

## PROSTATE ENLARGEMENT INCREASES URETHRAL ELASTIC RESISTANCE

### Aims of study

We investigated the conditions of the urethra with bladder outlet obstruction due to prostate enlargement by means of urethral resistance.

### Materials and methods

In a total of 131 cases including 65 normal males without urinary disorders (M group), 50 patients clinically diagnosed as benign prostate enlargement (BPE) (BPE group) and 16 cases from 8 patients with BPE before and after transurethral resection of the prostate (TURP) (preTURP group, postTURP group), we approximated the uroflowmetry curve using a voiding model (1,2). Voiding pressure (relative value) can be calculated from the voiding model and divided into pressure loss related to inertial, frictional and elastic resistance. We therefore determined urethral resistance by calculating the loss coefficient (LC) of the urethra based on the results of the approximation (3). The urethral LC was obtained from the ratio of pressure loss due to frictional and elastic resistance (PR, PC) to energy consumed by inertia (WL), (PR+PC)/WL. The frictional LC (fLC) was PR/WL and the elastic LC (eLC) was PC/WL, so that LC=fLC+eLC.

### Results

The mean LC was 1.4 and the mean eLC/fLC ratio was 0.44 in the M group, 4.1 and 1.00, respectively, in the BPE group, 9.3 and 1.04, respectively, in the preTURP group and 1.5 and 0.58, respectively, in the postTURP group (Table 1). The regression equation of eLC and LC and that of fLC and LC for the M group were expressed as follows. The inclination of the two lines was equal (0.955), while the y-intercept was not the same (-1.21, -0.388) (ANCOVA,  $p < 0.0001$ ).

$$\ln(\text{eLC}) = 0.899 \ln(\text{LC}) - 1.20 \quad r = 0.786, p < 0.0001$$

$$\ln(\text{fLC}) = 1.01 \ln(\text{LC}) - 0.396 \quad r = 0.959, p < 0.0001$$

The regression equation of eLC and LC and that of fLC and LC for the BPE group were expressed as follows. The inclination of the two lines was the same (0.989) and the y-intercept was also statistically equal (-0.751) (ANCOVA,  $p < 0.0001$ ).

$$\ln(\text{eLC}) = 0.980 \ln(\text{LC}) - 0.748 \quad r = 0.877, p < 0.0001$$

$$\ln(\text{fLC}) = 0.997 \ln(\text{LC}) - 0.754 \quad r = 0.866, p < 0.0001$$

### Interpretation of results

We tentatively decided that in males, LC of 2 or less was normal and that of 4 or more indicated obstruction and was abnormal. Regardless of the increase in LC, the statistically mean eLC/fLC value was 0.44 in the M group but was higher in the BPE group at 1.00, which indicated that among the LCs, eLC had increased. When TURP was performed on patients with BPE, eLC/fLC decreased from 1.04 to 0.58. This suggested that due to the removal of adenoma by TURP, eLC decreased relatively. At the same time, LC decreased from 9.3 to 1.5, indicating that obstruction was eliminated. The absolute level of voiding pressure cannot be mathematically calculated by approximating the uroflowmetry curve using the voiding model, and errors occur to some extent by approximate calculation. However, as LC is a relative value that is obtained from the shape of the uroflowmetry curve and can be calculated as accurately as approximating the shape of the uroflowmetry curve, it may therefore be considered a useful method to ascertain urethral resistance non-invasively.

### Concluding message

When urethral resistance is increased by prostate enlargement, both fLC and eLC also increase, but the increase in eLC is larger. By the removal of the adenoma, eLC decreases relatively to the same level as that of normal males.

Table 1. Mean value of eLC / fLC and LC of each group.

	n	eLC/fLC	LC
M group	65	0.44	1.4
BPE group	50	1.00	4.1
preTURP group	8	1.04	9.3
postTURP group	8	0.58	1.5

### Reference

1. Hinyokika Kiyou. 41:27-32, 1995
2. Int.J.Urol. 11:885-889, 2004
3. Proceedings of 32<sup>nd</sup> Annual Meeting of ICS 2002. 83-84

**DISCLOSURES: NONE**