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The Significance of Beaking Sign on Cystography in Stress Urinary Incontinence[1]

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Purpose: To evaluate the clinical and urodynamic significance of the beaking sign at cystography in patients with stress urinary incontinence (SUI).

Materials and Methods: We retrospectively reviewed the cystograms of 253 patients with SUI, defining the beaking sign as the triangular contrast collection below the bladder base in the resting state without overt leakage. Various clinical parameters including patient age, symptom duration, parity, the one-hour pad test, and urodynamic study data including Valsalva leak point pressure (VLPP) and maximal urethral closing pressure (MUCP) were compared between the beaking-positive and the beaking-negative group. The distribution of Blaivas type in SUI between these two groups was also analysed.

Results: The beaking sign was observed in 153 patients (60%). Those who were older and showed greater parity more often belonged to the beaking-positive group than the beaking-negative ($p < 0.05$). Both VLPP and MUCP were significantly lower in the beaking-positive group than in beaking-negative group ($p = 0.03$; $p = 0.01$, respectively). Type-0 or -I SUI was more common in the beaking-negative group, while the frequency of other types was similar between the two groups.

Conclusion: The beaking sign has clinical and urodynamic significance, reflecting functional deficiencies of the intrinsic sphincter, and may possibly be regarded as an additional parameter in the planning of treatment.

Index words : Bladder, radiography
Urine, incontinence

Stress urinary incontinence (SUI) is defined as the involuntary loss of urine that occurs due to increased intra-abdominal pressure and without detrusor contraction. Many investigators have attempted to classify SUI, and the classification of Blaivas et al (1), based on the descent of the bladder neck revealed by cystography, has been widely accepted because it provides useful information for determining the treatment modality. According to this classification system, retropubic urethropexy is indicated for patients with type-0 to type-IIb SUI, and suburethral sling for those with type-III SUI (1).

Although the Blaivas classification adequately reflects the degree of integrity of the intrinsic sphincter by grading the descent of the bladder neck between resting and stress states, morphological alteration in the resting state, involving subtle opening of the bladder neck with-

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out leakage (the beaking sign), which is frequently noted in daily practice, is not considered. Some previously published reports have investigated the clinical significance of the beaking sign, but controversy still remains (2, 3). With this in mind, we evaluated the significance of the beaking sign in patients with SUI by analyzing its relation to various clinical parameters and urodynamic study data.

Materials and Methods

Between January 1995 and February 1999, 452 women with SUI, diagnosed according to standard criteria including history, physical examination and urodynamic study, were evaluated by cystography. Of this total, 199 were excluded from analysis because their urodynamic results were not available. The age of the 253 women whose findings were analysed ranged from 26 to 75 (mean, 49) years (SD, 9.4). All patients except two had a history of two or more vaginal deliveries (mean, 2.8; range, 1 - 8).

For cystography, 300 to 450 mL of diluted contrast media (Telebrix, Guerbet, France) was instilled into the bladder using a Foley 12-F urinary catheter until patients felt a strong need for voiding. Thereafter, AP and lateral view cystography were performed in an erect position of rest and stress. For stress imaging, patients were asked to perform the Valsalva maneuver.

The beaking sign was defined as the appearance of contrast collection below the bladder base at rest without overt leakage, and two experienced radiologists (J.W.K., K.S.C.) reached a consensus as to the presence or absence of the beaking sign. The clinical and urodynamical significance of the sign was determined by dividing the patients into two groups: beaking-positive and beaking-negative. The clinical parameters for SUI, including patient age, symptom duration, parity, and the one-hour pad test were compared between the beaking-positive and beaking-negative group, and urodynamic data including Valsalva leak point pressure (VLPP) and maximal urethral closing pressure (MUCP) were also compared between the two groups. VLPP was defined as the pressure of the urinary bladder at the onset of urine leakage without detrusor contraction, while MUCP was defined as the maximal amount by which urethral pressure exceeds bladder pressure. Finally, the distribution of Blaivas type between the two groups was determined.

Student's t test was used to compare all clinical and urodynamic data between the beaking-positive and beaking-negative group, and the chi-square test for comparison of the distribution of Blaivas type between the two groups. A P value of less than 0.05 was deemed significant.

Results

The beaking sign was positive in 153 patients (60%), in whom the vertical length of the beaking area was 0.7± 0.0 cm and the anteroposterior length was 1.5±0.1 cm. A comparison of the various clinical parameters and urodynamic data between the beaking-positive and beaking-negative groups is shown in Table 1. Beaking-positive patients were older than beaking-negative ($p=0.00$), and also showed more parity (3.0±1.3 versus 2.6 ±1.0) ($p=0.04$). Symptom duration and the results of the one-hour pad test were not different between the two groups ($p>0.05$). A comparison of urodynamic study data showed that both VLPP and MUCP were significantly lower in the beaking-positive group than in the beaking-negative (P = 0.03 for VLPP; P = 0.01 for MUCP).

A comparison of the distribution of the Blaivas classification between the two groups is shown in Table 2. Both type-0 and type-0 or -I were more common in the beaking-positive group than in the beaking-negative ($p=0.00$; $p=0.02$, respectively), but other individual types or combinations of types were of similar frequency in both groups.

Discussion

SUI is caused by a deficient bladder outlet closure mechanism, which is presumed to be served by multiple pelvic organs including the bladder neck and proximal urethra, the urethra-supporting ligaments, and

Table 1. Comparison of Clinical and Urodynamic Data between Beaking-positive and Beaking-negative Groups

Parameters	Beaking-positive (n = 153)	Beaking-negative (n = 100)
Age* (years)	51 ± 9	47 ± 9
Symptom duration (years)	6 ± 7	7 ± 6
Parity*	3.0± 1.3	2.6± 1.0
VLPP (cmH_2O) *	93 ±41	105 ±47
MUCP (cmH_2O) *	50 ±18	56 ±21
One-hour pad test (gm)	37 ±43	37 ±92

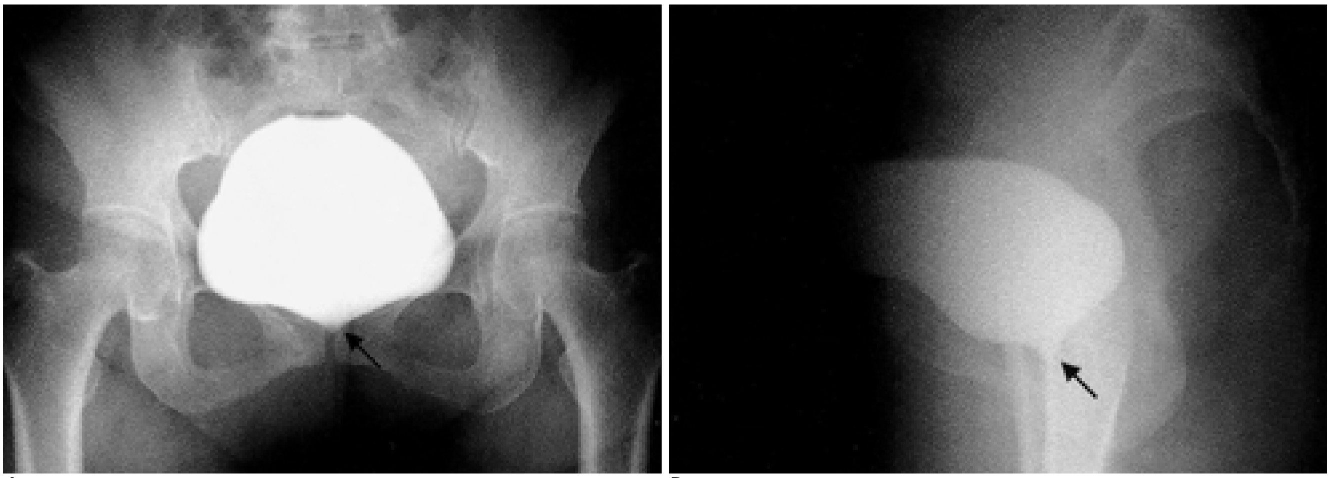
VLPP = Valsalva leak point pressure,
MUCP = maximal urethral closing pressure. * $p< .05$

pelvic floor muscles such as puborectalis sling (4). Among the many structures involved in the bladder outlet closure mechanism, the status of the bladder neck and proximal urethra in patients with SUI is relatively well demonstrated at radiography, and these structures have been the focus of the radiological approach to understanding the pathophysiology of SUI (5 - 10).

Table 2. Comparison of Blaivas Type of Stress Urinary Incontinence between Beaking-positive and Beaking-negative Groups

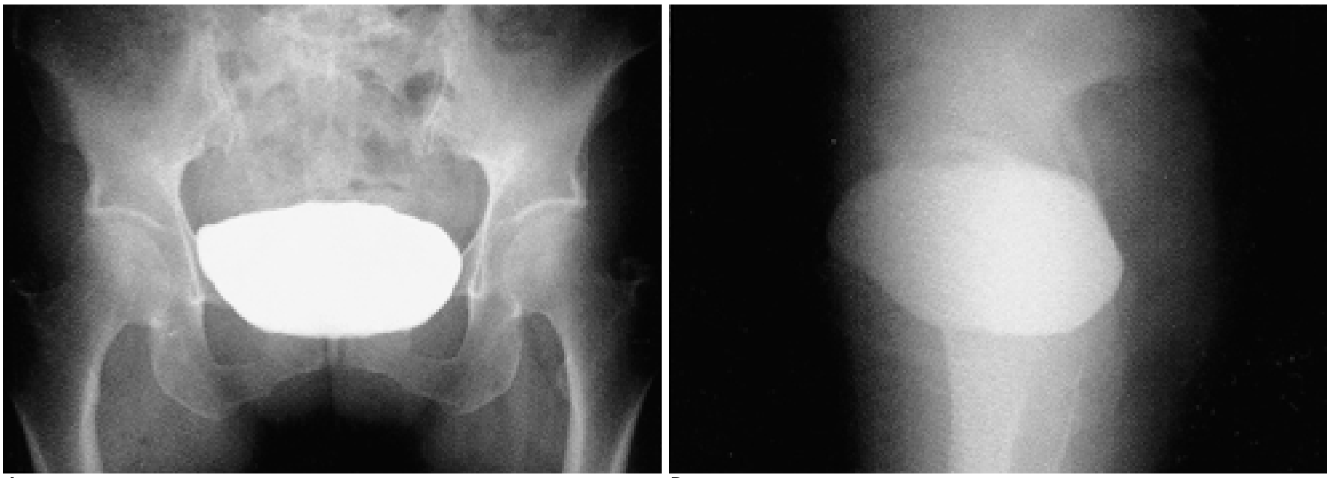
Type	Beaking-positive (n = 153)	Beaking-negative (n = 100)
O	10 (7%)	19 (19%)
I	90 (59%)	60 (60%)
IIa	34 (22%)	17 (17%)
IIb	19 (12%)	4 (4%)

Although controversies still remain, it has generally been suggested that the bladder neck and proximal urethra control urine flow, and published reports have described the normal closure and opening of the bladder neck and proximal urethra (5 - 10). Lapides et al. (5) suggested that under normal circumstances, the bladder neck opens in response to an adequate amount of urine and to contraction of the bladder smooth muscle, which causes the urethra to become shorter and wider. Hutch et al. (6) have noted that the arrangement of muscle



A B

Fig. 1. A 62-year-old woman who was diagnosed as stress urinary incontinence type I. Valsalva leak point pressure (VLPP) was 71 cmH_2O, maximal urethral closing pressure (MUCP) was 43 cmH_2O.
A, B. AP (A) and lateral view (B) of cystography show subtle bladder neck opening without overt urine leakage (positive beaking sign) at resting state.



A B

Fig. 2. A 54-year-old woman who was diagnosed as stress urinary incontinence type IIa. Valsalva leak point pressure (VLPP) was 112 cmH_2O, maximal urethral closing pressure (MUCP) was 76 cmH_2O.
A, B. AP (A) and lateral (B) view of cystography show no beaking sign.

fiber in the intrinsic urethral sphincter is closely related to closing or opening of the urethra, as morphological adaptation of this structure allows voiding. Some authors have reported that urethra-supporting structures regulate the resistance of the bladder and urethra to urine flow (7).

The original impetus for classifying stress urinary incontinence was provided by many investigators who stated the importance of the anatomical relationship between the urethra and bladder base for urinary continence (11, 12). The most commonly used classification was proposed by Blaivas et al. (1), who described five types of stress urinary incontinence on the basis of the location of the bladder neck and the presence or absence of urine leakage. The clinical impact of this classification system lies in its effect on decisions as to the treatment modality (1). However, the appearance of contrast below the bladder base in the resting state without overt leakage, defined in this study as the ' beaking sign ', is not considered in this classification system, even though it occurs with considerable frequency (2, 3, 13).

The clinical significance of the beaking sign is that according to our results, it tends to be demonstrated by old and multiparous women. As for the relationship between the beaking sign and parity, our data correspond to those of Chapple et al. (3), who claimed that the sign is associated with damage to the pudendal nerves during vaginal delivery.

A urodynamic study provides quantitative data about the function of the bladder detrusor, sphincter mechanism, and voiding pattern. VLPP has been increasingly used to categorize SUI, and is used to help differentiate between intrinsic sphincter deficiency-related SUI and urethral hypermobility-related SUI. Many authors believe that VLPP is a reliable parameter for measuring intrinsic sphincter efficiency (14 - 20). Our data show that VLPP was lower in the beaking-positive group than in the beaking-negative, suggesting that the beaking sign can reflect the intrinsic sphincter deficiency.

In addition to the reflection of an intrinsically deficient sphincter, VLPP is also related to the severity of SUI. McGuire et al. (21) stated that the lower the VLPP, the more severe the SUI. Our findings partially agree with theirs, in that type-0 or -I SUI was more common in the beaking-negative group while the frequency of other types was similar between the two groups.

In urodynamic studies, urethral resistance or closure profile is also an important diagnostic parameter for patients with SUI. MUCP, the maximal amount by which urethral pressure exceeds the bladder pressure, can be used to evaluate the urethral sphincter at rest, providing information on its intrinsic integrity; a low value represents intrinsic dysfunction. Many investigators believe that an MUCP reading of less than 20 cmH_2O indicates that the patient is at risk of failing of standard anti-incontinence procedures such as retropubic urethropexies and needle procedures, and that alternative procedures such as suburethral slings, periurethral collagen injections, or even artificial sphincters should be recommended (22 - 24). To our knowledge, this study is the first to assess the relationship between MUCP and the beaking sign, and MUCP was found to be significantly lower in the beaking-positive group than in the beaking-negative. Accordingly the presence of the beaking sign indicates an intrinsically deficient sphincter.

The urodynamic study data in this study implies that the that beaking sign is caused by sphincter function which is intrinsically deficient, and we therefore suggest that the significance of the sign lies not only in its use in evaluating patient status but also in decisions as to appropriate treatment. This should be regarded as additional information to that provided by Blaivas classification, which is already known to influence the choice of treatment modality.

The main drawback of this study is that we divided patients only according to the presence or absence of the beaking sign, without quantitative analysis. Although we measured the beaking area, it is difficult to apply this measurement only when estimating the degree of SUI; other functional factors including the capacity of the bladder, and body surface and weight, were not, in fact, considered. Accordingly, for accurate quantitative analysis of the beaking sign, it is necessary to integrate the various functional factors.

In conclusion, the beaking sign has clinical and urodynamical significance, its presence indicating an intrinsically deficient sphincter. The sign may possibly be regardeded as an important parameter in planning the treatment modality.

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긴장성 요실금 환자의 방광조영술에서 보이는 새부리 징후의 의의[1]

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목적: 긴장성 요실금 환자에 있어 방광조영술상 안정시 촬영 사진에서 보일 수 있는 새부리 징후의 임상적, 요로역학적 의의를 알아보고자 하였다.

대상과 방법: 253명의 긴장성 요실금이 있는 환자의 방광조영술을 후향적으로 분석하였다. 방광조영술상 안정시 조영제의 누출이 없는 상태에서 방광경부에 삼각형 모양으로 조영제가 보이는 것을 새부리 징후라 정의하였다. 새부리 징후가 있는 군과 없는 군 사이에 나이, 증상 기간, 출산 횟수 등의 임상 인자와, 발살바 요실금압 (Valsalva leak point pressure, VLPP)과 최대 요도 폐쇄압 (maximal urethral closing pressure, MUCP)등의 요로역학적 인자를 비교 분석하였고, Blaivas분류에 의한 긴장성 요실금 유형의 분포를 비교하였다.

결과: 새부리 징후는 153명(60%)에서 있었으며, 각 임상 인자들 중 나이가 많을수록, 출산 횟수가 많을수록 그 빈도가 유의하게 많았다 ($p<$ .05). 발살바 요실금압은 새부리 징후가 있는 군이 없는 군과 비교하여 유의하게 낮았으며 (p=.03), 최대 요도 폐쇄압도 새부리 징후가 있는 군에서 유의하게 낮았다 (p= .01). Blaivas분류에 의한 제 0형과 1형 긴장성 요실금은 새부리 징후가 없는 군에서 많았으나, 다른 유형은 두 군간에 차이는 없었다.

결론: 새부리 징후는 임상적, 요로역학적으로 의의가 있으며, 내인적 괄약근의 결함을 반영 할 수 있으므로 치료방침을 계획함에 있어 고려해야 할 요소로 사료된다.