

Urinary Incontinence in Nulliparous Women and Their Parous Sisters

Gunhilde M. Buchsbaum, MD, Erin E. Duecy, MD, Lindsey A. Kerr, MD, Li-Shan Huang, PhD, and David S. Guzick, MD, PhD

OBJECTIVE: To investigate the role of vaginal delivery and familial factors in the development of urinary incontinence by comparing the prevalence of this condition in nulliparous women and their parous sisters.

METHODS: A sample of 143 pairs of nulliparous/parous postmenopausal sisters completed a comprehensive questionnaire regarding symptoms of pelvic floor disorders. Of these, 101 pairs underwent clinical evaluation of urinary incontinence and genital prolapse.

RESULTS: Among this sample of biological sisters, urinary incontinence was reported by 47.6% of nulliparous women and by 49.7% of parous women ($P = .782$). We found no difference in the severity or type of urinary incontinence between these 2 groups. There was a high concordance in continence status, however, within biological sisters.

CONCLUSION: Vaginal birth does not seem to be associated with urinary incontinence in postmenopausal women. Considering the high concordance in continence status between sister pairs, and considering that the majority of parous women are continent, an underlying familial predisposition toward the development of urinary incontinence may be present.

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LEVEL OF EVIDENCE: II-2

It is estimated that 30–50% of adult women in Europe and the United States suffer from urinary incontinence.¹ Vaginal delivery is believed by many

to be the major risk factor for stress urinary incontinence.² Indeed, elective cesarean deliveries are now being performed for the sole purpose of preventing future incontinence. A recent survey of urogynecologists and obstetricians in the United States found that 65.4% of the responding physicians would perform, and 29.6% have performed, an elective cesarean delivery. A majority (62.1%) of urogynecologists surveyed would support elective cesarean delivery to prevent long-term sequelae of urinary incontinence.³ The benefit of this practice of performing one or more surgeries (cesarean deliveries) to prevent one or more surgeries (continence repairs) in the future has not been proven.⁴ The literature is inconsistent on the association of vaginal delivery and urinary incontinence, however. Several reports suggest such an association,^{5–7} whereas others fail to confirm a link between incontinence and parity.^{8–10} Besides parity, obesity, smoking, and age have been identified as risk factors for developing urinary incontinence.^{11,12}

Prior investigations of the relation between vaginal delivery and stress urinary incontinence share several common shortcomings. First, data on incontinence are typically based on unvalidated self-report survey instruments. Second, little or no distinction is made between the different types of urinary incontinence or the severity of the incontinence. Third, the percentage of nulliparous women in all studies is between 8% and 12%, corresponding roughly to the prevalence of nulliparity in the general population. Even with large overall sample sizes, the studies may lack sufficient power to address the relationship between vaginal delivery and risk of incontinence because of the small number of women in the nulliparous groups.

To investigate the role of vaginal delivery in the development of urinary incontinence, we compared the rate of incontinence and prolapse in nulliparous women with the corresponding rates in their biological sisters who had had at least one vaginal delivery. By using biological sisters as the control group, we

From the Departments of Obstetrics and Gynecology and Biostatistics and Computational Biology, University of Rochester Medical Center, Rochester, New York; and Department of Urology, University of Utah, Salt Lake City, Utah.

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Corresponding author: Gunhilde M. Buchsbaum, MD, 601 Elmwood Avenue, Box 668, Rochester, NY 14642; e-mail: Gunhilde_Buchsbaum@urmc.rochester.edu.

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were able to address the role of familial factors, which have also been linked to pelvic floor disorders.¹³⁻¹⁵

MATERIALS AND METHODS

We recruited pairs of postmenopausal biological sisters from the general population in Western New York State and Northern Vermont between October 2002 and March 2005. Subjects were recruited through advertisement in local newspapers and through flyers posted in public places such as hospitals, churches, libraries, and beauty parlors. Flyers and newspaper ads stated: "LOOKING FOR SISTERS. One has never given birth. The other one has had one or more deliveries. 45 years or older and post-menopausal (no period)." The purpose of the study was not mentioned. To be eligible for the study, one of the sisters had to be nulliparous, while the other had to have had at least one vaginal delivery. Both sisters had to be willing and able to comply with the study requirements. Information on

subject recruitment and dropout are depicted in Figure 1. All sister pairs in the study completed a questionnaire that elicited demographic characteristics, medical, surgical, and obstetric history, medication use, and the use of tobacco and alcohol.⁸ Subjects were further asked whether they had at least one episode of incontinence within the last 4 weeks. Subjects who answered "yes" were classified as incontinent. Additional questions asked about duration of incontinence (3 answer levels), frequency (6 answer levels), amount of leakage (4 answer levels), and the need for sanitary pads. For those subjects who were incontinent, the questionnaire went on to assess for symptoms of stress incontinence (whether urine leakage occurred in association with coughing, laughing, or physical activities) and urge incontinence (whether urine loss was associated with a strong urge to void, the sound or feel of running water, or sleep). On the basis of these questions, women were classified as having either stress incontinence, urge in-

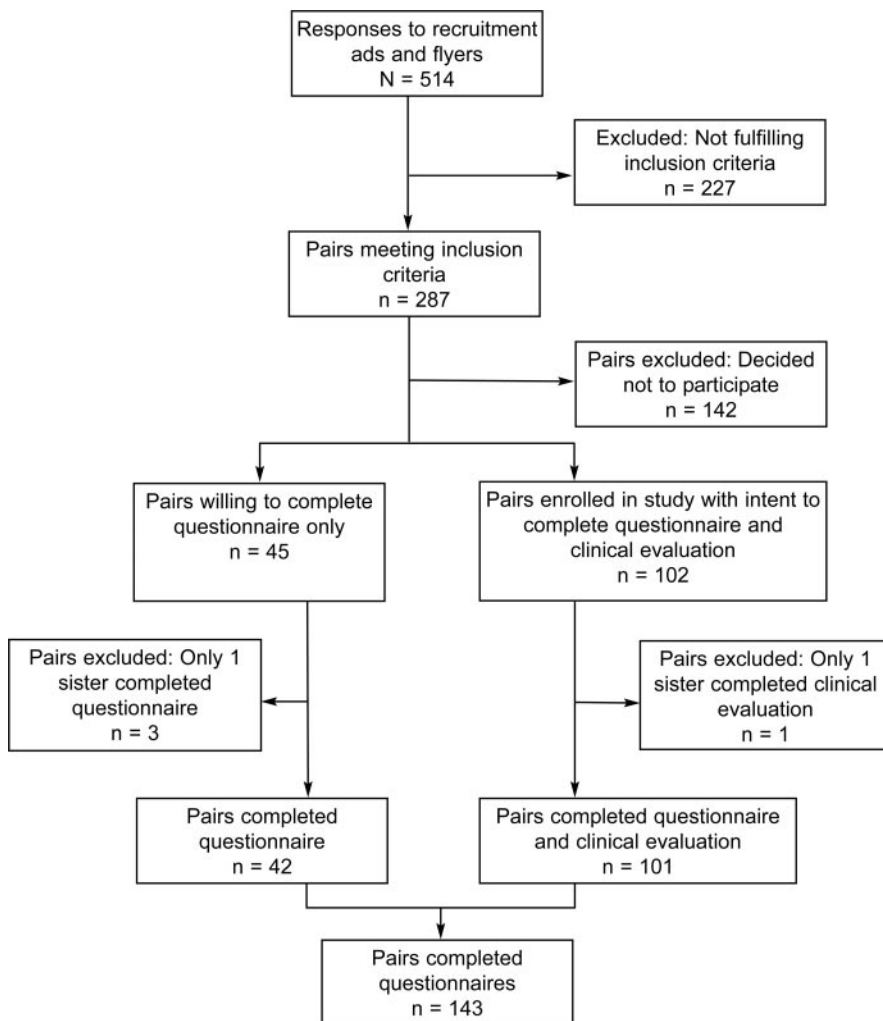


Fig. 1. Participant recruitment and dropout.

Buchsbaum. Role of Parity in Urinary Incontinence. Obstet Gynecol 2005.



continence, mixed incontinence, or no incontinence. An incontinence impact questionnaire, a measure of how urinary incontinence impacts the activities of daily living, was included in the questionnaire. We classified incontinence further into mild, moderate, and severe according to a previously validated severity index.^{16,17}

The sister pairs were invited to undergo a physical examination. Examiners were masked to the continence status and parity of the subjects. After a general assessment of mobility and gait, a cough stress test was performed with the subject in the upright position with a symptomatically full bladder. After the subject emptied her bladder, pelvic and rectovaginal examination were performed in the supine or partial recumbent position. This included an assessment of pelvic organ relaxation. Pelvic organ prolapse was quantified using the Baden-Walker system¹⁸ and the Pelvic Organ Prolapse Quantification staging system approved by the International Continence Society.¹⁹ Presence or absence of pelvic organs was assessed, as were palpable pelvic or rectal masses, integrity of anal sphincter, and the tone of anal sphincter and pelvic floor muscles. An ultrasonic bladder scanner (BladderScan BVI3000; Diagnostic Ultrasound Corporation, Bothell, WA) was used to estimate the postvoid residual urine volume and to identify subjects with voiding dysfunction. Urethral mobility was assessed with a cotton-tipped swab test. Subjects with signs or symptoms of urinary incontinence were asked to return for multichannel urodynamic evaluation. Study participants received an honorarium of \$50.00 for each visit.

We determined through power analysis that 95 sister pairs would have a power of 0.8 to detect a difference of 20% or more in the rate of urinary incontinence between parous and nulliparous sisters at a probability level of .05. Because this was a matched-pair design, the rate of incontinence and the rate of other response variables were compared between parous and nulliparous sisters using the McNemar test to account for possible nonindependence due to familial association. Conditional univariate analyses and multivariable logistic regression were used to assess the effect of various factors on the likelihood of developing urinary incontinence and pelvic organ prolapse, as well as their association with each other. To investigate further a possible familial association, the χ^2 contingency test was then performed to examine the degree of association within the pairs. The Institutional Review Board at the University of Rochester and the Western Institutional Review Board approved this study. Written informed consent was obtained from all study subjects before the examination.

RESULTS

The survey questionnaire was completed by 143 sister pairs. Of these, 101 also completed the clinical evaluation. Because results regarding urinary incontinence in the groups that completed the clinical evaluation were not statistically different from those that did not, pooled data of the 2 groups are presented.

Demographic characteristics of the sister pairs are depicted in Table 1. Except for parity, there were no statistically significant differences between nulliparous and parous sisters in any of these variables. Of note, all but 2 of the pairs in this study were white, despite efforts to recruit minorities.

The rate of urinary incontinence was 47.6% ($n = 68$) for nulliparous women and 49.7% ($n = 71$) for their parous sisters. This difference was not significant (McNemar test $P = .782$). Between sisters, however, there was concordance of continence status in 63% of the pairs ($\chi^2 = 9.5715$, $P = .002$) (Table 2). Comparing results by types of incontinence, 25 (18.4%) of the nulliparous and 25 (18.4%) of the parous women reported symptoms of pure stress incontinence. Urge-related urine loss was reported by 12 (8.8%) of the nulliparous and by 11 (8.1%) of the parous women. Twenty-four (17.7%) of the nulliparous women complained about urine loss with both stress and urge, compared with 30 (22.1%) of their parous sisters. Seven women reported incontinence unrelated to stress or urge. The dependence of the type of incontinence between sister pairs is marginally significant ($\chi^2 = 16.04$, $P = .066$). When combining mixed and pure stress-related urine loss by symptoms, to capture all stress-related urinary incontinence, we found a significant concordance of 55.15% between nulliparous women and their parous sisters ($\chi^2 = 9.4403$, $P = .051$).

We then examined the severity of incontinence among women who reported any incontinence. We classified incontinence as mild, moderate, or severe according to the urinary incontinence severity index,^{7,8} which considers both frequency and quantity

Table 1. Demographic Characteristics

Characteristic	Nulliparous Sisters	Parous Sisters
Parity	0	3.1 ± 1.9
Age (y)	61.0 ± 9.7	61.1 ± 9.3
Weight (lb)	165 ± 39.0	161 ± 34.5
Body mass index (kg/m ²)	28.1 ± 6.0	27.4 ± 5.5
Depression (%)	27.3	28.9
Hysterectomy (%)	25.9	29.6
Hypertension (%)	31.0	30.8
Race: white (%)	96.5	96.5

Data are expressed as mean ± standard deviation or percentage.



Table 2. Concordance of Continence Status Within Sister Pairs

Incontinence	Parous Sister		Total
	None	Present	
Nulliparous sister			
None	47 (32.87)	28 (19.58)	75 (52.45)
Present	25 (17.48)	43 (30.07)	68 (47.55)
Total	72 (50.35)	71 (49.65)	143 (100.00)

Seven sister pairs, in each of which one of the sisters had incontinence unrelated to stress or urge, were not included in this table. Data are expressed as n (%).

of urine leakage. Symptoms were classified as mild for the majority of women with incontinence (36 parous and 34 nulliparous women). Fourteen (20.59%) nulliparous and 19 (26.76%) parous women reported symptoms consistent with moderate incontinence. Ten (14.71%) nulliparous women and 10 (14.08%) parous women had severe incontinence. These differences within the incontinent sister pairs were not significant ($\chi^2 = 8.2494$, $P = .083$). When asked if urine leakage was a problem impacting their daily activities, 40.7% of nulliparous and 32.0% of parous women answered “yes.” This difference was not significant (McNemar test, $P = .196$). The degree of being bothered—from “not at all” to “greatly”—was also not different between parous and nulliparous women ($\chi^2 = 6.4772$, $P = .644$).

In 44 of the 203 patients who completed the physical evaluation, continence status reported on the questionnaire did not agree with that diagnosed at the time of the physical examination. We were unable to confirm urine leakage by observation, pad test, or multichannel urodynamics in 19 women who reported at least one primarily urge-related incontinence episode within the last 4 weeks. Fourteen of these women did not complete urodynamic testing. Of these women, 10 were nulliparous and 9 parous. Almost half of these women (47.4%) also reported that they did not consider incontinence to be a problem. In many cases the incontinence episodes appeared to have been situational. On the other hand, stress urinary incontinence was diagnosed by a positive cough stress test in 15 women who reported no incontinence on their questionnaire; 14 of these women also had stress urinary incontinence confirmed on multichannel urodynamics. Six of these women were nulliparous, and 9 were parous.

Evaluating the 53 discordant sister pairs, we found the parous sister to be incontinent in 28 pairs, and the nulliparous sister to be incontinent in the remaining 25 pairs (conditional logistic regression, $P = .82$, odds ratio 1.12, 95% confidence interval

0.653–1.932). A matched-pair conditional logistic regression analysis was used to evaluate associations between urinary incontinence and several predictor variables, including age, body mass index, hysterectomy, and diagnosis of hypertension or depression. There were no statistically significant differences for any of the demographic variables within the discordant pairs.

DISCUSSION

Contrary to the conventional wisdom that nulliparity protects against stress urinary incontinence, we found similar rates of urinary incontinence in postmenopausal nulliparous women and their parous biological sisters. This is in accordance with our previous findings of a high prevalence of symptoms of urinary incontinence in our uncontrolled series of postmenopausal, nulliparous nuns.⁸

In contrast to the negative results for parity, we found that family history appears to be a strong predictor of incontinence, as indicated by the high degree of concordance of incontinence status between parous women and their nulliparous sisters. Our matched-pair design of parous/nulliparous sister pairs has several other substantial advantages. Many important variables that are related to the risk of urinary incontinence, such as body mass index, hypertension, or integrity of the pelvic floor, are related to familial factors. Sister-sister pairs provide a control for such variables that could not be duplicated by statistical adjustment in a comparison of independent samples. In addition, the study of nulliparous women and their parous sisters allows us to examine the role of a familial variable in the development of urinary incontinence and pelvic organ prolapse. Because all of the parous sisters, by design, had to have had at least one vaginal delivery, we specifically addressed vaginal delivery in relation to developing urinary incontinence, thereby avoiding dilution of our data by using all parous women, including those who delivered only by cesarean.

We found no difference in the rate of urinary incontinence between nulliparous postmenopausal women and their parous sisters. There was also no difference in the reported severity of incontinence or its perceived impact on quality of life. Furthermore, we found no difference in the types of incontinence by symptoms between nulliparous women and their parous sisters.

Consistent with our previous results,⁸ we found high rates of urinary incontinence of all types in nulliparous postmenopausal women. We found no statistical difference in the rate of overall urinary



incontinence between nulliparous women and their parous sisters, nor in the severity of symptoms among sisters pairs who were both incontinent. Thus, damage to the pelvic support systems during vaginal delivery does not appear to increase the prevalence or severity of incontinence later in life. Rortveit and coworkers¹⁰ reported, in a large population-based study of 27,900 Norwegian women, that the effects of parity on incontinence appeared to dissipate in older age. They found no difference in the prevalence of urinary incontinence of any type in women over the age of 65 who were nulliparous, had delivered by cesarean only or vaginally. However, they did find parity, especially vaginal delivery, to be a risk factor for urinary incontinence at earlier ages.

We found a discrepancy between reported symptoms of urinary incontinence and clinical observation in 20% of women. Urge-related urinary incontinence could often not be confirmed in women with mild or situational incontinence. The limited correlation between presenting symptoms of incontinence and urodynamic diagnosis has been reported in the past. Reported sensitivities have ranged between 65% and 100% for stress urinary incontinence,²⁰⁻²² and between 71% and 78% for urge incontinence.^{23,24} Discrepancies between functional symptoms of stress urinary incontinence and clinical observations of urine loss with coughing or jumping jacks are likely due to differences in intensity of activity during evaluation compared with activities in daily life. The high concordance of continence status between sisters of 63% ($\chi^2 = 9.5715$, $P = .002$) strongly suggests that familial factors play a greater role than vaginal delivery in the development of urinary incontinence in postmenopausal women.

We acknowledge that our study cannot address the possibility that parous women might have onset of urinary incontinence at an earlier age than their nulliparous sisters because most of the incontinent participants in our study stated they had lived with this condition for decades. Any further inquiry to determine the date of the onset of incontinence would have been subject to recall bias. Factors associated with vaginal delivery might well play a role in precipitating the onset of urinary incontinence for some women. This is suggested by a survey study of predominately premenopausal identical twins, which found vaginal delivery to be an independent risk factor for urinary incontinence (Goldberg RP, Abramov Y, Botros S, Miller J, Rurak M. Delivery mode is a major determinant of stress urinary incontinence in childbearing women: analysis of 542 identical twins [abstract]. *J Pelvic Med Surg* 2005;11:71).

Considering, however, our finding of high concordance in the continence status between sister pairs and considering further that the majority of parous women are continent, one may infer that the development of urinary incontinence may have an underlying genetic influence. A further limitation of this study is that the findings pertain to white women only. We cannot draw any conclusions as to the role of vaginal delivery or familial relationship as risk factors for urinary incontinence in women of different races.

In summary, we found that incontinence among postmenopausal women was more strongly associated with familial factors than with a history of vaginal delivery. A genetic predisposition for urinary incontinence needs to be explored further because finding a genetic link to this condition would have great implications for the direction of basic research, treatment approaches, risk management, and potential prophylactic interventions.

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