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ORIGINAL ARTICLE

Incidence rate and risk factors for vaginal vault prolapse repair after hysterectomy

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Abstract Our objective was to estimate the incidence and identify the risk factors for vaginal vault prolapse repair after hysterectomy. We conducted a case control study among 6,214 women who underwent hysterectomy from 1982 to 2002. Cases (n=32) were women who required vaginal vault suspension following the hysterectomy through December 2005. Controls (n=236) were women, randomly selected from the same cohort, who did not require pelvic organ prolapse surgery. The incidence of vaginal vault prolapse repair was 0.36 per 1,000 women-years. The cumulative incidence was 0.5%. Risk factors included preoperative prolapse (odds ratio (OR) 6.6; 95% confidence interval (CI) 1.5–28.4) and sexual activity (OR 1.3; 95% CI 1.0–1.5). Vaginal hysterectomy was not a risk factor when preoperative prolapse was taken into account (OR 0.9; 95% CI 0.5–1.8).Vaginal vault prolapse repair after hysterectomy is an infrequent event and is due to preexisting weakness of pelvic tissues.

Keywords Case control study · Hysterectomy · Incidence · Risk factors · Vault prolapse

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Abbreviations

POP	pelvic organ prolapse
OR	odds ratio
CI	confidence interval
TAH	total abdominal hysterectomy
VH	vaginal hysterectomy
LAVH	laparoscopic-assisted vaginal hysterectomy
TLH	total laparoscopic hysterectomy
BMI	body mass index
HT	hormonal replacement therapy
USO	unilateral salpingo-oophorectomy
BSO	bilateral salpingo-oophorectomy

Introduction

Pelvic organ prolapse (POP) is a common problem, affecting 30% to 50% of women. The prevalence increases with age [1, 2]. The lifetime risk of surgery for prolapse or incontinence by the age of 80 years is estimated to be 11.1% [3]. The overall incidence of prolapse after hysterectomy was reported to be 3.6 per 1,000 women-years in a large cohort, but there were no data available for vaginal vault prolapse [4]. Vaginal vault prolapse with or without enterocele after hysterectomy represents a distressing condition both for the patient and the surgeon. Incidence of vaginal vault prolapse was estimated to range from 0.2% to 43% [5–8]. However, after an extensive review of medical literature, we found that these rates resulted from estimations derived from case series done in the 1960s and that the incidence of vault prolapses after hysterectomy had never been accurately evaluated. Therefore, considering this lack of data, we decided to conduct a study to estimate the incidence and identify the risk factors for vaginal vault prolapse repair after hysterectomy. In a previous study, we estimated the incidence of prolapse repair after hysterectomy to be 1.3 per 1,000 women-years and identified the risk factors for pelvic organ prolapse repair after hysterectomy [9]. We used the data of the same cohort and restricted the analysis to women having a vault suspension for vaginal prolapse. The route of hysterectomy may play a role in the subsequent development of vaginal vault prolapse, but available data are limited and the conclusions vary between authors [6, 10]. One specific objective was to estimate the effect of vaginal hysterectomy compared with abdominal hysterectomy on the risk of subsequent vault repair.

Materials and methods

We performed a case control study within a cohort. This study was approved by the Institutional Ethics committee of the Geneva University Hospitals. We identified, using a computerized medical record database, all women (N= 6,214) who underwent hysterectomy for any reason in the Department of Obstetrics and Gynecology, Geneva University Hospitals, from January 1982 to December 2002. Cases (n=32) were women of this cohort who required surgical correction of vault prolapse after hysterectomy from January 1982 to December 2005 in our institution. They belonged to the group of cases (n=114) described in a previous report and represented a subgroup of these patients who required surgical correction for POP after hysterectomy [9]. Controls (n=236) were patients randomly selected from the same cohort who were not readmitted for subsequent POP repair during the same period. We selected all cases and drew a sample of controls from the hospital database which includes all women who had hysterectomy. We used the same controls as in our previous report; thus, eight controls per case were included in this analysis. Cases and controls for whom medical records were not available were excluded from the univariable analysis (n=48). Women were excluded from the multivariable analysis if they had missing values on crucial predictors or adjustment variables (n=11). Because there were very few women who had laparoscopic hysterectomy (n=11), they were also excluded from the multivariable analysis. To avoid bias in the evaluation of risk factors, data were collected in the medical charts by observers blinded to the study group. The medical charts were photocopied and stripped of patient's identity. Then the part concerning the first intervention was separated from that of the second in cases. One of the authors (IK-G) reviewed all the charts related to the first intervention (268 hysterectomies) and another one (PD) reviewed the charts related to the second intervention (32 reoperations for vault prolapse). Variables included age, weight, height, parity, number of vaginal deliveries, previous caesareans, menopausal status, hormonal replacement therapy, smoking, constipation, chronic obstructive pulmonary disease, cardiovascular disease, and previous operation for genital prolapse. All women had a standardized preoperative prolapse assessment, using the Baden–Walker classification, which was the classification system in use in our institution during the study period [11]. The grade of cystocele, hysterocele, rectocele, and enterocele were identified, as well as the grade of urinary stress incontinence. The date and indication of hysterectomy were collected, as well as the type of hysterectomy (abdominal, vaginal, laparoscopy-assisted vaginal, or total laparoscopic hysterectomy) and the weight of the uterus. The surgical techniques in use in our institution for abdominal and vaginal hysterectomy were the ones described by Käser et al. [12]. Postoperative complications such as fever or vault abscess were systematically searched.

Cases and controls were compared for predictor variables. Differences in proportions were tested with the chi-square test or Fisher exact test. Differences in continuous variables were tested using the t test. We performed a univariable analysis to compute the odds ratio (ORs) for each predictor. Variables found to be statistically associated with the outcome or clinically important were then entered in logistic regression models to compute adjusted odds ratios. A P value less than or equal to 0.05 was considered to be statistically significant and 95% confidence intervals (CIs) were reported. Annual incidence of reoperation was computed taking into account the fact that only a sample of the potential controls was included. We multiplied the number of person-years at risk of controls by the sampling fraction (236/6,214).

Data were managed and analyzed with Epi-Info 6 (Centers of Disease Control and Prevention, Atlanta, GA, USA) and SPSS 11.0 statistical software (SPSS Inc., Chicago, IL, USA).

Results

Between January 1982 and December 2002, 6,214 hysterectomies were performed in our institution. Regarding the access, 4,304 women (69.3%) had total abdominal hysterectomy; 1,749 (28.1%) had vaginal hysterectomy, 65 (1%) had laparoscopic-assisted vaginal hysterectomy and 96 (1.5%) had total laparoscopic hysterectomy. Between January 1982 and December 2005, 32 women (0.5%) of this cohort were reoperated for subsequent vault prolapse. The distribution of grade of vaginal vault prolapse which required surgical suspension was grade 1 in four (13.3%), grade 2 in 13 (43.3%), grade 3 in 11 (36.7%), and grade 4 in one (3.3%) women (grade was unknown for one woman).

The mean interval between the two operations was 6.2 years (range 0.2 to 21.8 years) in cases and the mean duration of follow-up was 13.2 years (range 3.1 to 23.8 years) in controls. The incidence of vault prolapse requiring surgical correction after hysterectomy was 0.36 per 1,000 women-years. The incidence was 1.1 per 1,000 women-years if initial hysterectomy was performed for prolapse, compared with 0.2 per 1,000 women-years if the hysterectomy was performed for other reasons (hazard rate ratio 5.8). If preoperative prolapse grade 2 or more was present at initial hysterectomy, the incidence was 0.95 per 1,000 women-years, compared to 0.2 per 1,000 women-years for women with preoperative prolapse grade 0 or 1 (hazard rate ratio 5.2). The cumulative risk of vaginal vault repair following hysterectomy over time is shown in Fig. 1.

After a similar search in both groups, two (6.3%) and 46 women (19.5%) in the case and control groups, respectively, were excluded from the analysis because records were not available or values for crucial predictors were missing. This left 30 cases and 190 controls for the analysis.

The univariable analysis is reported in Tables 1, 2, 3, 4, 5. The mean age and the mean body mass index were similar in both groups. Sexual activity appeared as a risk factor (OR 4.0; 95% CI 1.1–21.5, *P*=0.02; Table 1). Parity (OR 4.1; 95% CI 1.0–37.0, *P*=0.04) and one or more vaginal deliveries (OR 4.9; 95% CI 1.2–43.8, *P*=0.02) were strongly associated with an increased risk of reoperation for vault prolapse after hysterectomy. Previous POP or urinary incontinence surgery was also associated with a significant increase in the risk (OR 6.9; 95% CI 0.9–53.6, *P*=0.03; Table 2).

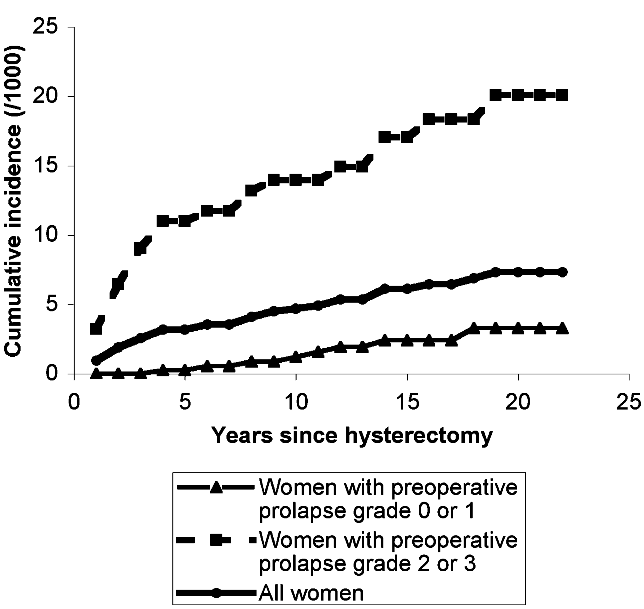

Fig. 1 Cumulative incidence of vaginal vault repair surgery after hysterectomy for all women and for women with preoperative prolapse

Table 1 Characteristics of the study population at hysterectomy

Characteristics	Cases (*n*=30)	Controls (*n*=190)	*P* value
Age (year) mean (SD)	52.7 (10.1)	51.6 (12.4)	0.63
Height (cm) mean (SD)	159.8 (5.5)	160.9 (6.4)	0.42
Weight (kg) mean (SD)	66.1 (9.1)	64.3 (11.2)	0.42
BMI (kg/m^2) mean (SD)	26.1 (3.7)	24.8 (4.6)	0.22
BMI>30 (kg/m^2) *n* (%)	4 (13.3)	20 (10.7)	0.75[b]
Menopause, *n* (%)	16 (53.3)	68 (35.8)	0.07[b]
HT, *n* (%)	7 (23.3)	18 (9.5)[a]	0.08
Menopause without HT, *n* (%)	9 (30.0)	52 (27.5)	0.83[b]
Diabetes, *n* (%)	1 (3.3)	11 (5.8)	1.0[b]
Smoking >5 cigarettes per day n (%)	5 (17.2)	41 (21.6)	0.81[b]
Constipation, *n* (%)	7 (23.3)	46 (24.2)	1.0[b]
Sexual activity	24 (80.0)	120 (63.2)	0.04

P values are calculated with the chi-squared test for proportions and with the *T* test for means unless specified.
BMI Body mass index, *HT* hormonal replacement therapy
[a] Two women with HT in perimenopause
[b] Fisher exact test

Cases and controls significantly differed in indications for hysterectomy. Cases were more likely to have had hysterectomy for genital prolapse, while controls were more likely to have had hysterectomy for myoma or neoplasia. Preoperative urinary stress incontinence was also significantly more frequent in the case group (Table 3).

Table 2 Characteristics of study population at hysterectomy: predictors

Predictor	Cases (*n*=30)	Controls (*n*=190)	Unadjusted OR (95% CI)	*P* value
Parity, *n* (%)				
Nulliparous	2 (6.7)	43 (22.6)	Reference	
Multiparous	28 (93.3)	146 (76.8)	4.1 (1.0–37.0)	0.04
Vaginal delivery				
None	2 (6.7)	49 (25.8)	Reference	
One	5 (16.7)	43 (22.6)	2.9 (0.4–31.1)	0.26[a]
Two or more	23 (76.7)	97 (51.1)	5.8 (1.3–52.5)	0.01
Caesarean section				
None	30 (100.0)	178 (93.7)	Reference	
One or more	0	11 (5.8)	–	0.37[a]
Previous POP or incontinence surgery	3 (10.0)	3 (1.6)	6.9 (0.9–53.6)	0.03[a]
None	27 (90.0)	187 (98.4)	Reference	

P values are calculated with the chi-squared test unless specified. Data are presented as *n* (%). Percentages do not add up to 100% because of missing values (one in the control group)
OR Odds ratio, *CI* confidence interval, *BMI* body mass index, *POP* pelvic organ prolapse, *USO* unilateral salpingo-oophorectomy, *BSO* bilateral salpingo-oophorectomy
[a] Fisher exact test

Table 3 Indication for hysterectomy

Variable	Cases (*n*=30)	Controls (*n*=190)	Unadjusted OR (95% CI)	*P* value
Indication[a]				
Myoma	9 (30.0)	93 (48.9)	Reference	
Genital prolapse	18 (60.0)	38 (20.0)	4.9 (1.9–13.1)	<0.001
Adenomyosis endometriosis	2 (6.7)	8 (4.2)	2.6 (0.2–15.9)	0.25[c]
Dysfunctional bleeding	2 (6.7)	9 (4.7)	2.3 (0.2–13.8)	0.29[c]
Neoplasia	1 (3.3)	33 (17.4)	0.3 (0.01–2.4)	0.45[c]
Others[b]	0	21 (11.1)	–	0.36[c]
Associated urinary stress incontinence	8 (26.7)	23 (12.1)	2.6 (1.0–7.2)	0.05[c]

P values are calculated with the chi-squared test unless specified. Data are presented as *n* (%). Abbreviations as in Table 2.
[a] Percentage may add to more than 100% because some women may have more than one indication
[b] Including polyps, ovarian masses or cysts, cervical dysplasia
[c] Fisher exact test

The presence of preoperative POP, regardless of which pelvic floor compartment was involved, was associated with an increased risk of having vault prolapse repair following hysterectomy (OR 5.1; 95% CI 2.0–13.2, $P<0.001$). Grade 1 preoperative POP was not a risk factor, but grade 2 or more was significantly associated with reoperation (OR 6.5; 95% CI 2.5–17.4, $P<0.001$; Table 4). Preoperative enterocele was significantly more frequent in the case group (three women) than in the control group (one woman; OR 21.8; 95% CI 1.6–21.8, $P<0.001$).

In the multivariable analysis, the most important independent risk factors were the presence of preoperative POP grade 2 or more (adjusted OR 6.6; 95% CI 1.54–28.4, $P=0.01$) and sexual activity (adjusted OR 1.3; 95% CI 1.0–1.6, $P=0.05$). Previous surgery for POP or urinary incontinence (adjusted OR 6.3; 95% CI 0.8–50.50, $P=0.08$) and the history of vaginal delivery (adjusted OR 3.5; 95% CI 0.6–21.2; $P=0.18$) were not statistically significant risk factors after adjustment, but there was a tendency to increase the risk (Table 6). Adjustment for associated urinary incontinence or prolapse repair during hysterectomy did not modify these results.

In univariable analysis, cases and controls differed significantly for the type of intervention (Table 5). Cases were more likely to have had vaginal hysterectomy (OR 3.9; 95% CI 1.6–9.6, $P<0.001$). This association was no longer present in multivariable analysis (adjusted OR 0.9; 95% CI 0.5–1.8, $P=0.86$). Prolapse or urinary incontinence repairs were performed more frequently in the case group (Table 5). The weight of the uterus and postoperative complications were similar in both groups. We found a modest but significantly lower risk of reoperation for women who had had bilateral salpingo-oophorectomy during hysterectomy. The protective effect disappeared in multivariable analysis.

Discussion

Our study confirms that vaginal vault prolapse repair after hysterectomy is an infrequent complication and is due to preexisting weakness of pelvic tissues.

We systematically searched (search terms: "vaginal vault prolapse after hysterectomy," "follow-up studies") the published literature indexed in MEDLINE in all languages, using PubMed, from 1966 to October 2007, and found few studies reporting the incidence of vaginal vault prolapse after hysterectomy. In two review articles, the incidence reported varied from 0.2% to 43% [5, 6]. In these studies, it is unclear which data they relied upon to report an incidence as high as 43%. Cruikshank and Kovac [7] reported the same rate and referred to the textbook of Käser et al. [12] in which this rate was estimated using German literature dating from the 1960s. Most authors agree for a more realistic rate between 0.2% and 1% [6, 13]. They refer to the studies of Symmonds et al. [8], who derived the

Table 4 Preoperative status

Variable	Cases (*n*=30)[a]	Controls (*n*=190)	Unadjusted OR (CI 95%)	*P* value
POP	21 (70.0)	65 (34.2)	5.1 (2.0–13.2)	<0.001
None	8 (26.7)	125 (65.8)	Reference	
Grade 1	1 (3.3)	17 (8.9)	0.9 (0.02–7.6)	1.0[b]
Grade 2 or more	20 (66.7)	48 (25.3)	6.5 (2.5–17.4)	<0.001
Cystocele	21 (70.0)	59 (31.1)	5.8 (2.3–15.3)	<0.001
None	8 (26.7)	131 (68.9)	Reference	
Grade 1	3 (10.0)	16 (8.4)	3.1 (0.5–14.4)	0.13[b]
Grade 2 or more	18 (60.0)	43 (22.6)	6.9 (2.6–18.7)	<0.001
Uterine prolapse	16 (53.3)	50 (26.3)	3.5 (1.5–8.3)	0.002
None	13 (43.3)	140 (73.7)	Reference	
Grade 1	5 (16.7)	26 (13.7)	2.1 (0.5–6.9)	0.19[b]
Grade 2 or more	11 (36.7)	24 (12.6)	4.9 (1.8–13.5)	<0.001
Rectocele	12 (40.0)	37 (19.5)	2.9 (1.2–7.1)	0.009
None	17 (56.7)	153 (80.5)	Reference	
Grade 1	7 (23.3)	26 (13.7)	2.4 (0.8–7.0)	0.08[b]
Grade 2 or more	5 (16.7)	11 (5.8)	4.1 (1.0–14.6)	0.03[b]

P values are calculated with the chi-squared test unless specified. Data are presented as *n* (%). Abbreviations as in Table 2.
[a] Percentages do not add up to hundred percent because of one missing value in the case group
[b] Fisher exact test

Table 5 Type of intervention

Variable	Cases (n=30)	Controls (n=190)	Unadjusted OR (CI 95%)	P value
Abdominal hysterectomy	11 (36.7)	127 (66.8)	Reference	
Vaginal hysterectomy	18 (60.0)	53 (27.9)	3.9 (1.6–9.6)	<0.001
LAVH	1 (3.3)	7 (3.7)	1.7 (0.03–14.9)	0.51[a]
TLH	0	3 (1.6)	–	1.0[a]
Associated prolapse intervention	17 (56.7)	44 (23.2)	4.3 (1.8–10.4)	<0.001
None	13 (43.3)	146 (76.8)	Reference	
Anterior colporrhaphy	17 (56.7)	39 (20.5)	4.9 (2.1–11.8)	<0.001
Posterior colporrhaphy	8 (26.7)	21 (11.1)	4.3 (1.4–12.8)	0.006[a]
Vault suspension	0	1 (0.5)	NA	1.0[a]
Enterocele	0	0	NA	NA
Culdoplasty	0	4 (2.1)	NA	1.0[a]
Urinary incontinence repair	9 (30)	20 (10.5)	3.6 (1.3–9.8)	0.007[a]
None	21 (70)	170 (89.5)	Reference	
Vaginal	4 (13.3)	8 (4.2)	4.1 (0.8–16.6)	0.05[a]
Abdominal (Burch)	5 (16.7)	12 (6.3)	3.4 (0.8–11.5)	0.04[a]
Associated prolapse and/or incontinence repair				
None	8 (26.7)	134 (70.5)	Reference	
Any	22 (73.3)	56 (29.5)	6.6 (2.6–17.2)	<0.001
Salpingo-oophorectomy	9 (30.0)	98 (51.6)	0.4 (0.2–1.0)	0.03
None	21 (70.0)	92 (48.4)	Reference	
Unilateral	2 (6.7)	19 (10)	0.5 (0.1–2.2)	0.52[a]
bilateral	7 (23.3)	79 (41.6)	0.4 (0.1–1.0)	0.04
Postoperative complications				
Fever >38°C	2 (6.7)	5 (2.6)	2.6 (0.2–17.0)	0.24[a]
Vaginal vault abscess	1 (3.3)	2 (1.1)	3.2 (0.1–63.6)	0.36[a]
Median weight of uterus in grams (25th–75th percentile)	105 (50–151)	121 (64–300)	NA	0.27[b]

Data are presented as n (%) except for the weight of the uterus. P values are calculated with the chi-squared test unless specified. Other abbreviations as in Table 2.
LAVH Laparoscopic-assisted vaginal hysterectomy, *TLH* total laparoscopic hysterectomy
[a] Fisher exact test
[b] Kruskal–Wallis test

estimates from case series using as the denominator an estimate of the total number of hysterectomies performed during the same time period [13]. However, the authors themselves stated that their estimate was uncertain [8].

Table 6 Odds ratios and 95% confidence intervals adjusted for the other factors in the model

Risk factor	Adjusted OR (95% CI)	P value
BMI>30 (kg/m^2)	0.99 (0.27–3.66)	0.99
Smoking >5 cigarettes per day	1.05 (0.30–3.65)	0.94
Sexual activity	1.25 (1.01–1.55)	0.05
Menopause	0.85 (0.31–2.36)	0.76
Vaginal delivery (one or more)	3.45 (0.56–21.22)	0.18
Previous POP and incontinence surgery	6.31 (0.79–50.51)	0.08
Preoperative POP grade 1	0.83 (0.84–8.07)	0.87
Preoperative POP grade 2 or more	6.62 (1.54–28.40)	0.01
Type of intervention		
Abdominal hysterectomy	Reference	
Vaginal hysterectomy	0.94 (0.49–1.80)	0.86

P values are calculated with the chi-squared test unless specified. Abbreviations as in Table 2. Each OR and 95% CI is adjusted for all other covariates listed in this table. Laparoscopic hysterectomies were excluded (one in the case group and ten in the control group)

More recently, Marchionni et al. [10] reviewed 2,670 hysterectomies performed between 1983 and 1987. They found 20 women having vault prolapse (4.4%) among a randomly selected subgroup of 448 women examined in 1996. However, only five of the 2,670 women (0.2%) were reoperated for vault prolapse on their own initiative. Among the 20 women found to have vault prolapse in the selected follow-up subgroup, eight (40%) had grade 1 vault prolapse, and 12 (60%) had grade 2 or more vault prolapse. After being contacted and examined by the study group, eight of the 448 patients (1.8%) underwent surgical correction of vaginal vault prolapse.

As the incidence is influenced by access to medical care and financial considerations, comparisons between different populations are difficult. We report a higher incidence of vault repair (0.5%), compared with the incidence reported in the study conducted by Marchionni et al. [10]. In the latter study, the number of women who returned on their own initiative for surgical correction of vaginal vault prolapse may have been underestimated if care was sought outside the institution. In our cohort, there were 13.3% of women reoperated for vault suspension with grade 1 vaginal vault prolapse and 83.3% had grade 2 or more, suggesting that women with grade 1 vault prolapse are less likely to seek care. In the study of Marchionni et al. [10], the incidence of reoperation was higher (1.8%) in the selected subgroup that was randomly selected to be examined. The patient's decision to be operated might have been influenced by the study procedure, as there were more women with grade 1 prolapse (40%) than in our cohort. We believe that, for the majority of asymptomatic women with prolapse only detected during a vaginal examination, surgery is probably not indicated. Despite these differences, the relative risk of vaginal vault prolapse repair when hysterectomy was performed for POP was, however, similar in both studies.

The incidence in our study might be underestimated if women with vaginal vault prolapse who had undergone hysterectomy in our institution had been treated for prolapse elsewhere. However, that number is probably low because our clinic is the only public institution in the canton of Geneva. Women followed in public hospitals in Switzerland rarely go to private clinics due to their lack of private health insurance coverage, and Swiss health insurances only exceptionally accept that a patient go to another canton or country to be operated.

In our analysis of risk factors, both univariable and multivariable, stage 1 prolapse was not associated with a higher risk of reoperation and could be considered as a normal variant of vaginal anatomy [14–16]. Preoperative prolapse (grade 2 or more) was the main risk factor for vault repair following hysterectomy, which is in agreement with large epidemiological studies [3, 4, 15, 17, 18]. Although not significant in multivariable analysis, previous surgery for prolapse or urinary incontinence and vaginal delivery also showed a tendency to increase the risk and were significant risk factors in univariable analysis. The lack of significance in multivariable analysis is probably due to the small numbers of patients. An important finding was that vaginal hysterectomy, compared with abdominal hysterectomy, did not increase the risk for vaginal vault prolapse requiring surgical correction. During the study period, vaginal hysterectomy was performed in our institution mostly if prolapse was present and surgical prolapse correction was associated whenever necessary. These findings are consistent with previous reports showing that vaginal vault prolapse after hysterectomy was related to preexisting defects in pelvic support and not to the route of hysterectomy [10, 19]. Unrecognized uterine prolapse at the time of hysterectomy may explain some of the consecutive vault prolapses. However, should vaginal vault suspension be performed at the time of hysterectomy in the 1,500 women having some degree of preoperative uterine prolapse (25% of our cohort) and if vaginal vault suspension (i.e., Richter procedure) prevented all vaginal vault prolapse repair (n=30), then 50 vaginal vault suspensions at the time of hysterectomy would be needed to avoid one additional case of subsequent vault prolapse repair. In the multivariable model, we have adjusted for prolapse repair during hysterectomy, without significant modification of its effect on the risk factors. We did not find any association between vault prolapse repair and obesity. This might be explained by the fact that there were very few obese women in our cohort, thus reducing the power to show an effect of this variable. In our previous report, sexual activity was significantly associated with an increased risk of pelvic floor repair after hysterectomy [9]. In the present analysis, the association is weaker. This association may be due to other variables influencing the decision to operate, such as the physical condition of the patient. We noted a 10 to 15 years age difference at the time of hysterectomy, in both cases and controls, between women with or without sexual activity. However, when we included age in the multivariable model, there was no change in the estimate. We may also hypothesize that mechanical factors associated with sexual activity increase the risk of subsequent genital prolapse.

The limitations of our study included those typical of studies relying on information collected in medical records. Despite similar efforts to trace the medical charts, a different percentage of identification remained between groups. Unavailability of records might have been due to changing names, as in Switzerland individuals have no unique identifier. We cannot comment on the presence of vault prolapse in women not seeking care. However, their vault prolapse is likely to be of a milder degree or produce fewer symptoms. Due to the lack of long-term systematic follow-up in this population, the overall incidence of vault prolapse, including those not needing a repair, may have therefore been underestimated. We believe however that this does not modify the relation between risk factors and the outcome. The number of laparoscopic hysterectomies was too small in this cohort to draw any conclusions on the consequences of this technique.

The strength of this study was the availability of a continuously updated computerized register, which allowed us to identify cases and controls in the same large cohort with a long follow-up. Another strength was the preoperative standardized assessment of the genital prolapse according to the Baden–Walker classification [11].

Our study shows that vaginal vault prolapse which requires surgical correction after hysterectomy is relatively rare. We identified pelvic organ prolapse grade 2 or more as the main risk factor for subsequent vaginal vault prolapse repair after hysterectomy, vaginal hysterectomy not being an independent cause.

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Conflicts of interest None.

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