Diabetes and Obesity-Related Risks for Pelvic Reconstructive Surgery in a Cohort of Swedish Twins

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OBJECTIVE — To determine the diabetes- and obesity-related risks for surgically managed stress urinary incontinence and pelvic organ prolapse.

RESEARCH DESIGN AND METHODS — This twin cohort study used the Swedish Twin Register to identify 8,443 female twin pairs born from 1926 through 1958. The association between diabetes and pelvic floor surgery was estimated while taking into account the correlated (twin) structure of the data.

RESULTS — For type 1 and type 2 diabetes, no significant associations were observed for stress urinary incontinence (odds ratio [OR] 1.0 [95% CI 0.1–9.2] and 2.0 [1.0–4.0], respectively). There were no cases of prolapse surgery in type 1 diabetic subjects, and for type 2 diabetes the risk estimate was nonsignificant (1.6 [1.0–2.7]). BMI >25 kg/m^2, age ≥60 years, and childbirth were the strongest risk factors for having incontinence surgery.

CONCLUSIONS — Our data suggest that diabetes is not associated with stress urinary incontinence or pelvic organ prolapse surgery.

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The estimated 11% lifetime risk of female pelvic reconstructive surgery in U.S. women mainly comprises stress urinary incontinence and pelvic organ prolapse surgery (1). In addition to the health-economic burden on society, pelvic floor disorders are associated with often severe implications regarding quality of life (2).

Diabetes and obesity are often promoted as risk factors for urogenital disorders (3,4), but previous studies are limited by cross-sectional study designs (5–7). Some studies do not differentiate between diabetes or incontinence types (3), and genetic influences on the association are unknown.

Genetic effects may contribute to the occurrence of both pelvic floor disorders and diabetes (8,9). Using twin data, the association between diabetes and development of pelvic floor disorders can be estimated while taking into account the genetically correlated (twin) structure of the data. We used the nationwide Swedish Twin Register to estimate the risk of diabetes and obesity on stress urinary incontinence and pelvic organ prolapse surgery.

RESEARCH DESIGN AND METHODS

— This nationwide twin cohort study was performed through cross-linkage of the Swedish Twin Register and the Swedish Inpatient Register. The Swedish Twin Register contains data on nearly all twins born in Sweden since 1886 (10). The present study included the female Swedish Twin Register cohort born from 1926 through 1958, for which we obtained information on age, diabetes type (i.e., type 1 versus type 2), BMI, and childbirths.

The cohort was subsequently linked to the Swedish Inpatient Register to obtain detailed information on pelvic floor surgery based on the Swedish Classification of Operations and Major Procedures. Subjects contributed to the study from 1973 until first occurrence of stress urinary incontinence and/or pelvic organ prolapse surgery, death, or the end of the observation period (31 December 2005). The study conforms to the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines for reporting observational studies (11). The study was approved by the regional research ethics board at Karolinska Institutet.

Classification of surgical procedures

Using the Swedish Classification of Operations and Major Procedures, stress urinary incontinence surgery was classified as any one of the following: Kelly/Kennedy plication, Burch colposuspensions, Stamey procedures, Marshal-Marchetti-Krantz procedures, Ingelman-Sundberg plasty, intravaginal slingplasty, bladder-neck and suburethral slings, and tension-free vaginal tapes (operation codes 6355, 6356, 6358, 7470, and 7471 for 1973–1996 and LEG00, LEG10, LEG20, and KDG10-40 for 1997–2005). Pelvic organ prolapse surgery was categorized as any one of the following: anterior or posterior repair, Manchester procedures, abdominal sacrocolpopexy, sacrospinous fixations, and enterocele obliteration and colpocleisis (operation codes 7120, 7121, 74607-464, 7466, 7469, and 7541 for 1973–1996 and LEF00, LEF03, LEF10-50, LEF53, and LEF96 for 1997–2005).

Statistical analyses

Logistic regression was used based on generalized estimating equations, which take into account the correlated (twin) structure of the data. Provided that there is a significant association between the ex-

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Table 1—*Risk for stress urinary incontinence and pelvic organ prolapse surgery in an adjusted multivariable analysis*

	Stress urinary incontinence				Pelvic organ prolapse			
	Unadjusted		Adjusted		Unadjusted		Adjusted	
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
Diabetes status								
No diabetes	1.0	Reference	1.0	Reference	1.0	Reference	1.0	Reference
Diabetes	1.9	1.1–3.4	1.6	0.9–2.9	1.3	0.8–2.1	0.9	0.5–1.4
BMI (kg/m^2)								
BMI <25	1.0	Reference	1.0	Reference	1.0	Reference	1.0	Reference
BMI 25–30	2.0	1.3–2.9	1.7	1.1–2.6	1.5	1.1–2.1	1.1	0.8–1.5
BMI >30	0.5	0.1–2.7	0.4	0.1–2.4	2.1	1.1–4.0	1.4	0.7–2.8
Age (years)								
48–59	1.0	Reference	1.0	Reference	1.0	Reference	1.0	Reference
60–70	2.0	1.3–2.9	1.8	1.2–2.7	2.4	1.7–3.4	2.4	1.7–3.3
71–81	2.1	1.4–3.2	1.8	1.2–2.8	4.5	3.3–6.2	4.6	3.3–6.5
Childbirth								
No children	1.0	Reference	1.0	Reference	1.0	Reference	1.0	Reference
At least one child	2.8	1.4–5.4	3.8	1.8–7.9	6.0	3.2–11.3	6.1	3.3–11.4

Analysis based on 3,376 complete monozygotic and 5,067 dizygotic female twin pairs.

posure and outcome, using a twin-based study design allows further in-depth assessments of a genetic interaction. Multivariable analyses were adjusted for age, BMI, and childbirth (ever/never). Odds ratios (ORs) were estimated with 95% CIs. All statistical analyses were performed using SAS software (Cary, NC).

RESULTS — A total of 29,881 women were included in the study cohort, including 8,443 same-sex female twin pairs with known zygosity. Mean ± SD parity was 2.3 ± 0.97, BMI 21.2 ± 2.9 kg/m^2, and age 64.1 ± 9.2 years. The accumulated prevalence of pelvic floor surgery in the cohort was 5.6%: stress urinary incontinence surgery was performed in 555 women (1.9%), and pelvic organ prolapse surgery was performed in 1,099 women (3.7%).

We identified 3,376 complete monozygotic and 5,067 dizygotic same-sex female twin pairs from the cohort for correlated generalized estimating equations analysis (Table 1). For type 1 and 2 diabetes, no significant association was observed for stress urinary incontinence (OR 1.0 [95% CI 0.1–9.2] and 2.0 [1.0–4.0]). There were no cases of pelvic organ prolapse surgery in women with type 1 diabetes, and for type 2 diabetes, the risk estimate was nonsignificant (1.6 [1.0–2.7]). We therefore combined type 1 and 2 diabetes into a single variable for the regression analysis.

In the univariate (unadjusted) analysis, diabetes was associated with an increased risk of stress urinary incontinence (OR 1.9 [95% CI 1.1–3.4]). However, after adjustment, the association diminished to a nonsignificant level (1.6 [0.9–2.9]). For stress urinary incontinence, BMI >25 kg/m^2, age ≥60 years, and childbirth were independently associated with an increased risk for having incontinence surgery. Diabetes and BMI were not independent risk factors for pelvic organ prolapse surgery.

CONCLUSIONS — Women undergoing pelvic floor surgery are the ones most likely to have experienced severe symptoms (12), and a presumed causal association would be evident. Nonetheless, we found no independent association between type 1 or type 2 diabetes and surgically managed stress urinary incontinence. When considering both diabetes types as a single exposure, any diabetes was associated with an increased risk for stress urinary incontinence in a univariate setting, but the statistical significance of the association was lost when adjusting for established confounders. Similar to the results for stress urinary incontinence, we found no significant association between diabetes and pelvic organ prolapse surgery after adjusting for potential confounders. Thus, the often-promoted association between diabetes and pelvic floor disorders is confounded by environmental factors.

Genetic effects contribute to the occurrence of both stress urinary incontinence and pelvic organ prolapse (9). There were no consistent indications of a common genetic basis for diabetes and stress urinary incontinence or pelvic organ prolapse. Further exhaustive analyses on mono- or dizygotic twin similarity would therefore be futile.

Being overweight, but not obese, was a risk factor for stress urinary incontinence surgery. This paradoxical result is probably explained by a negative selection for surgery due to apprehension for increased complication rates and poor outcomes in obese subjects. Consistent evidence from observational studies suggests that obese women experience more severe stress urinary incontinence than women of normal weight (13,14). Thus, despite having more severe symptoms and comparable success rates after surgical treatment (15), obese women are less likely to undergo surgical treatment than women of normal weight.

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