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/m², 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.

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, Ingelum-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 enterocoele 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-
Pelvic reconstructive surgery and diabetes

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/m²)            |                             |                       |                             |                       |
| 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/m², 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/m², 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.

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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