning	significance
BV(ml)	231 7±70 1	333.4±97.8	P<0 01
Qmax(ml/s)	11 1±4 5	8 2±2 1	P<0.05

Table 2

REFERENCES
1 Neuro Urodyn 1999, 18 25-32
2.Am J Med.Sci 1997, 314(4). 232-238

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