

URODYNAMIC TESTS FOR FEMALE GERIATRIC URINARY INCONTINENCE*

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ABSTRACT—Most urodynamic tests currently in use in the evaluation of female urinary incontinence have not been applied to a community-based sample to determine their specificity. In this study of a random sample of noninstitutionalized elderly, 258 self-reported continent and 198 self-reported incontinent women sixty years and older, who participated in a household survey, underwent a clinic evaluation (history, physical examination, and urinalysis); of these, 67 continent and 100 incontinent female respondents underwent urodynamic testing. The uroflowmetry, cystometry, and supine static urethral pressure profilometry (UPP) findings did not differ significantly between continent and incontinent subjects (whether based on a self-report or a clinician's diagnosis of urinary continence status). Standing static and dynamic UPP and lateral cystography showed significant differences between self-reported continent and incontinent respondents. The provocative stress test significantly distinguishes continence from incontinence, and stress incontinence from other types. The sensitivity of the provocative stress test was 39.5 percent, whereas its specificity is 98.5 percent. Urodynamic testing including uroflow study, static UPP, and lateral cystography should not be used as a screening test but rather selectively as a confirmatory test, and to determine the therapeutic approach, and to assess the outcome of therapy.

There are several urodynamic procedures that are currently used to evaluate urinary incontinence. Although these tests have contributed to our knowledge of the physiology of vesicourethral structures, most of these tests have not been subjected to population-based studies to determine their clinical usefulness in the evaluation of female urinary incontinence. Specifically, in the female geriatric population where urinary incontinence is highly prevalent, there are very limited data establishing the "normal" and "abnormal" results for the urodynamic procedures currently used. To estab-

lish the urodynamic characteristics of the continent and incontinent elderly, and to determine the value of the various tests used to evaluate urinary incontinence, a study was undertaken among continent and incontinent survey respondents as part of the overall urinary incontinence study conducted in Washtenaw County, Michigan.

Material and Methods

The details of the sampling technique were presented in previous publications.^{1,2} In summary, a total of 1,956 seniors were interviewed in their households, of which 1,152 were women. Of these, 1,108 women were invited

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by telephone to a free clinic evaluation; 258 self-reported continent and 198 self-reported incontinent women sixty years and older accepted and were examined. The clinic evaluation included answering a forty-minute questionnaire (history), physical examination with a pelvic examination, noninstrumented provocative stress test, and urinalysis. Based on the clinic information, a clinician's impression was made regarding the continence status of the subject. If the respondent was considered incontinent, she was assigned to one of the conventional types of urine loss: stress, when urine loss was associated with physical exertion; urge, when urine loss was preceded by an urge to void; mixed, when urine loss was a combination of urge and stress loss; other, when urine loss could not be associated with any of the previous categories.

A self-report of continence or incontinence status was obtained while in the clinic from the standardized set of incontinence questions previously published.¹ The severity measure of self-reported incontinence was also reported previously.³

At the conclusion of the clinic visit, all subjects were invited to participate in a thorough urodynamic testing. A total of 67 clinic-diagnosed continent and 100 incontinent female respondents accepted and participated in the urodynamic testing.

The urodynamic testing (UDT) started with an initial noninstrumented uroflowmetry, immediately followed by measurement of the post-void residual urine volume. An esophageal membrane catheter was inserted into the rectum to continuously monitor the intra-abdominal pressure. An 8F double-sensor microtransducer monitored the intravesical and intraurethral pressures. The urethral sensor was located at the midurethra with proper localization aided by the fluoroscope.

Cystometry was performed using a flow rate of 100 mL per minute of 25% sodium diatrizoate solution. At the conclusion of cystometry, passive (static) and dynamic urethral profilometry (UPP) were performed with the subjects in the supine and standing positions. The sensor was oriented toward the lateral wall of the urethra. During the static UPP, the catheter was pulled automatically with a puller at a rate of 1 mm/second. During the dynamic profilometry, the urethral sensor was kept at the midurethra while the respondent was asked to cough vigorously three times each in the supine

and again in the standing positions. The bladder pressure was simultaneously monitored by the sensor located within the bladder.

At the end of the standing dynamic UPP, a lateral standing cystogram was performed with the bladder still filled with 25% sodium diatrizoate solution and the opaque double-sensor catheter visible along the urethra. The lateral cystogram was obtained first in the upright resting and then in the upright straining positions. At the conclusion of the cystography, the pressure flow study (PFS) was conducted while the patient was sitting on the uroflowmeter commode. The intravesical, rectal, and detrusor pressures, and uroflow rates were obtained simultaneously during the pressure flow study.

At the conclusion of the PFS, the subject was recatheterized, using the measuring Foley catheter. The bladder was refilled with sterile water to capacity. At capacity, and while the patient was in the supine position, the anatomic urethral length was measured. The patient was asked to stand, and the urethral length was measured in the upright position. The catheter was removed, and the provocative stress test was performed: The patient was asked to cough vigorously three times to provoke any incontinent episodes. The presence of leakage determined a positive result. The volume of urine leaked was also measured.

The uroflow rates recorded were the peak flow rate (PFR), average flow rate (AFR), and volume voided. The voiding pattern was also identified as a continuous or interrupted stream.

The static urethral profilometry results were determined by measuring the maximum urethral pressure (MUP), maximum closure pressure (MCP), and functional urethral length (FUL). The dynamic profilometry was produced by measuring the intravesical pressure and maximum urethral pressure at the highest peak of urethral pressure during coughing. The urethral pressure was subtracted from the bladder pressure to determine whether the bladder pressure equaled or exceeded the urethral pressure, a finding considered positive for incontinence.

The lateral stress cystogram results were assessed by measuring the posterior urethral vesical angle (PUV) and the urethral axis. In addition, the location of the bladder neck was assessed as to whether it was at, above, or below the line drawn between the inferior edge of the symphysis pubis and the sacrococcygeal

junction. This line is presumed to be the location of the urogenital diaphragm (UGD).

A urodynamic diagnosis of incompetent urethral sphincter was made when one of the three findings was observed: positive stress test, positive urine loss on stress cystography, positive findings on dynamic urethral profilometry. When none of the criteria was satisfied, a diagnosis of competent urethral sphincter was made. The diagnosis of uninhibited detrusor contraction (UDC) on cystometry was based on the criteria of the International Continence Society.²

Biostatistical analysis

When comparisons between two groups are made (for instance, between continent and incontinent subjects), the test is based on a t-statistic, computed by taking the difference between group means, and dividing by the appropriate standard error. This t-statistic and its significance level are reported. To make appropriate comparisons between two or more groups with respect to certain variables (e.g., peak flow rate), the value of a covariate (in this case, volume voided) must be considered. In these cases, analyses of covariance⁴ have been performed; the t-statistics are tests of the equality of group means at the average value of the covariate; i.e., after adjusting for the presence of the covariate.

Pressure values frequently exhibit a skewed distribution (that is, display a few legitimate but extremely large values) which violates the assumptions of the aforementioned statistical tests. Therefore, the tests were performed on the original variables and on the logarithms of the variables to ensure that significant results were not artifacts of the skewed distributions.

Although the initial MESA sample was a self-weighting probability sample from the population of elderly in Washtenaw County, the probability that a respondent was invited to urodynamic testing was altered according to the subject's sex, age, and continence status to ensure sufficiently large numbers of both continent and incontinent respondents in all age groups. Observed outcomes must be weighted to predict probabilities of test results in the general population. These weights are listed in Table I of Diokno, *et al.*² Weights are not necessary when the mean and standard deviations are computed separately for continent or incontinent subjects, or for comparisons between these groups.

Results

Demographics of urodynamic respondents

At the urodynamic examination, the age range of the continent female respondents was sixty to eighty-six years, and it was sixty to eighty-two years for the incontinent respondents. Of the respondents, 65.9 percent were sixty to sixty-nine years old, 26.9 percent were seventy to seventy-nine, and 7.2 percent were eighty or over. Ninety-five percent of the respondents were white. The self-assessed health status at the time of interview was considered good to excellent by 94.0 percent of continent women and 80.0 percent of incontinent women.

Uroflowmetry

The uroflow measures of peak flow rate (PFR) and average flow rate (AFR) were analyzed according to the volume voided at increments of 100 mL. When volume was controlled, the mean PFR and AFR were not significantly different between the clinic diagnosis of continence and incontinence (Fig. 1), or between the four clinical types of urinary incontinence, or between the urodynamic diagnosis of competent and incompetent sphincters. The continuity of the urinary stream was not associated with continence status or with the clinical types of incontinence.

Post-void residual urine and cystometry

As reported recently,² the volume of post-void residual urine did not correlate with the continence status nor with the clinical types of urinary incontinence. In the same publication, it was observed that uninhibited detrusor contractions (UDC) among women were observed more frequently among incontinent respondents (12.2%) than among continent respondents (4.9%). The overall estimated prevalence rate is 7.9 percent. It was also noted that the questions, "Do you ever have trouble getting to the bathroom on time?" and "What about finding the toilet is occupied and you are delayed in getting in?" were highly significant in predicting occurrence of UDC on cystometry. The prevalence of the combination of uninhibited bladder with incompetent sphincter in women was 4.4 percent.

Static urethral pressure profilometry

The mean functional urethral length did not significantly change as the age of the subjects increased, but the values of MUP and MCP

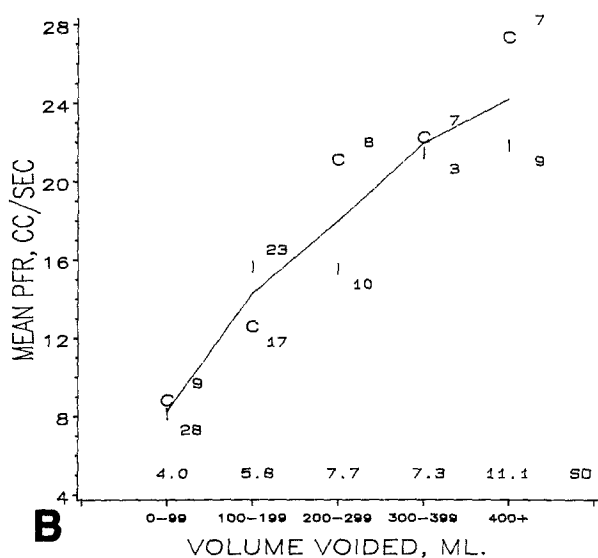
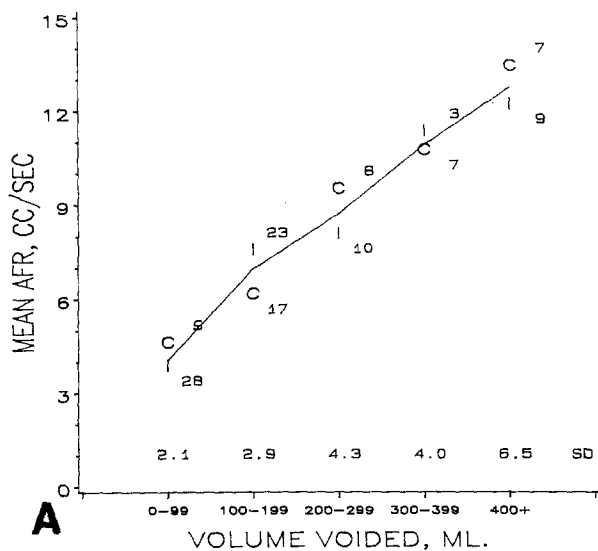


FIGURE 1. Uroflowmetry in continent and incontinent subjects. Symbols "C" and "I" represent mean average (A), or peak (B) flow rates for continent and incontinent subjects within volume categories. Super- and sub-scripted numbers are sample sizes; trend lines represent overall means. Standard deviation of flow rates within volume groups, ignoring continence status, displayed across the bottom.

demonstrated a significant progressive reduction as age increased ($t = -3.08$ and -3.72 , $p = 0.002$ and $p = 0.0003$, respectively), so all further comparisons with respect to these two latter variables must be made after adjusting for age.

Neither continence status nor the clinical types of incontinence produced significantly different mean values when the MUP, MCP, or FUL were measured in the supine position. However, in the standing position, significant

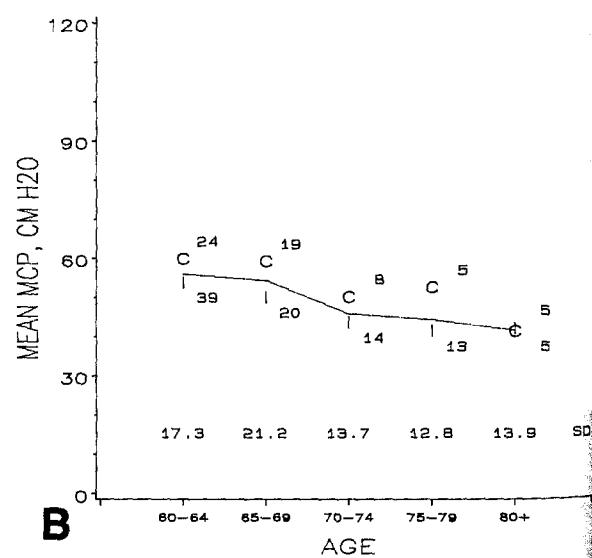
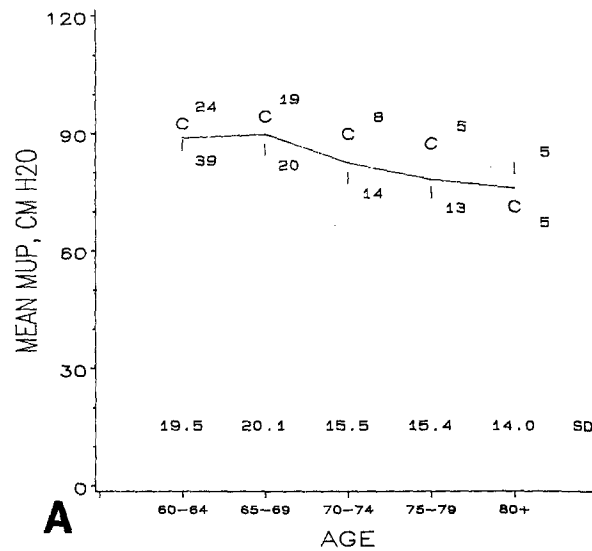


FIGURE 2. Urethral profilometry. Symbols "C" and "I" represent means of standing maximum urethral pressure (A), or maximum closure pressure (B) for continent and incontinent subjects within age categories. Super- and sub-scripted numbers are sample sizes; trend lines represent overall means. Standard deviation of pressures within age groups, ignoring continence status, displayed across the bottom.

differences were observed between the continent and incontinent groups with respect to the MUP ($t = 2.46$, $p = 0.015$, Fig. 2A), MCP ($t = 2.63$, $p = 0.001$, Fig. 2B), and FUL ($t = 3.09$, $p = 0.0025$). The mean values of the incontinent subjects were lower than those of the continent ones on all three variables. Significant differences in the mean values of these variables did not exist between the stress (including mixed stress/urge) and nonstress incontinent subjects.

When comparisons between continent subjects with competent sphincters and incontinent subjects with incompetent sphincters were made, the pattern generally was repeated. Significance levels decreased somewhat due to the removal of 50 subjects (incontinent subjects with competent sphincter and continent ones with incompetent sphincter).

No significant differences were demonstrated between the groups with respect to measurements made in the supine position. The standing MUP also did not vary significantly between the continent/competent sphincter group and incontinent/incompetent sphincter group ($t = 1.78, p = 0.08$). Significantly reduced values of the standing MCP ($t = 2.47, p = 0.015$) and FUL ($t = 3.62, p = 0.0005$) occurred in the incontinent/incompetent sphincter subjects, compared with the continent/competent sphincter subjects.

Dynamic urethral pressure profilometry

Comparison of the results of the dynamic profilometry when divided into positive results (zero or positive correspond to incontinence) and negative results (continence) revealed no significant difference between the self-reported continence and incontinence with tests in both supine, standing, or supine or standing tests. The clinic diagnosis of continence and incontinence also did not show any significant difference in the supine test, but show significance in the standing ($X^2 = 4.94, p = 0.026$) or both supine or standing tests ($X^2 = 5.71, p = 0.017$) where 50.0 percent of clinic diagnosed incontinent respondents have a positive result, as opposed to 31.3 percent of the continent respondents. The severity and type of the self-reported incontinence also showed no significant difference in the results of the dynamic profilometry either in the supine, standing or both supine or standing tests. However, the clinic-diagnosed types showed a significant relationship ($X^2 = 13.4, p = 0.009$), where 61.4 percent of respondents with stress have a positive result, compared with 39.1 percent of the mixed group, 33.3 percent of the urge group, 31.3 percent of the continent subjects, and 20.0 percent of the other category.

Lateral stress cystography

Comparison between clinic diagnosis of continence and incontinence, and between clinic diagnosis of continence, stress (with or without urge), and nonstress incontinence with regard

TABLE I. Comparison of provocative stress test to self-reported continence status

Stress Test	—Self-Reported Continence Status—			
	Continence	Nonstress	Stress	Total
Absent	67 98.5 %	13 100 %	49 62.0 %	129
Present	1 1.5 %	0 0 %	30 38.0 %	31
TOTALS	68 100 %	13 100 %	79 100 %	160
Not determined	4	0	3	

Sensitivity 39.5 %
Specificity 98.5 %
Accuracy 75.3 %
False positive 5.5 %
False negative 28.5 %

(These values must be calculated using weights described in data analysis section.)

to urethral axis, posterior urethrovesical angle, and distance of urethrovesical junction to the urogenital diaphragm (UGD) revealed that a significantly wider posterior urethrovesical angle is noted among incontinence than continent respondents ($t = 3.26, p = 0.001$), but no significant difference was observed between the stress and nonstress types of incontinence. There was no difference with the urethral axis and position of the bladder neck with regard to the UGD between the continence status or the clinical types of incontinence.

There is also a significantly wider mean value of posterior urethrovesical angle among incontinent incompetent sphincter than among continent competent sphincter ($t = 3.63, p = 0.004$), but neither the measurements of the urethral axis nor the location of the bladder neck in relation to the UGD demonstrated a difference between these two groups.

Provocative stress test

A positive provocative stress test result was found to be significantly correlated to self-report and clinic diagnosis of continence and incontinence and specifically of a stress type of urine loss with or without associated urge loss ($p \leq 0.0005$) (Table I). The test also produced more positive results in the moderate to severe level of incontinence than in those with mild urine loss (Table II).

The result of the lateral cystogram (straining urethral axis) showed a strong association ($X^2 = 6.81, p = 0.009$) with a positive provocative

TABLE II. Comparison of provocative stress test to self-reported severity of incontinence

Stress Test	Incontinence				Total
	Cont.	Mild	Mod.	Severe	
Absent	70 98.6%	31 86.1%	9 52.9%	17 54.8%	127
Present	1 1.4%	5 13.9%	8 47.1%	14 45.6%	28
TOTALS	71 100%	36 100%	17 100%	31 100%	155
Not determined*	4	0	0	3	

*Also, 5 with no severity of incontinence, 2 with stress absent, 3 with stress present.

stress test; an axis of the urethra of $\geq 30^\circ$ is more likely to result in a positive stress test than an axis of $< 30^\circ$. There was no association between the stress test and vesicourethral angle.

Anatomic urethral lengths

The anatomic urethral length in the supine and in the standing positions showed no significant difference between the continent and incontinent respondents and between the clinical types of urinary incontinence. The urethral lengths were also not found to correlate with the results of provocative stress tests.

Urodynamic diagnosis

Of the 167 respondents who underwent UDT, 85 did not have any stress incontinent symptoms, and 82 had stress or mixed stress-urge symptoms. Sixty-five of the 82 respondents with stress symptoms and 30 of the 85 asymptomatic subjects were diagnosed to have incompetent sphincter, for a total of 95.

Of the 166 respondents who had cystometry, 12 were diagnosed to have uninhibited detrusor contraction (UDC) on cystometry, and 38 had symptoms of urge incontinence, of which 7 were found to have uninhibited detrusor contraction. The rest did not have the symptoms of urge, but 5 were found to have UDC on cystometry. The results of the pressure flow study will be reported in another article.

Sensitivity, specificity, and predictive values of various urodynamic tests

The sensitivity and specificity of the provocative stress test were determined by comparing the actual result of the test with the self-reported continence and incontinence status and the characteristic description of urine loss as to stress or non-stress type (Table I) and then using

weights to obtain estimates appropriate to the population of older women. The sensitivity of the test is 39.5 percent, which is the expected probability that the provocative stress test will be positive if the respondent is complaining of a stress type of incontinence. The specificity of the test is 98.5 percent, which is the likelihood that a person in the population without stress incontinence (i.e., complaining of nonstress incontinence or not being incontinent) will have a negative stress test. The expected false-negative rate is 28.5 percent, which is the percent of the population producing a negative test who will complain of stress type incontinence. The false-positive rate is 5.5 percent, representing subjects in whom positive results will develop when they do not report incontinence or report a non-stress type of incontinence. Actually in none of the 13 respondents who complained of nonstress type of incontinence did any positive results develop, while a positive stress test result developed in only 1 of 68 respondents who did not report any incontinence.

To determine the sensitivity and specificity of the self-report of the continence and incontinence status (positive response to our incontinence question) and the stress and nonstress type of incontinence response as indicators of urethral incompetence, these self-reports were compared with the urodynamic diagnosis of competence and incompetence of the urethra (Table III). The sensitivity of the self-report of stress incontinence with or without urge is 57.2 percent, whereas the specificity is 84.1 percent. Conversely, if urethral incompetence is used as an indicator of incontinence, its sensitivity is 82.0 percent (= 100% - false positive) and its

TABLE III. Comparison of self-report of continence status to urodynamic urethral diagnosis

Cont. Status	—Urethral Diagnosis—		Total	Not Det.
	Competent	Incompetent		
Stress Incontinence	14 21.2%	65 68.4%	79	3
Continent + nonstress incont.	52 78.8%	30 31.6%	82	3
TOTALS	66 100%	95 100%	161	

Sensitivity 57.2%
Specificity 84.1%
Accuracy 69.0%
False positive 18.0%
False negative 39.2%
(These values must be calculated using weights described in data analysis section.)

TABLE IV. Comparison of self-report of continence to uninhibited detrusor contractions

Cont. Status	Absent	Present	Total	Not Det.
Continence, stress incont. or other incont.	101 65.6%	4 33.3%	105	1
Urge incont. or mixed incont.	53 34.4%	8 66.7%	61	0
TOTALS	154 100%	12 100%	166	

Sensitivity 52.0%

Specificity 73.2%

Accuracy 72.1%

False positive 90.3%

False negative 3.5%

(These values must be calculated using weights described in data analysis section.)

specificity is 61.8 percent (= 100% - false negative). The accuracy of the test, which is the unconditional probability that the self-report of stress incontinence will predict properly the urethral status, is 69.0 percent.

The sensitivity of the self-report, of urge or mixed urge and stress symptoms with respect to the presence of UDC on cystometry is 52.0 percent. The specificity of the test (the probability that a subject who will not produce UDC in cystometry will also not complain of urge-type symptoms) is 73.2 percent. Conversely, if the presence of UDC is used as an indicator of incontinence, its sensitivity is only 9.7 percent, but its specificity is 96.5 percent. The accuracy of the urge symptoms predicting UDC in cystometry is 72.1 percent (Table IV).

Comment

This report is the outcome of tests done among relatively healthy elderly women living in a community identified through a random probability sampling technique, and who consented to be interviewed in their household, examined in a geriatric clinic, and tested urodynamically in a hospital urodynamic suite. Because of this sampling technique, in contrast to studies conducted among a group of inpatients and or outpatients, estimates of prevalence in a population can be calculated.

The urine flow rates were not found to be helpful in distinguishing between continent and incontinent subjects and between the clinical types of incontinence, confirming the previous observation of Fantl *et al.*⁵ As in the present clinical practice, uroflow measurements may

be found more helpful in predicting voiding or emptying symptoms after a bladder suspension operation rather than as a tool in the diagnosis of an incontinent patient. However, the value of such practice needs further confirmation.

A surprise finding was a low prevalence of uninhibited detrusor contraction in our subjects. The reported prevalences of UDC among women in nursing homes or outpatient and inpatient subjects⁶ are significantly higher than our overall prevalence rate of 7.9 percent.² It is believed that the discrepancy can be explained by the fact that our subjects are healthier when compared with patients in nursing homes as well as patients in inpatient and outpatient settings. This finding lends more credence to the theory that UDC is a result of a specific local, regional, or generalized disorder rather than a direct result of aging.

The low prevalence of UDC among women with symptoms of urge incontinence suggests other mechanisms operate to explain the urge symptoms. Further studies are needed to explore the pathophysiology of urge type incontinence in the elderly.

Henriksson, Andersson, and Ulmsten⁷ and Rud⁸ have shown that urethral pressures decrease with age. Contrary to the observation of Henriksson *et al.*⁷ that by the age of sixty the drop in MUP and MCP has maximized so that no further decrease is discernible, our data showed progressive reduction of pressure as age increases. The supine static and dynamic urethral profilometry values were not significantly different between continent and incontinent (self-report or clinic impression) elderly respondents, and therefore are of no use as a primary diagnostic tool in this age group. Although there was a significant difference in the results of standing static and dynamic UPP between continent and incontinent respondents, and between continent respondents with competent sphincters compared with respondents who are incontinent and have incompetent sphincters, the overlap in values prevents the use of the maximum urethral and closing pressures in identifying patients with urethral incompetence (Fig. 3).

The supine lengths of the urethra, both functional and anatomic, and the standing anatomic length were not found to distinguish the self-report and clinic impressions of continence from incontinence nor were they able to distinguish stress from nonstress types of urine loss in this age group. The functional lengths in the

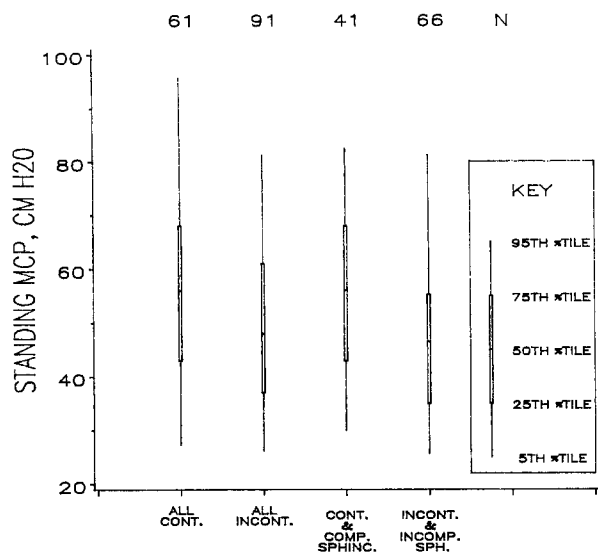


FIGURE 3. Percentiles of maximum closure pressure. Box-plots of MCP measured in standing position for all continent and incontinent subjects, those continent with diagnosis of competent sphincter, and those incontinent with diagnosis of incompetent sphincter. Sample sizes of different groups displayed across the top.

standing position of continent and incontinent subjects were significantly different, but, because of the overlap between groups, functional length cannot reliably be used for diagnosis.

It should be emphasized that the result of this UPP study can be applied only to the elderly and cannot be generalized to younger women. It is known that the MUP and MCP among continent young women are approximately double that of the elderly group and, therefore, values of MUP and MCP among stress incontinent young women may indeed show a distinctly different pattern when compared with older women.^{7,8} The Henriksson *et al.*⁷ study that compares the UPP values of continent and stress incontinent subjects age thirty to sixty-nine showed significant differences between the two diagnoses in the values of MUP and MCP between the ages of thirty to fifty-nine, and in the value of FUL and anatomic lengths between the ages of thirty to forty-nine. In spite of the significance of these differences, the MUP, MCP, and FUL measurements are inappropriate as diagnostic tools, since the values overlap a great deal between the different diagnostic groups; see Figure 3 for a demonstration with respect to MCP. These studies also emphasize the need to avoid generalizing the UPP values across all age groups, since the values vary according to the age group.

The result of the dynamic urethral profilometry study was disappointing (sensitivity 50.0%, specificity 68.7%), although it showed marginal significance. The low sensitivity may be due to the technique used in this study. However, it is probable that these tests may be influenced by many factors rendering the test nonspecific. Whether or not the continuous pull dynamic measurement is better than the technique used in this study requires further testing.

The lateral stress cystogram revealed several surprising findings. The location of the bladder neck above or below the UGD nor the urethral axis (angle) did not correlate with the self-report and clinic diagnosis of continence or incontinence status nor with urodynamic diagnosis of competent and incompetent urethra. The lack of correlation between either continence status or competency of the urethra with the location of the bladder neck above or below the UGD line raises doubts about the theory that descent of the bladder neck below the urogenital diaphragm is a major factor in the development of stress urinary incontinence.^{9,10}

The posterior urethrovesical angle (PUV) was strongly associated with continence status. This finding supports the view that PUV is significantly wider among incontinent women, which is probably due to loss of support or weakness of the posterior floor of the urethrovesical junction, a finding in support of observations by Jeffcoate and Roberts.¹¹ Although there was a significant difference between average PUV values of continent and incontinent respondents, it did not distinguish between stress and nonstress type of urinary incontinence. In addition, significant overlap in PUV values existed between continent and incontinent subjects, so that this test cannot be used alone in the diagnosis of urinary incontinence. Again, it appears that the value of the test may be in the assessment of the type of repair to be used rather than as a diagnostic test.

The provocative stress test was an extremely specific test, producing only one false-positive result out of 68 when tested against self-reported continence status. Of greater importance is that it was 100 percent specific for subjects who have nonstress incontinence symptoms.

However, the sensitivity was low, and the expected false-negative rate in the population was 28.5 percent. The sensitivity was further reduced if the severity of stress urine loss was minimal; the stress test was positive in only 13.9

percent of such subjects (Table II). This is a significant observation in the sense that a positive stress test suggests that the urine loss is most likely of the moderate-to-severe degree.

The urodynamic criteria for an incompetent sphincter in this study may be considered too liberal since it includes any one positive finding among the three tests (stress test, dynamic UPP, or stress cystography). However, since there is no known standardized criteria, the sensitivity and specificity of our incompetent and competent sphincter diagnosis were tested by comparing the self-reported symptoms of stress incontinence and nonstress incontinence, including continent respondents. A sensitivity of 57.2 percent and specificity of 84.1 percent were noted. Therefore, using the competent and incompetent sphincter diagnosis as the gold standard, the symptom of stress incontinence has an expected accuracy of prediction of 69.0 percent.

In the final analysis, the findings of this study suggest that the symptom of stress urine loss either alone or in combination with other symptoms makes it likely that the patient will have an incompetent sphincter. In addition, a simple full-bladder provocative stress test is extremely specific, and although its sensitivity is low, when positive, it indicates a moderate-to-severe degree of stress urinary incontinence.

Only 13.1 percent of the subjects with urge incontinence produced UDC, suggesting a non-specific nature of this symptom. Unless one opted for a therapeutic trial of an anticholinergic-antispasmodic agent, cystometry is the only direct test available to distinguish UDC from other causes of urge incontinence.

The rest of the battery of urodynamic testing, including uroflow study, static and dynamic urethral pressure profile, and lateral cystography, should be used mainly as a confirmatory study when the diagnosis is suspected but not well established. It also may help when the diagnosis is already established to determine the therapeutic approach to be used, and to assess or predict the outcome of therapy.

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