

ORIGINAL RESEARCH ARTICLE

Incidence of self-reported pelvic pain and risk factors for pain 1 year after benign hysterectomy: A register study from the Swedish National Quality Registry for Gynecological Surgery

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Abstract

Introduction: The primary aim of this study was to determine the incidence of patient-reported pain 1 year after hysterectomy for benign gynecological conditions in relation to occurrence of preoperative pain. The secondary aim was to analyze clinical risk factors for pain 1 year after the hysterectomy in women with and without preoperatively reported pelvic/lower abdominal pain.

Material and methods: This was a historical cohort study using data from the Swedish National Quality Registry for Gynecological Surgery on 16 694 benign hysterectomies. Data were analyzed using multivariable logistic regression models.

Results: One year after surgery, 22.4% of women with preoperative pain reported pelvic pain and 7.8% reported de novo pelvic pain. For those with preoperative pain younger age (adjusted odds ratio [aOR] 1.75, 95% confidence interval [CI] 1.38–2.23 and aOR 1.21, 95% CI 1.10–1.34 for women aged <35 and 35–44 years, respectively), not being gainfully employed (aOR 1.43, 95% CI 1.26–1.63), pelvic pain as the main symptom leading to hysterectomy (aOR 1.51, 95% CI 1.19–1.90), endometriosis (aOR 1.18, 95% CI 1.06–1.31), and laparoscopic hysterectomy (aOR 1.30, 95% CI 1.07–1.58), were clinically relevant independent risk factors for pelvic/lower abdominal pain 1 year after surgery, as were postoperative complications within 8 weeks after discharge. Meanwhile, clinically relevant independent risk factors for reporting de novo pain 1 year after surgery were younger age (aOR 2.05, 95% CI 1.08–3.86 and aOR 1.29, 95% CI 1.04–1.60 for women aged <35 and 35–44 years, respectively), and postoperative complications within 8 weeks after discharge.

Conclusions: The incidence of pelvic pain and de novo pain 1 year after hysterectomy was relatively high. Women with and without reported preoperative pelvic/lower abdominal pain represented clinically different populations. The risk factors for pelvic pain seemed to differ in these two populations. The differences in risk factors

Abbreviations: aOR, adjusted odds ratio; ASA, American Society of Anesthesiologists; BMI, body mass index; CI, confidence interval; EDA, epidural anesthesia; GynOp, Swedish National Quality Registry for Gynecological Surgery; OR, odds ratio.

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could be taken into consideration in the preoperative counseling and in the decision-making concerning method of hysterectomy, provided that large well-designed studies confirm these risk factors.

KEYWORDS

epidemiology, hysterectomy, incidence, lower abdominal pain, pelvic pain, risk factors

1 | INTRODUCTION

Hysterectomy is the most common major gynecological surgical procedure in many countries.¹ Even though the majority (>90%) of women are satisfied with the results of the procedure,² many women report chronic pain following hysterectomy. The reported prevalence of chronic pain after hysterectomy for benign gynecological conditions varies between 5% and 32%.³ The wide range in variation mostly reflects differences in selection of study populations, definitions and study design.⁴ Most women with chronic pain after hysterectomy also report pain preoperatively,⁵ whereas the prevalence of new onset of pelvic pain varies between <5%⁵ and 12.5%.⁶ The etiology of chronic pelvic pain is multifactorial and is associated with somatic a surgical comorbidity as well as mental health disorders.⁷ This may also apply with chronic pelvic pain after hysterectomy. The most consistently reported risk factors for developing chronic pain after hysterectomy are psychological factors, preoperative pelvic pain or pain elsewhere, mode of hysterectomy and acute postoperative pain.^{4,8,9} Although it is recommended that the patient's preoperative pain status and psychological condition are "optimized" before surgery,¹⁰ many of the psychological factors may not be easily treated or modulated before hysterectomy. The variety in etiology may influence the determination of risk factors for chronic pain. Most of the studies on chronic pain after hysterectomy did not discriminate risk factors for persistent chronic pain and de novo pain, although they are not necessarily the same. Such distinction may even indicate different approaches to preventive measures to chronic pain.⁵

It is important to analyze pain after hysterectomy and risk factors to gain a better understanding of the mechanisms of persistent or de novo pain after hysterectomy and to find possible preventive measures. National healthcare quality registers such as the Swedish National Quality Registry for Gynecological Surgery (GynOp) provide excellent opportunities to evaluate large populations epidemiologically and thereby also assess risk factors. The primary aim of this study was to determine the incidence of patient-reported pain 1 year after hysterectomy for benign gynecological conditions in relation to occurrence of preoperative pain. The secondary aim was to analyze clinical risk factors for pain 1 year after the hysterectomy in women with and without preoperatively reported pelvic/lower abdominal pain.

2 | MATERIAL AND METHODS

Data from GynOp were used in this historical cohort study. The GynOp has collected data since 1994 and started registering data

Key message

Remaining and de novo pelvic pain were relatively common 1 year after hysterectomy. Risk factors for postoperative pain differed between women with and without preoperative pain, which should be taken into consideration in the preoperative counseling regarding hysterectomy.

on hysterectomies in 1997. This study is based on data collected during the period January 1, 2004 to August 1, 2016 from 57 hospitals, which accounts for over 75% of all benign hysterectomies performed in Sweden during that time.¹¹

Written information about the register and the possible use of collected data for research purposes is given to all women scheduled for gynecological surgery. When they answer the health declaration and questionnaires, the women are giving formal consent to participate in the register, which is in accordance with the Swedish legislation. Women are also informed about their opportunity to decline or withdraw from participating later on.

The GynOp collects data via patient questionnaires and surgeons' records. Before surgery, the patient fills in a detailed health declaration. Postoperatively, a questionnaire is sent on two occasions: after 8 weeks and 1 year. The questionnaires contain questions on health status, recovery and remaining or new complaints. The surgeon registers pre- and perioperative clinical data at the time of surgery using computerized forms.¹¹

Those eligible for the study were women undergoing benign hysterectomy, aged 18 years and older, registered in the GynOp, and who had answered the 1-year postoperative questionnaire. Women older than 55 years of age and those who had hysterectomy due to genital prolapse, urinary incontinence, peripartum complications, premalignant conditions, cancer prophylactic, and gender-corrective indications were excluded. Women without a gynecological indication or for whom the indication for the hysterectomy was not noted were likewise excluded.

The data obtained from the GynOp included age, parity, body mass index (BMI), smoking habits, employment, self-reported preoperative pelvic/lower abdominal pain (yes/no) and a rating of the main symptom leading to hysterectomy in four categories (bleeding disorder/pelvic pain/mechanical symptom [including pelvic pressure and heaviness]/other). All these data were retrieved from the health declaration. Clinical data obtained from the surgeons' forms were the American Society of Anesthesiologist

(ASA) classification, mode of hysterectomy (abdominal, vaginal or laparoscopically), hysterectomy type (total or subtotal), bilateral oophorectomy (yes/no), mode of anesthesia (general anesthesia, general anesthesia combined with regional anesthesia, or regional anesthesia (spinal or epidural [EDA] only), complications during the hospital stay and a diagnosis of endometriosis (International Classification of Diseases 10th revision, codes N80.0–9) as a main or secondary diagnosis obtained after the hysterectomy. The information on complications after discharge was obtained from the 8-week patient questionnaire. The self-reported complications were categorized as: (1) bleeding complications (consisting of heavy vaginal bleeding, bleeding from abdominal wall/wound, bleeding from abdominal cavity, anemia, other bleeding), yes/no, or (2) infection complications (consisting of fever $>38^{\circ}\text{C}$ for more than 2 days, urinary tract infection, genital infection/smelly discharge, wound infection, intra-abdominal abscess, sepsis, other infections) yes/no, or (3) micturition complications (urinary retention that required catheterization, persistent pain during micturition >1 month after surgery, urinary incontinence, other) yes/no, or (4) other complications (fatigue, constipation, ileus/sub-ileus, thromboembolism, other), yes/no. Postoperative pelvic pain was retrieved from the 1-year patient questionnaire ("Do you have pelvic pain/lower abdominal pain? yes/no").

2.1 | Statistical analyses

The software TIBCO Statistica™, version 13.5 (TIBCO Software Inc.) and IBM SPSS® version 28 (IBM Corp.) were used to conduct the statistical analyses. Continuous data are presented as mean and one standard deviation, and nominal data are described as number and percentage. Univariate comparisons between groups were carried out by means of t-test for continuous data and Pearson's chi-square tests for nominal data. The statistical tests were two-sided, and the level of significance was set at 5%.

To assess the dichotomized outcome measure "Self-reported pelvic/lower abdominal pain one year after the hysterectomy" (yes/no), logistic regression analysis models were used. Multivariable logistic regression models were set up to evaluate independent risk factors for pelvic pain 1 year after hysterectomy. All selected variables depicted in Table 1 were entered simultaneously in the models. Since missing data generated a substantial reduction in the number of participants in the multivariable logistic regression models, missing data were replaced by multiple imputation. Thus, the adjusted logistic regression models were based on the imputed datasets. The results of the logistic regression analyses are presented as crude and adjusted odds ratio (OR and aOR, respectively) and 95% confidence intervals (CI).

2.2 | Ethics statement

Approval was granted by the Regional Ethics Board of Linköping on February 24, 2016 (Dnr. M19–07; amendment 2016/66–32). By

answering the health declaration and questionnaires, women gave formal consent to participate in the register for research purposes.

3 | RESULTS

The study group comprised 16 694 women. The selection of these women from the entire hysterectomy population in the GynOp and the relation to pelvic/lower abdominal pain reported preoperatively and 1 year postoperatively are presented in the flow chart (Figure 1).

The demographic and clinical data of the groups with and without reported pelvic/lower abdominal pain preoperatively are presented in Table 1. Compared with women who reported pain preoperatively, the women who did not report preoperative pain were significantly older, had lower BMI, were more often non-smokers and gainfully employed, had more often bleeding disorder and mechanical symptoms as main indication and more seldom a diagnosis of endometriosis. In addition, they more often had abdominal and vaginal hysterectomy and less often laparoscopic, and the mode of anesthesia more often included regional anesthesia. Likewise, the proportion of women that reported complications within 8 weeks after discharge was lower.

The incidence of pelvic/lower abdominal pain 1 year postoperatively was 22.4% (2492 of 11 107) among women who reported pain preoperatively, and 7.8% (436 of 5587) in women who did not report pain preoperatively.

The demographic and clinical data of women with preoperative pelvic/lower abdominal divided after reported pelvic/lower abdominal pain 1 year after surgery are depicted in Table 2 together with the outcomes of the univariate and multivariate logistic regression analyses. In the univariate analysis, almost all factors differed significantly between women with and without reported pain 1 year after the hysterectomy. However, the multivariate logistic regression models restricted the independent risk factors to younger age groups (aOR 1.75, 95% CI 1.38–2.23 and aOR 1.21, 95% CI 1.10–1.34 for women aged <35 and 35–44 years, respectively, vs women aged 45–55 years), ASA class II (aOR 1.23, 95% CI 1.10–1.39 vs ASA class I), and not gainfully employed (aOR 1.43, 95% CI 1.26–1.63 vs gainfully employed). Moreover, pelvic pain as the main symptom leading to hysterectomy (aOR 1.51, 95% CI 1.19–1.90 vs other main symptoms leading to hysterectomy), endometriosis (aOR 1.18, 95% CI 1.06–1.31 vs no endometriosis), laparoscopic hysterectomy (aOR 1.30, 95% CI 1.07–1.58 vs vaginal hysterectomy), and subtotal hysterectomy (aOR 1.19, 95% CI 1.05–1.34 vs total hysterectomy) were independent risk factors for pelvic/lower abdominal pain 1 year after surgery. Reporting bleeding complications, micturition complications and other complications within 8 weeks after discharge from the hysterectomy were likewise independent risk factors (aOR 1.39, 95% CI 1.22–1.58, aOR 2.07, 95% CI 1.80–2.37, and aOR 1.40, 95% CI 1.23–1.60, respectively, vs no complications).

Neither parity, BMI, smoking, bilateral oophorectomy, mode of anesthesia, complications during hospitalization nor infection

TABLE 1 Demographic and clinical descriptive data of 16 694 women registered in the GynOp as benign hysterectomy in relation to self-reported pelvic/lower abdominal pain preoperatively

	Reported pelvic/lower abdominal pain preoperatively (n = 11 107)	No reported pelvic/lower abdominal pain preoperatively (n = 5587)	P-value ^c
Age, years	44.9 (5.2)	46.4 (4.8)	<0.0001 ^a
Age groups			
<35 years	359 (3.2)	88 (1.6)	<0.0001 ^b
35–44 years	4534 (40.8)	1743 (31.2)	
45–55 years	6214 (59.9)	3756 (67.2)	
Parity			
Nulliparous	919 (8.3)	426 (7.6)	0.08 ^b
Parous	9366 (84.3)	4841 (86.6)	
Missing data	822 (7.4)	320 (5.7)	
BMI, kg/m ²	26.4 (4.7)	26.2 (4.7)	<0.01 ^a
BMI groups			
<25 kg/m ²	4802 (43.2)	2517 (45.1)	0.03 ^b
25–29.9 kg/m ²	3728 (33.6)	1894 (33.9)	
≥30 kg/m ²	2154 (19.4)	1000 (17.9)	
Missing data	423 (3.8)	176 (3.2)	
ASA classes			
ASA 1	8563 (77.1)	4371 (78.2)	0.14 ^b
ASA 2	2199 (19.8)	1037 (18.7)	
ASA 3–4	95 (0.9)	53 (0.9)	
Missing data	250 (2.2)	126 (2.2)	
Currently smoking			
Yes	2157 (19.4)	808 (14.5)	<0.0001 ^b
No	8802 (79.3)	4707 (84.2)	
Missing data	148 (1.3)	72 (1.3)	
Gainfully employed			
Yes	9254 (83.2)	4865 (87.1)	<0.0001 ^b
No	1635 (14.7)	541 (9.7)	
Missing data	218 (2.0)	181 (3.2)	
Main symptom leading to hysterectomy ^d			
Bleeding disorder	6184 (55.7)	3867 (69.2)	<0.0001 ^b
Pelvic pain	3275 (29.5)	–	
Mechanical symptom ^e	880 (7.9)	705 (12.6)	
Others	552 (5.0)	745 (13.4)	
Missing data	216 (1.9)	270 (4.8)	
Mode of hysterectomy			
Abdominal	7721 (69.5)	3947 (70.7)	<0.001 ^b
Vaginal	2384 (21.5)	1241 (22.2)	
Laparoscopic	999 (9.0)	399 (7.1)	
Missing data	3 (0.03)	0 (0.0)	
Hysterectomy type			
Total	8816 (79.4)	4391 (78.6)	0.24 ^b
Subtotal	2291 (20.6)	1196 (21.4)	

TABLE 1 (Continued)

	Reported pelvic/lower abdominal pain preoperatively (n = 11 107)	No reported pelvic/lower abdominal pain preoperatively (n = 5587)	P-value ^c
Bilateral oophorectomy			
Yes	766 (6.9)	405 (7.2)	0.15 ^b
No	8628 (77.7)	4157 (74.4)	
Missing data	1713 (15.4)	1025 (18.4)	
Mode of anesthesia			
GA	5735 (51.6)	2681 (48.0)	<0.0001 ^b
GA + SA or EDA	2062 (18.7)	1144 (20.5)	
SA or EDA	900 (8.1)	523 (9.4)	
Missing data	2410 (21.7)	1239 (22.2)	
Endometriosis ^f			
Yes	3007 (27.1)	1128 (19.2)	<0.0001 ^b
No	7979 (71.8)	4380 (78.4)	
Missing data	121 (1.1)	79 (1.4)	
Complications during hospital stay			
Yes	1299 (11.7)	604 (10.8)	0.08 ^b
No	9655 (86.9)	4914 (88.0)	
Missing data	153 (1.4)	69 (1.2)	
Bleeding complications within 8 weeks after discharge			
Yes	3694 (33.3)	1411 (25.3)	<0.0001 ^b
No	6599 (59.4)	3818 (68.3)	
Missing data	814 (7.3)	358 (6.4)	
Infection complications within 8 weeks after discharge			
Yes	2022 (18.2)	714 (12.8)	<0.0001 ^b
No	8271 (74.4)	4515 (80.8)	
Missing data	814 (7.3)	358 (6.4)	
Micturition complications within 8 weeks after discharge			
Yes	1823 (16.4)	496 (8.9)	<0.0001 ^b
No	8470 (76.3)	4733 (84.7)	
Missing data	814 (7.3)	358 (6.4)	
Other complications within 8 weeks after discharge			
Yes	2313 (20.8)	751 (13.4)	<0.0001 ^b
No	7980 (71.8)	4479 (80.2)	
Missing data	814 (7.3)	357 (6.4)	

Note: Figures denote mean and standard deviation (SD) or number (%).

Abbreviations: ASA, American Society of Anesthesiology classification; BMI, body mass index; EDA, epidural anesthesia; GA, general anesthesia; SA, spinal anesthesia.

^at-test.

^bPearson's chi-square tests.

^cAnalyses do not include missing data.

^dPatient reported the main symptom that led to hysterectomy.

^eComprises pelvic pressure and heaviness.

^fEndometriosis confirmed histopathologically as the main and secondary diagnosis after hysterectomy.

complications after discharge were independent risk factors for pelvic pain 1 year after hysterectomy (Table 2).

Laparoscopic hysterectomy was significantly more often used in women with pain as the main symptom leading to hysterectomy compared with the aggregation of the other symptoms that lead to

the hysterectomy. By contrast, subtotal hysterectomy was significantly less often used (Table 3).

In Table 4, the demographic and clinical data of women without preoperative pelvic/lower abdominal divided after reported pelvic/lower abdominal pain 1 year after surgery are presented.

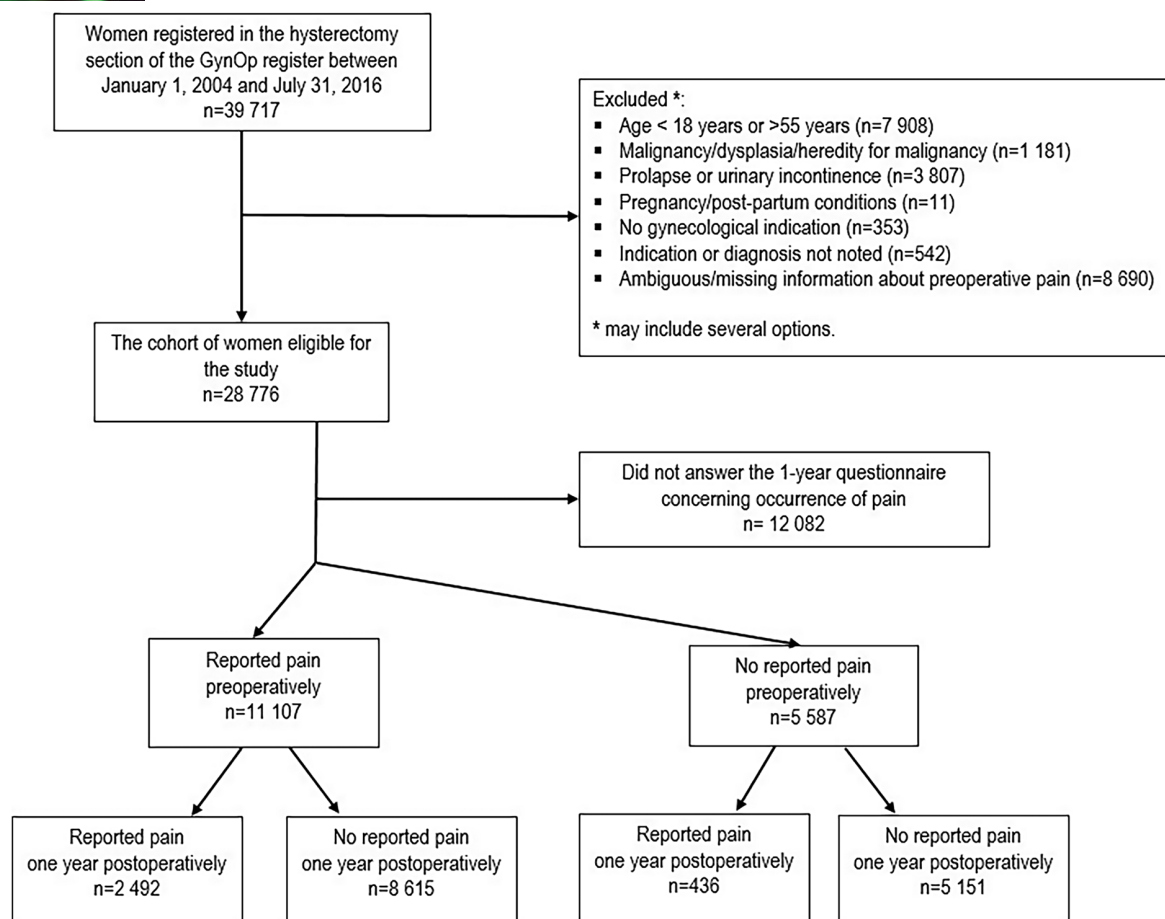


FIGURE 1 Flow chart of study population

A few variables differed significantly in the univariate analysis between women with and without reported de novo pain 1 year after hysterectomy; younger age groups, obesity, not gainfully employed, complications during hospital stay, and all categories of complications within 8 weeks after discharge from surgery. However, in the multivariate logistic regression models, only younger age groups (aOR 2.05, 95% CI 1.08–3.86 and aOR 1.29, 95% CI 1.04–1.60 for women aged <35 and 35–44 years, respectively, vs women aged 45–55 years), reported complications within 8 weeks after discharge (aOR 1.39, 95% CI 1.06–1.83, aOR 1.77, 95% CI 1.32–2.37, and aOR 1.45, 95% CI 1.09–1.92 for bleeding complications, micturition complications, and other complications, respectively, vs no complications) were independent risk factors for reporting de novo pain 1 year after surgery.

4 | DISCUSSION

This large Swedish population-based study showed that more than 22% of women with preoperatively reported pelvic/lower abdominal pain reported pain 1 year after benign hysterectomy. The reported incidence of de novo pain was nearly 8%.

The risk factors for pain 1 year after hysterectomy in women with and without reported preoperative pain demonstrated similarities

but also marked differences. Whereas younger age groups and reported complications within 8 weeks after surgery (bleeding, micturition and other complications) were independent risk factors in women both with and without preoperative pain, ASA class 2, not being gainfully employed, subtotal and laparoscopic hysterectomy, endometriosis and pelvic pain as indication for the hysterectomy were independent risk factors for pain 1 year after surgery exclusively in women with preoperatively reported pain.

To the best of our knowledge, this is the first study that investigates pain 1 year postoperatively after hysterectomy for benign conditions in relation to the occurrence of preoperative pain using data from a nationwide population-based registry. None of the published Cochrane Database of Systematic Reviews of surgical approach to hysterectomy for benign gynecological disease¹² or total vs subtotal hysterectomy¹³ have included pain in the presentation of outcomes after hysterectomy.

The incidence of pain 1 year after hysterectomy in women with preoperative pain reported in the present study is comparable to that reported by Stoval et al.¹⁴ (22.2%) and Hillis et al.¹⁵ (26%), but considerably lower than that reported by Brandsborg et al.⁶ (43.8%) and Pinto et al.⁸ (53.6%). In contrast, the incidence of de novo pain in women without pain preoperatively was significantly lower in the present study than those reported by Brandsborg et al.³ (12.5%) and Pinto et al.⁸ (36.5%). A comparison of the incidence in the various

TABLE 2 Associations between occurrence of pelvic/lower abdominal pain 1 year after hysterectomy and demographic and clinical factors in women reporting pelvic/lower abdominal pain preoperatively

Demographic and clinic factors	Grouping	Pelvic/lower abdominal pain at 1 year (n = 2492)	No pelvic/lower abdominal pain at 1 year (n = 8615)	Univariate analysis ^a OR (95% CI)	Multivariate analysis ^b aOR (95% CI)
Age groups	45–55 years	130 (5.2)	229 (2.7)	1.00 (reference)	1.00 (reference)
	35–44 years	1109 (44.5)	3425 (39.8)	1.39 (1.28–1.52)	1.21 (1.10–1.34)
	<35 years	1253 (50.3)	4961 (57.6)	2.63 (2.14–3.22)	1.75 (1.38–2.23)
Parity	Parous	2072 (83.2)	7294 (84.7)	1.00 (reference)	1.00 (reference)
	Nulliparous	227 (9.1)	692 (8.0)	1.17 (1.02–1.34)	1.10 (0.85–1.19)
	Missing data	193 (7.7)	629 (7.3)		
BMI groups	<25 kg/m ²	1007 (40.4)	3795 (44.1)	1.00 (reference)	1.00 (reference)
	25–29.9 kg/m ²	854 (34.3)	2874 (33.4)	1.12 (1.02–1.23)	1.10 (0.98–1.22)
	≥30 kg/m ²	517 (20.8)	1637 (19.0)	1.22 (1.09–1.36)	1.06 (0.93–1.21)
	Missing data	114 (4.6)	309 (3.6)		
ASA class	ASA 1	1808 (72.6)	6755 (78.4)	1.00 (reference)	1.00 (reference)
	ASA 2	596 (23.9)	1603 (18.6)	1.34 (1.22–1.48)	1.23 (1.10–1.39)
	ASA 3	28 (1.1)	67 (0.78)	1.39 (0.94–2.06)	1.21 (0.75–1.95)
	Missing data	60 (2.4)	190 (2.2)		
Currently smoking	No	1919 (77.0)	6883 (79.9)	1.00 (reference)	1.00 (reference)
	Yes	545 (21.9)	1612 (18.7)	1.28 (1.16–1.42)	1.05 (0.94–1.18)
	Missing data	28 (1.1)	120 (1.4)		
Gainfully employed	Yes	1918 (77.0)	7336 (85.2)	1.00 (reference)	1.00 (reference)
	No	519 (20.8)	1116 (13.0)	1.86 (1.68–2.07)	1.43 (1.26–1.63)
	Missing data	55 (2.2)	163 (1.9)		
Main symptom leading to hysterectomy ^c	Others	112 (4.5)	440 (5.1)	1.00 (reference)	1.00 (reference)
	Bleeding disorder	1131 (45.4)	5053 (58.7)	1.14 (0.96–1.36)	0.85 (0.68–1.07)
	Pelvic pain	1018 (40.9)	2257 (26.2)	2.89 (2.42–3.46)	1.51 (1.19–1.90)
	Mechanical symptom ^d	178 (7.1)	702 (8.2)	1.18 (0.95–1.46)	0.98 (0.75–1.29)
	Missing data	53 (2.1)	163 (1.9)		
Mode of surgery	Vaginal	440 (17.7)	1944 (22.6)	1.00 (reference)	1.00 (reference)
	Laparoscopic	269 (10.8)	730 (8.5)	1.29 (1.16–1.43)	1.30 (1.07–1.58)
	Abdominal	1782 (71.5)	5939 (68.9)	1.60 (1.37–1.88)	1.09 (0.95–1.25)
	Missing data	1 (0.04)	2 (0.02)		
Hysterectomy type	Total	1956 (78.5)	6860 (79.6)	1.00 (reference)	1.00 (reference)
	Subtotal	536 (21.5)	1755 (20.4)	1.03 (0.93–1.13)	1.19 (1.05–1.34)
Bilateral oophorectomy	No	1859 (74.6)	6769 (78.6)	1.00 (reference)	1.00 (reference)
	Yes	217 (8.7)	549 (6.4)	1.27 (1.10–1.48)	1.09 (0.91–1.29)
	Missing data	416 (16.7)	1297 (15.1)		
Mode of anesthesia	GA	1334 (53.5)	4401 (51.1)	1.00 (reference)	1.00 (reference)
	GA + SA or EDA	479 (19.2)	1583 (18.4)	0.94 (0.84–1.06)	0.96 (0.78–1.19)
	SA or EDA	174 (6.9)	726 (8.4)	0.78 (0.67–0.90)	1.00 (0.89–1.12)
	Missing data	505 (20.3)	1905 (22.1)		
Endometriosis ^e	No	1676 (67.3)	6303 (73.2)	1.00 (reference)	1.00 (reference)
	Yes	790 (31.7)	2217 (25.7)	1.40 (1.28–1.53)	1.18 (1.06–1.31)
	Missing data	26 (1.0)	95 (1.1)		

(Continues)

TABLE 2 (Continued)

Demographic and clinic factors	Grouping	Pelvic/lower abdominal pain at 1 year (n = 2492)	No pelvic/lower abdominal pain at 1 year (n = 8615)	Univariate analysis ^a OR (95% CI)	Multivariate analysis ^b aOR (95% CI)
Complications during hospital stay	No	2124 (85.2)	7531 (87.4)	1.00 (reference)	1.00 (reference)
	Yes	328 (13.2)	971 (11.3)	1.28 (1.14–1.45)	0.90 (0.78–1.05)
	Missing data	40 (1.6)	113 (1.3)		
Bleeding complications within 8 weeks after discharge	No	1095 (43.9)	5504 (63.9)	1.00 (reference)	1.00 (reference)
	Yes	1163 (46.7)	2531 (29.4)	2.45 (2.25–2.70)	1.39 (1.22–1.58)
	Missing data	234 (9.4)	580 (6.7)		
Infection complication within 8 weeks after discharge	No	1595 (64.0)	6676 (77.5)	1.00 (reference)	1.00 (reference)
	Yes	663 (26.6)	1359 (15.8)	2.18 (1.97–2.40)	1.15 (0.99–1.32)
	Missing data	234 (9.4)	580 (6.7)		
Micturition complications within 8 weeks after discharge	No	1527 (61.3)	6943 (80.6)	1.00 (reference)	1.00 (reference)
	Yes	731 (29.3)	1092 (12.7)	3.36 (3.04–3.70)	2.07 (1.80–2.37)
	Missing data	234 (9.4)	580 (6.7)		
Other complications within 8 weeks after discharge	No	1474 (59.2)	6506 (75.5)	1.00 (reference)	1.00 (reference)
	Yes	784 (31.5)	1529 (17.8)	2.47 (2.25–2.71)	1.40 (1.23–1.60)
	Missing data	234 (9.4)	580 (6.7)		

Note: Figures denote number (%).

Abbreviations: aOR, adjusted odds ratio; ASA, American Society of Anesthesiology classification; BMI, body mass index; CI, confidence interval; EDA, epidural anesthesia; GA, general anesthesia; OR, odds ratio; SA, spinal anesthesia.

^aMissing data not included in calculations in the univariate analysis.

^bMissing data replaced by multiple imputation.

^cPatient reported the main symptom that led to hysterectomy.

^dComprises pelvic pressure and heaviness.

^eEndometriosis confirmed histopathologically as main and secondary diagnosis after hysterectomy.

	Main symptom leading to hysterectomy		P-value [*]
	Pain (n = 3275)	Aggregation of the other main symptoms (n = 7616)	
Mode of hysterectomy			
Vaginal	570 (17.4)	1781 (23.4)	<0.0001 [†]
Laparoscopic	388 (11.9)	602 (7.9)	
Abdominal	2315 (70.7)	5232 (68.7)	
Missing data	2 (0.06)	1 (0.01)	
Type of hysterectomy			
Total	2667 (81.4)	5980 (78.5)	<0.001 [‡]
Subtotal	608 (18.6)	1636 (21.5)	

Note: Figures denote number (%).

^{*}Missing data not included in the calculation.

[†]Pearson's chi-square test (df = 2).

[‡]Pearson's chi-square test (df = 1).

TABLE 3 Association between mode and type of hysterectomy, respectively, in relation to pain as the main symptom leading to hysterectomy

studies should be undertaken with caution, keeping in mind the differences in definitions of pain, sample sizes, populations and societies, and healthcare structures.

Younger age was a strong risk factor for postoperative pain, independent of occurrence of preoperative pain. The

influence of age may be explained by the fact that hysterectomy is only performed in younger women on meticulously selected indications.¹⁶ Meanwhile, endometriosis was a risk factor for postoperative pain only in women with preoperative pain. This emphasizes the importance of prioritizing pain

TABLE 4 Associations between occurrence of de novo pelvic/lower abdominal pain 1 year postoperatively and demographic and clinical factors in women without pelvic/abdominal pain preoperatively

Demographic and clinical factors	Grouping	De novo pelvic/ lower abdominal pain at 1 year (n = 436)	No pelvic/lower abdominal pain at 1 year (n = 5151)	Univariate analysis ^a OR (95% CI)	Multivariate analysis ^b aOR (95% CI)
Age groups	45–55 years	13 (3.0)	75 (1.5)	1.00 (reference)	1.00 (reference)
	35–44 years	156 (35.8)	1587 (30.8)	1.27 (1.03–1.57)	1.29 (1.04–1.60)
	<35 years	267 (61.2)	3489 (67.7)	2.16 (1.16–4.03)	2.05 (1.08–3.86)
Parity	Parous	367 (84.2)	4474 (86.9)	1.00 (reference)	1.00 (reference)
	Nulliparous	39 (8.9)	387 (7.5)	1.20 (0.85–1.71)	1.15 (0.81–1.64)
	Missing data	30 (6.9)	290 (5.6)		
BMI groups	<25 kg/m ²	173 (39.7)	2344 (45.5)	1.00 (reference)	1.00 (reference)
	25–29.9 kg/m ²	152 (34.9)	1742 (33.8)	1.18 (0.94–1.49)	1.17 (0.93–1.46)
	≥30 kg/m ²	91 (20.9)	909 (17.7)	1.35 (1.03–1.77)	1.23 (0.94–1.62)
	Missing data	20 (4.6)	156 (3.0)		
ASA classes	ASA 1	335 (76.8)	4036 (78.4)	1.00 (reference)	1.00 (reference)
	ASA 2	86 (19.7)	951 (18.5)	1.11 (0.86–1.43)	0.97 (0.75–1.25)
	ASA 3–4	4 (0.82)	49 (0.96)	0.98 (0.35–2.74)	0.82 (0.29–2.33)
	Missing data	11 (2.5)	115 (2.2)		
Currently smoking	No	356 (81.7)	4351 (84.5)	1.00 (reference)	1.00 (reference)
	Yes	74 (17.0)	734 (14.3)	1.24 (0.94–1.63)	1.18 (0.91–1.55)
	Missing data	6 (1.4)	66 (1.3)		
Gainfully employed	Yes	365 (83.7)	4500 (87.4)	1.00 (reference)	1.00 (reference)
	No	55 (12.6)	486 (9.4)	1.41 (1.04–1.92)	1.27 (0.94–1.72)
	Missing data	16 (3.2)	165 (3.2)		
Main symptom leading to hysterectomy ^c	Others	53 (12.2)	692 (13.4)	1.00 (reference)	1.00 (reference)
	Bleeding disorder	302 (69.3)	3565 (69.2)	1.13 (0.83–1.52)	1.44 (0.87–2.36)
	Mechanical symptom ^d	54 (12.4)	651 (12.6)	1.06 (0.71–1.58)	1.10 (0.73–1.64)
	Missing data	27 (6.2)	243 (4.7)		
Mode of surgery	Vaginal	321 (73.6)	3626 (70.4)	1.00 (reference)	1.00 (reference)
	Laparoscopic	86 (19.7)	1155 (22.4)	1.18 (0.92–1.52)	1.28 (0.95–1.72)
	Abdominal	29 (7.2)	370 (7.2)	1.06 (0.68–1.65)	1.10 (0.69–1.76)
Hysterectomy type	Total	347 (79.6)	4044 (78.5)	1.00 (reference)	1.00 (reference)
	Subtotal	89 (20.4)	1107 (21.5)	0.94 (0.73–1.21)	0.93 (0.72–1.20)
Bilateral oophorectomy	No	26 (6.0)	379 (7.4)	1.00 (reference)	1.00 (reference)
	Yes	325 (74.5)	3832 (74.4)	0.88 (0.56–1.39)	0.87 (0.59–1.27)
	Missing data	85 (19.5)	940 (18.3)		
Mode of anesthesia	GA	214 (49.1)	2467 (47.9)	1.00 (reference)	1.00 (reference)
	GA+SA or EDA	87 (20.0)	1057 (20.5)	0.93 (0.72–1.20)	1.05 (0.74–1.49)
	SA or EDA	34 (7.8)	489 (9.5)	0.80 (0.55–1.17)	0.90 (0.71–1.15)
	Missing data	101 (23.2)	1138 (22.1)		
Endometriosis ^e	No	100 (22.9)	1028 (20.0)	1.00 (reference)	1.00 (reference)
	Yes	325 (74.5)	4055 (78.7)	1.21 (0.95–1.54)	1.21 (0.95–1.54)
	Missing data	11 (2.5)	68 (1.3)		
Complications during hospital stay	No	361 (82.8)	4553 (88.4)	1.00 (reference)	1.00 (reference)
	Yes	68 (15.6)	536 (10.4)	1.61 (1.22–2.12)	1.22 (0.91–1.63)
	Missing data	7 (1.6)	62 (1.2)		

(Continues)

TABLE 4 (Continued)

Demographic and clinical factors	Grouping	De novo pelvic/ lower abdominal pain at 1 year (n = 436)	No pelvic/lower abdominal pain at 1 year (n = 5151)	Univariate analysis ^a OR (95% CI)	Multivariate analysis ^b aOR (95% CI)
Bleeding complications within 8 weeks after discharge	No	224 (51.4)	3594 (69.8)	1.00 (reference)	1.00 (reference)
	Yes	175 (40.1)	1236 (24.0)	2.26 (1.83–2.80)	1.39 (1.06–1.83)
	Missing data	37 (8.5)	321 (6.2)		
Infection complications within 8 weeks after discharge	No	306 (70.2)	4209 (81.7)	1.00 (reference)	1.00 (reference)
	Yes	93 (21.3)	621 (12.1)	2.09 (1.63–2.68)	1.13 (0.85–1.51)
	Missing data	37 (8.5)	321 (6.2)		
Micturition complications within 8 weeks after discharge	No	315 (72.3)	4418 (85.8)	1.00 (reference)	1.00 (reference)
	Yes	84 (19.3)	412 (8.0)	2.89 (2.22–3.75)	1.77 (1.32–2.37)
	Missing data	37 (8.5)	321 (6.2)		
Other complications within 8 weeks after discharge	No	296 (67.9)	4183 (81.2)	1.00 (reference)	1.00 (reference)
	Yes	104 (23.9)	647 (12.6)	2.25 (1.76–2.87)	1.45 (1.09–1.92)
	Missing data	36 (8.3)	321 (6.2)		

Abbreviations: aOR, adjusted odds ratio; ASA, American Society of Anesthesiology classification; BMI, body mass index; CI, confidence interval; EDA, epidural anesthesia; GA, general anesthesia; SA, spinal anesthesia.

^aMissing data not included in calculation in the univariate analysis.

^bMissing data replaced by multiple imputation.

^cPatient reported the main symptom that led to hysterectomy.

^dComprises pelvic pressure and heaviness.

^eEndometriosis confirmed histopathologically as main and secondary diagnosis after hysterectomy.

treatment independently of endometriosis, especially among young women with pelvic pain.

In this study, only 20% of the women had pain as the main indication for the hysterectomy. This relatively low number may reflect the restrictiveness and thoroughness of selecting women to hysterectomy on pain indication among Swedish gynecologists. The occurrence of preoperative pain increases the risk of postoperative pain after benign hysterectomy^{6,8,17} and in a wide range of other medical conditions.¹⁸⁻²¹ The results of the present study support this. Preoperative pain predisposes to development of pain hypersensitivity, a condition induced by neuroplastic changes in the central nervous system. The changes lead to the activation and production of pain sensation despite decreased peripheral nociceptive input. If hypersensitivity is already present preoperatively, the pain will not decrease even after hysterectomy. In the development of pain hypersensitivity, psychosocial factors are of major importance and should also be taken into consideration.²² Women with chronic pelvic pain have worse psychological health than pain-free individuals.²³ The role of psychosocial factors in the development of pain after hysterectomy needs to be examined further.

Undergoing hysterectomy laparoscopically was an independent risk factor for postoperative pain only in women with preoperative pain. The laparoscopic method was selected more often in particular when pain was the main indication for the hysterectomy. The reason for selecting the method of hysterectomy is not noted in the GynOp, but usually several factors are taken into consideration. Thus, there

is a risk of selection bias in the selection of method of hysterectomy. Although minimal invasive hysterectomy has been associated with better clinical outcomes compared with abdominal hysterectomy,¹² it is important to emphasise that the impact of minimal invasive surgery on postoperative pain has not been evaluated previously.

Interestingly, subtotal hysterectomy was associated with a higher risk for postoperative pain only in women with preoperative pain. In a recently published meta-analysis of total and subtotal hysterectomy, no difference was seen between the methods in postoperative pelvic pain, but no division into pain vs no pain preoperatively was performed.²⁴ The reason for selecting subtotal or total hysterectomy is not reported in the GynOp, but the decision is often based on considerations made in agreement with the patient. Due to the lack of evidence-based recommendations, the result may indicate a warning for recommending subtotal hysterectomy in women who have a history of preoperative pain until further evidence is provided.

To be not gainfully employed and having mild to moderate systemic disease (ASA 2) were independent risk factors for postoperative pain, but only in the women who reported pain preoperatively. This may indicate that both employment and ASA classification are interrelated with preoperative pain, but there may be other reasons behind these results. For example, patients with preoperative pain are more at risk of being on sick leave both before and after surgery. However, these issues could be included in the preoperative counseling, among many other aspects.

This study showed that self-reported complications related to bleeding, micturition or other complications were strongly

associated with postoperative pain in both women with and without preoperative pain. However, the statistical analyses indicated a considerable correlation between the categories of complications, since the aORs for all four categories were noticeable lower than the corresponding ORs in the univariate analyses. Due to the construction of the questions concerning complications in the GynOp questionnaire, it is difficult to deepen the analysis of complications further, but the findings merit further investigation. Prevention of complications appearing after discharge seems to be of importance to optimize the outcomes of hysterectomy from several perspectives.

This study has several strengths. The inclusion of register data allowed a large sample size, and the high coverage of the register enabled a nationwide sample to be used. The large sample size also allowed us to have wide exclusion criteria that still enabled the inclusion of a broad spectrum of different benign gynecological conditions and premenopausal women. However, as in all register studies, there is a risk of selection bias and missing data, which are limitations of the study. Furthermore, as in all epidemiological studies containing large datasets, statistical significance may not always be clinically relevant, and the associations do not necessarily reflect causality. There might also be additional risk factors for postoperative pain that are not reported in the GynOp. Because of the limitation of the questions about pain in the GynOp, we cannot ensure that postoperative pain has been caused by the hysterectomy, nor can we conclude that residual pain has the same origin before and after the surgery. By using multiple imputation models, the impact of missing data was remedied and this can be seen as a strength of the study.

Two-thirds of the study population reported pelvic/lower abdominal pain preoperatively which included regularly recurring dysmenorrhea as well as non-specified pelvic/lower abdominal pain. More specific information about the pain, its degree and duration might provide the opportunity for more detailed analyses. The lack of specific information about the pain can be seen as a drawback. Nevertheless, we believe that to meet the aims of this study, the present information in the GynOp was sufficient, but interpretation of the results should be done with caution. Generalization of the results can only be done to populations with corresponding characteristics. Another limitation is the lack of a comprehensive validation of the GynOp. However, the registry is well described and evaluated, and has been the source of several studies in peer-reviewed journals and doctoral dissertations. Due to the high internal coverage of gynecological surgery in Sweden, the register is generally considered reliable.

The fact that preoperative pain and pain as the main symptom leading to hysterectomy were strong risk factors for postoperative pain, might imply that more effort should be put into pain treatment before hysterectomy to improve the outcome of hysterectomy. Additionally, work with prevention of postoperative complications seem to be essential to lower the risk for long-term pain after the surgery.

5 | CONCLUSION

The occurrence of pelvic pain 1 year after hysterectomy, as well as de novo pain, was relatively common. Women with and without reported preoperative pelvic/lower abdominal pain represent clinically different populations, and risk factors for pelvic pain 1 year after the hysterectomy seemed to be different in these two populations. The differences in risk factors should possibly be taken into consideration in the preoperative counseling, but such action should be preceded by confirming results from well-designed studies.

AUTHOR CONTRIBUTIONS

All authors contributed to the study conception and design. Data preparation and analysis were performed by HG, MF and PK. The draft was written by HG and PK. MF, SA and CB participated in the revisions of the article. All authors read and approved the final article.

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CONFLICT OF INTEREST

The authors have stated explicitly that there are no conflicts of interest in connection with this article.

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