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ORIGINAL RESEARCH ARTICLE

Recurrent surgery in uterine prolapse: A nationwide register study

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Abstract

Introduction: One in three women with pelvic organ prolapse (POP) undergoing surgery have a relapse. Currently, no optimal surgical treatment has been identified for correcting a uterine prolapse. This population-based register study aims to compare the relapse rate in patients with uterine prolapse undergoing hysterectomy with suspension or uterine-sparing surgical procedures.

Material and methods: All women with uterine prolapse undergoing prolapse surgery in Sweden from January 1, 2015 to December 31, 2018, were identified from the Gynecological Operation Register (GynOp). The primary outcome was the number of recurrent POP surgeries up to December 31, 2020.

Results: Sacrospinous hysteropexy (SSHP) without graft and sacrohysteropexy (SHP) were associated with a significantly higher rate of recurrent POP surgery (SSHP without graft: adjusted odds ratio [aOR] 2.6, 95% CI 2.0–3.5; SHP aOR 2.6, 95% CI 1.8–3.7) and patients describing a sense of globe (SSHP without graft, aOR 2.0, 95% CI 1.6–2.6; SHP, aOR 1.8, 95% CI 1.1–3.1) compared with cervical amputation with uterosacral ligament fixation (Manchester procedure). There was no difference in the reoperation rate or sense of a globe between SSHP with graft and Manchester procedure. Patients undergoing SSHP without graft had a higher frequency of 1-year postoperative complications compared with Manchester procedure (aOR 2.0, 95% CI 1.6–2.6) and SHP (aOR 2.4, 95% CI 1.4–3.9). Moreover, the frequency of 1-year postoperative complications was higher in SSHP with graft (aOR 1.6, 95% CI 1.1–2.2) than in Manchester procedure.

Conclusions: The Manchester procedure was associated with a low rate of recurrent POP surgery, symptomatic recurrence and low surgical morbidity compared with other surgical methods in women with uterine prolapse.

KEYWORDS
apical prolapse, pelvic organ prolapse, reoperation, uterine prolapse

Abbreviations: aOR, adjusted odds ratio; CI, confidence interval; cOR, crude odds ratio; POP, pelvic organ prolapse; RCT, randomized controlled trial; SCP, sacrocolpopexy; SCerP, sacrocervicopexy; SHP, sacrohysteropexy; SSLF, sacrospinous ligament fixation; SSHP, sacrospinous hysteropexy; VH, vaginal hysterectomy.

1 | INTRODUCTION

The symptomatology of pelvic organ prolapse (POP) is diverse, but the sense of a bulge in or outside the vagina is characteristic for the condition.[1] Surgical treatment has been associated with high recurrence rates, with one in three women undergoing surgery having a relapse.[2] Uterine prolapse is a special challenge and it has been hard to identify the optimal surgical treatment for this condition.[3] Vaginal hysterectomy (VH) combined with fixation of the vaginal cuff has been one of the standard surgical procedures for repairing uterine prolapse.[1] However, the procedure has been questioned because of a high rate of relapse.[4] An even older method is the Manchester procedure (MP) (with cervical amputation and uterosacral ligament fixation instead of hysterectomy), which has shown similar cure rates compared to VH but with a lower morbidity rate.[5–8] Vaginal mesh was introduced over a decade ago. However, because chronic pain problems have emerged over the years, in 2019 the U.S. Food and Drug Administration ordered all manufacturers to discontinue selling and distributing mesh for transvaginal repair of POP.[9–11] Sacrospinous ligament fixation (SSLF) without graft is another common uterine prolapse treatment. Sacrospinous hysteropexy (SSHP) has shown a lower relapse rate compared with VH with uterosacral ligament fixation in previous Dutch randomized controlled trials (RCTs).[12,13] However, a large Danish nationwide cohort study showed that SSHP without mesh has exceedingly high numbers of recurrent POP surgery compared with VH with uterosacral ligament fixation or MP.[7] In a 2016 Cochrane review comparing vaginal with abdominal surgery of apical prolapse, the authors recommended sacrocolpopexy (SCP) and sacrohysteropexy (SHP) as the first choice in women with apical prolapse (including both uterine and vaginal vault prolapse).[14] SCP and SHP were reported to be associated with a low risk of recurrent POP surgery and a much lower risk of mesh exposure compared with vaginal mesh repairs. This population-based register study aims to compare the relapse rate in patients with uterine prolapse undergoing hysterectomy with suspension or uterine-sparing surgical procedures with real world data in a contemporary context.

Key message

Lower rate of recurrent POP surgery in the Manchester procedure compared with mesh in uterine prolapse. Sacrohysteropexy is a useful technique in patients with a wish to conceive. Sacrospinous ligament fixation with or without graft showed a high rate of 1-year postoperative complications.

2 | MATERIAL AND METHODS

This study is a Swedish nationwide population-based register study. All women with uterine prolapse undergoing prolapse surgery in Sweden between January 1, 2015 and December 31, 2018, were identified through the Gynecological Operation Register (GynOp).

The GynOp is a national operation register established in 1994 covering 55/56 (92%) gynecological departments in Sweden. All data entering the register are collected prospectively. The coverage of prolapse surgery is 92%–98%.[15] Patients undergoing surgery answer a questionnaire about demographics, medical history and symptoms associated with the pelvic organ before surgery and 2 and 12 months post-surgery. The rate of missing patients responding to the questionnaire 12 months post-surgery in the vaginal group was 20%–23%, in the Sacrocervicopexy (SCerP) group 34% and in the SHP group 41% in this study. The surgeon reports pre-, intra- and postoperative data, including a preoperative gynecological examination of the patient and previous POP surgery. To differentiate robotic and laparoscopic SCP and SHP a review of medical records ($n = 454$) was performed.

We included women with point C ≥ −1 cm in relation to the hymen (stage II prolapse or worse) to identify women with apical prolapse. All patients with a vaginal vault prolapse were excluded. Patients with uterine prolapse were classified into two main groups: those with an uterine prolapse with or without concomitant hysterectomy. We compared the following surgical procedures in women with uterine prolapse and concomitant hysterectomy: VH with uterosacral ligament fixation or sacrospinous ligament fixation without graft or laparoscopic or robotic-assisted hysterectomy with sacrocervicopexy. In women with a uterine prolapse with preserved uterus, we compared the MP, sacrospinous hysteropexy with or without graft, and laparoscopic or robotic-assisted hysteropexy. All surgical procedures were defined as in the Joint report on terminology for surgical procedures to treat POP.[16] Uterosacral ligament fixation was not differentiated into midline plication (McCall) or ipsilateral (Bob Shull). Only lightweight non-degradable polypropylene vaginal meshes fixated to sacrospinous ligament were included in the study: Nuvia®, UpHold®, Elevate®, Pinnacle®, Splentis®, Calister®. Vaginal meshes used in Sweden during this time-period that were excluded from the study were: Prolene®, Prolift®, Surgisis®, Pelvicol® and Prosima®. Three of the meshes used in SCP and SHP were lightweight (Artisyn®, Ultrapro®, Upsylon®) and two heavyweight (Parietex Prosup®, Vypro®).

Our primary outcome was the number of recurrent POP surgery defined as any POP surgery reported to the GynOp up to 2 years post-surgery, ie to December 31, 2020. Patients' self-reported symptomatic recurrence via one question 1 year postoperatively. The question asked was: "Do you feel that something is bulging out from the vagina?" We dichotomized the answer into yes (1–3 times per week or daily) or no (never, almost never, 1–3 times per month).

Demographic and intraoperative surgical variables were chosen and analyzed for their association with outcomes: age, body mass index (BMI), American Society of Anesthesiologists Physical Status Classification system (ASA-PS, grouped as ASA-PS class 1–2 or 3–5), parity (grouped as 0, 1–2, ≥3 children), smoking habits, previous prolapse surgery, previous incontinence surgery, prolapse stage (grouped as I–IV defined by Pop-Q and the leading compartment),

concomitant anterior, posterior colporrhaphy or perineorrhaphy, hospital procedure volume (grouped as <50, 50–100 and >100, defined as numbers of vaginal or minimally invasive uterine prolapse repair/year), surgeon procedure volume (grouped as <10, 10–20 and >20, defined as numbers of vaginal or minimally invasive uterine prolapse repair/year).

Two sensitivity analyses were performed to adjust further for confounding factors that might have affected indication for primary surgery. In these subgroup analyses, primary outcome was analyzed in patients with previous prolapse surgery or a stage IV uterine prolapse.

2.1 | Statistical analyses

We presented categorical and binomial variables as frequencies and proportions and non-normally distributed continuous variables as median and interquartile range. To analyze differences in baseline characteristics between surgical groups, we used logistic, multinomial and quantile univariable regression. All the groups were initially compared with each other, but some groups were combined as a second step when the initial analysis supported this manipulation. Median and quantile regression was chosen for its robustness to outliers in comparison with mean and ordinary linear regression. This analysis was particularly relevant in that subclassification of apical prolapse surgery created small groups.

Uni- and multivariable logistic and quantile regression was used for the primary and secondary outcome. Clustered robust standard errors were used to obtain correct estimates for the standard errors in the presence of repeated measures. All variables from Table 1 were tested for inclusion in the multivariable analyses. Multivariable regression was conducted in a stepwise procedure; variables from the univariable model with a *P*-value >0.25 were excluded from the model. Restricted cubic splines with four knots were used for BMI and age because these variables were considered nonlinear. Results from the univariable regression model are presented as crude odds ratios (cOR), and from the multivariable regression model as adjusted odds ratios (aOR) with 95% confidence intervals (CI). All analyses were done in STATA (Stata v 16.0, StataCorp LLC). The level of statistically significance was set to $P < 0.05$.

Appendix S1 gives exact information about which variables were included in the final adjusted analyses and which groups were combined when comparing baseline characteristics. A detailed description of how missing data were handled is also found in Appendix S1.

2.2 | Ethical approval

The study was approved by the Research Ethics Committee at Karolinska Institutet, Stockholm, Sweden (Reference number 2018/18–31) on March 21, 2018 and conforms to the STROBE guidelines regarding observational studies (www.strobe-statement.org).

3 | RESULTS

In Sweden, 25 109 operations for POP were performed; of these, 9967 (40%) were preoperatively diagnosed with an apical prolapse at stage II or higher. The study included 8155 patients with a uterine prolapse, of which 5935 (73%) were treated with uterine-preserving POP surgery and 2200 (27%) with POP procedures including concomitant hysterectomy (Figure 1).

Table 1 presents baseline characteristics of the study population. The median age of patients with uterine prolapse undergoing SCerP with concomitant hysterectomy or SHP was younger (cCoef Q − 4 years, 95% CI −6 to −2), with a higher proportion of patients with ASA-PS 1–2 (cOR 3.0, 95% CI 1.7–5.6) and a lower BMI (cCoef Q −0.7, 95% CI −1.2 to −0.2) compared with all vaginal procedures. In addition, in the SSLF and SSHP with graft group, patients were older (cCoef Q 4 years, 95% CI 3–5) and the proportion of previous prolapse surgery was significantly higher (cOR 10.0, 95% CI 8.3–12.1) than in all other surgical groups. Moreover, prolapse stage IV was more frequent in the SHP and SCerP group than in the vaginal surgery group (cOR 2.8, 95% CI 2.2–3.5). The rate of surgeon volume over 20 procedures/year in patients undergoing MP was lower compared with all other surgical groups (cOR 0.3, 95% CI 0.2–0.3). Concomitant vaginal surgery was more frequent in the vaginal group than in the abdominal laparoscopic group (cOR 90.6, 95% CI 60.8–135.1).

3.1 | Uterine prolapse repair with concomitant hysterectomy

The primary outcomes in patients with uterine prolapse repair and a concomitant hysterectomy are listed in Table 2. No significant differences were noted in recurrent POP surgery or patients describing a sense of globe between SCerP, VH with SSLF or uterosacral ligament fixation.

SCerP was associated with a lower frequency of 1-year postoperative complications compared with VH with uterosacral ligament fixation (aOR 0.5, 95% CI 0.3–0.8) and VH with SSLF (aOR 0.4, 95% CI 0.2–0.8). In addition, the median estimated blood loss was lower in SCP than in VH with uterosacral ligament fixation (aCoef Q 20 mL, 95% CI 27 to −12) and VH with SSLF (aCoef Q 11 mL, 95% CI −19 to −3). Finally, VH with uterosacral ligament fixation was associated with the shortest operative time compared with SCP (aCoef Q 11 min, 95% CI −18 to −5) and VH with SSLF (aCoef Q 9 min, 95% CI −15 to −3).

3.2 | Uterine prolapse repair with preservation of the uterus

Primary and secondary outcomes in patients with a uterine prolapse repair and no hysterectomy are shown in Table 3. SSHP without graft and SHP were associated with a significantly higher rate of recurrent

TABLE 1 Baseline characteristics of the study population

	Uterine prolapse with hysterectomy			Uterine prolapse with preservation of the uterus			
	Vaginal Hysterectomy with uterosacral fixation *n* = 1643	Vaginal hysterectomy with sacrospinous fixation *n* = 196	Lap/Rob hysterectomy with sacrocervicopexy *n* = 245	Manchester procedure *n* = 1807	Sacrospinous hysteropexy with graft *n* = 661	Sacrospinous Hysteropexy without graft *n* = 913	Lap/Rob sacrohysteropexy *n* = 173
Age	66 (56–72)	67 (58–73)	63 (55–70)	65 (55–71)	70 (62–76)	67 (58–73)	59 (42–68)
BMI	25 (23–28)	25 (23–28)	25 (23–27)	25 (23–28)	26 (24–29)	26 (23–28)	25 (23–28)
ASA							
1–2	1542 (93.9)	175 (89.3)	239 (97.6)	1706 (94.4)	561 (86.3)	827 (90.7)	166 (97.1)
3–5	101 (6.2)	21 (10.7)	6 (2.4)	101 (5.6)	89 (13.7)	85 (9.3)	5 (2.9)
Parity							
1–2	845 (59.6)	99 (56.6)	90 (40.2)	925 (62.1)	244 (58.2)	470 (59.6)	70 (44.3)
>2	563 (39.7)	72 (41.1)	132 (58.9)	552 (37.1)	169 (40.3)	307 (38.9)	87 (55.1)
Smoking	103 (7.6)	21 (12.1)	8 (4.2)	75 (5.9)	22 (6.0)	63 (8.1)	13 (9.5)
Previous prolapse surgery	294 (18.1)	58 (29.7)	70 (28.6)	302 (16.8)	405 (71.8)	232 (25.4)	51 (35.7)
Prolapse stage							
II	612 (37.8)	41 (21.0)	90 (37.0)	945 (53.3)	153 (23.2)	320 (35.2)	71 (41.5)
III	802 (49.5)	99 (50.8)	66 (27.2)	748 (42.2)	303 (46.0)	486 (53.5)	45 (26.3)
IV	203 (12.5)	54 (27.7)	84 (34.6)	76 (4.3)	202 (30.7)	102 (11.2)	54 (31.6)
Surgeon volume							
<10	1071 (65.2)	73 (37.2)	43 (17.6)	1291 (71.4)	179 (27.1)	355 (38.9)	116 (67.1)
10–20	251 (15.3)	50 (25.5)	2 (0.8)	252 (14.0)	130 (19.7)	183 (20.0)	37 (21.4)
>20	321 (19.5)	73 (37.2)	200 (81.6)	264 (14.6)	352 (53.3)	375 (41.1)	20 (11.6)
Hospital volume							
<50	961 (58.5)	92 (46.9)	27 (11.0)	1196 (66.2)	251 (38.0)	308 (33.7)	149 (86.1)
50–100	654 (39.8)	45 (23.0)	218 (89.0)	582 (32.3)	333 (50.4)	249 (27.3)	24 (13.9)
>100	28 (1.7)	59 (30.1)	0	29 (1.6)	77 (11.7)	356 (39.0)	0
Concomitant posterior colporrhaphy	648 (39.4)	73 (37.2)	3 (1.3)	537 (29.7)	155 (23.5)	306 (33.5)	13 (8.3)
Concomitant anterior colporrhaphy	1323 (80.5)	147 (75.0)	3 (1.3)	1448 (80.1)	566 (85.6)	647 (70.9)	9 (5.8)
Concomitant perineorrhaphy	405 (24.7)	5 (17.9)	2 (0.9)	332 (18.4)	101 (15.3)	233 (25.5)	12 (7.8)

Figures are frequencies (proportions) and median (interquartile range).

n = frequencies.

Lab/Rob = laparoscopic/robotic.

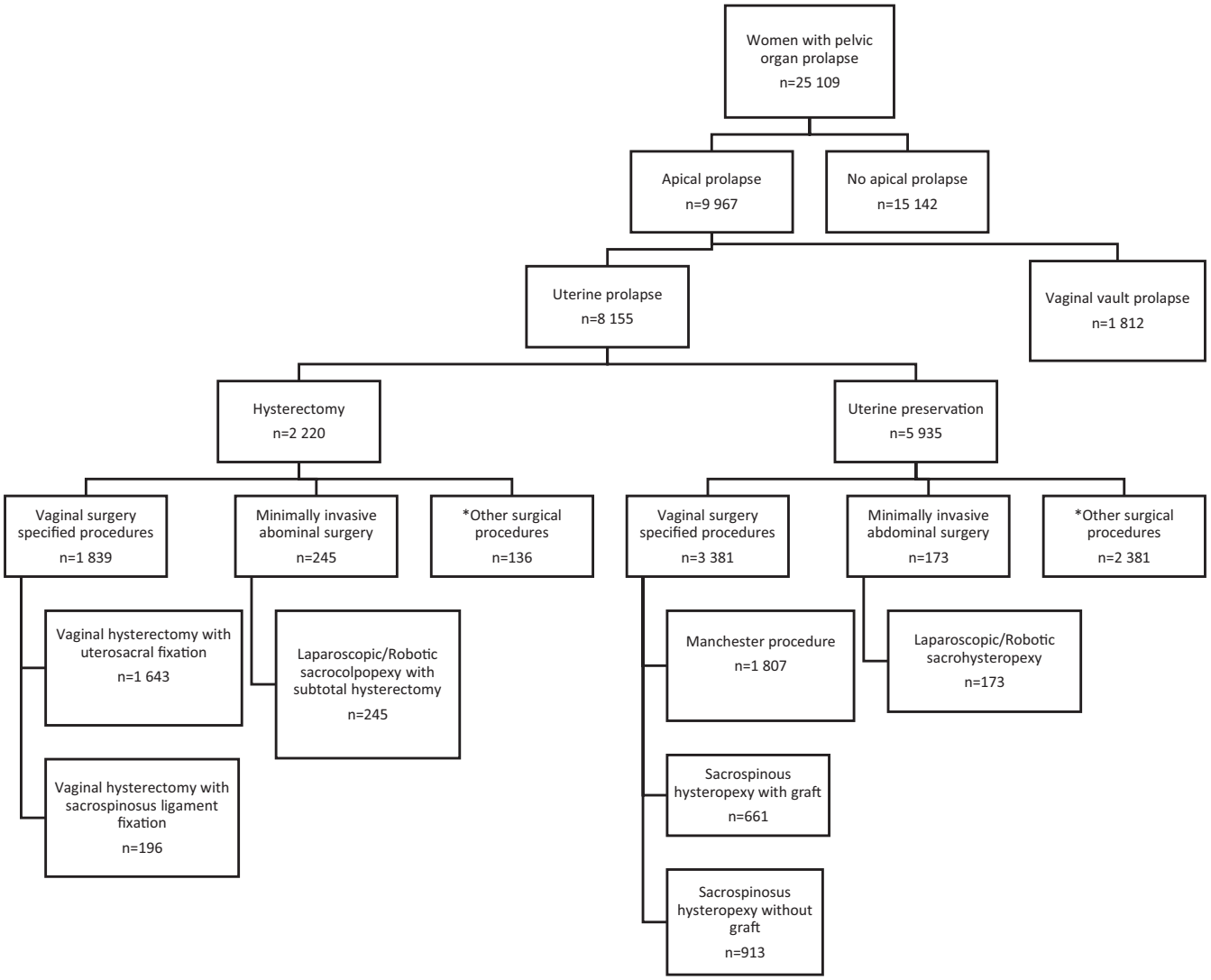

FIGURE 1 Flowchart of the study population

POP surgery (SSHP without graft aOR 2.6, 95% CI 2.0–3.5; SHP aOR 2.6, 95% CI 1.8–3.7) and patients describing a sense of globe (SSHP without graft aOR 2.0, 95% CI 1.6–2.6; SHP aOR 1.8, 95% CI 1.1–3.1) compared to the MP. There was no difference in reoperation rate or sense of a globe between SSHP with graft and the MP. Moreover, SSHP without graft and SHP showed a higher frequency of recurrent POP surgery (SSHP without graft aOR 2.1, 95% CI 1.5–3.1; SHP 2.1, 95% CI 1.4–3.1) and a higher proportion of patients describing a sense of globe (SSHP without graft aOR 2.6, 95% CI 1.7–3.8; SCP 2.3, 95% CI 1.2–4.3) compared to SSHP with graft. No significant differences were observed between SSHP without graft and SHP in recurrent POP surgery or symptomatic recurrence.

Patients undergoing SSHP without graft had a higher frequency of 1-year postoperative complications compared with the MP (aOR 2.0, 95% CI 1.6–2.6) and SHP (aOR 2.4, 95% CI 1.4–3.9). In addition, the frequency of 1-year postoperative complications was higher in SSHP with graft (aOR 1.6, 95% CI 1.1–2.2) than in the MP. Perioperative data showed a higher estimated blood loss in SSHP with graft (aCoef Q 8 mL, 95% CI 5–11) and SSHP without graft (aCoef Q 3 mL, 95% CI 1–5) than in the MP. SHP had a significantly lower estimated blood loss and a longer operative time than all other surgical methods.

In two subgroup analyses the primary outcome was analyzed in patients with previous prolapse surgery or a stage IV apical prolapse (Tables S1 and S2). There were no major differences in these analyses compared with the main result.

4 | DISCUSSION

In this study, the MP and sacrospinous hysteropexy with graft were associated with a lower frequency of recurrent POP surgery compared with all other surgical procedures in women with uterine prolapse without hysterectomy. In addition, the MP showed a lower estimated blood loss, shorter operative time and a lower 1-year postoperative complication rate than SSHP with and without graft, where pain and mesh erosion were more frequently reported. In previous studies, hysterectomy in prolapse repair has not been

TABLE 2 Peri- and postoperative outcome in patients with uterine prolapse and concomitant hysterectomy

Outcome	Primary operation	*n* (%)/median (IQR)	cOR/Coef Q[b] (95% CI)	aOR/Coef Q (95% CI)
[a]Vaginal hysterectomy with uterosacral fixation (VH) vs Vaginal hysterectomy with sacrospinous ligament fixation (VH + SSLF)				
Recurrent POP surgery	V	124 (7.6)	1.1 (0.6–1.9)	1.1 (0.6–1.9)
	VH + SSLF	16 (8.2)		
Sensation of a bulge Daily/1–3 times/week	VH	252 (19.2)	1.1 (0.6–1.9)	1.0 (0.6–1.7)
	VH + SSLF	33 (22.2)		
Operative time (min)	VH	82 (60–106)	8[b] (3–13)	9[b] (3–15)
	VH + SSLF	90 (73–114)		
Estimated blood loss (mL)	VH	50 (25–100)	1[b] (−7–7)	−7[b] (−14–1)
	VH + SSLF	45 (25–100)		
Complications in total 1-year postoperative	VH	265 (19.3)	1.1 (0.7–1.7)	1.2 (0.8–1.8)
	VH + SSLF	32 (20.8)		
[a]Vaginal hysterectomy with uterosacral fixation (VH) vs Lap/Rob hysterectomy and sacrocervicopexy (SCerP)				
Recurrent POP surgery	VH	124 (7.6)	3.1 (2.2–4.5)	1.6 (1.0–2.6)
	SCerP	50 (20.4)		
Sensation of a bulge Daily/1–3 times/week	VH	252 (19.2)	1.4 (0.9–2.1)	1.4 (0.9–2.3)
	SCerP	36 (25.0)		
Operative time (min)	VH	82 (60–106)	−9[b] (−12 to −6)	11[b] (5–18)
	SCerP	73 (65–82)		
Estimated blood loss (mL)	VH	50 (25–100)	−25[b] (−29 to −21)	−20[b] (−27 to −12)
	SCerP	25 (10–50)		
Complications in total 1-year postoperative	VH	265 (19.3)	0.4 (0.3–0.7)	0.5 (0.3–0.8)
	SCerP	20 (9.1)		
[a]Vaginal hysterectomy with sacrospinous ligament fixation vs Lap/Rob hysterectomy and sacrocervicopexy				
Recurrent POP surgery	VH + SSLF	16 (8.2)	2.9 (1.6–5.2)	1.5 (0.7–2.9)
	SCerP	50 (20.4)		
Sensation of a bulge Daily/1–3 times/week	VH + SSLF	33 (22.2)	1.2 (0.7–2.0)	1.4 (0.7–2.6)
	SCerP	36 (25.0)		
Operative time (min)	VH + SSLF	90 (73–114)	−17[b] (−22 to −12)	2[b] (−6–11)
	SCerP	73 (65–82)		
Estimated blood loss (mL)	VH + SLSF	45 (25–100)	−25[b] (−33 to −17)	−11[b] (−19 to −3)
	SCerP	25 (10–50)		
Complications in total 1-year postoperative	VH + SSLF	32 (20.8)	0.4 (0.2–0.7)	0.4 (0.2–0.8)
	SCerP	20 (9.1)		

Figures are frequencies (proportions) and median (interquartile range).

n = frequencies of outcome.

cOR = crude odds ratio.

aOR = adjusted odds ratio, all variables in Table 1 were adjusted for and then stepwise excluded if p-value >0.25. For a detailed description of variables included in the final analysis see supplemental material.

95% CI = 95% confidence interval.

Lab/Rob = laparoscopic/robotic.

[a]Reference.

[b]Coef Q*q* = Coefficient in quantile regression (50).

TABLE 3 Peri- and postoperative outcome in patients with uterine prolapse and preservation of uterus

Outcome	Primary operation	*n* (%) /median (IQR)	cOR/Coef Q[b] (95% CI)	aOR/Coef Q[b] (95% CI)
[a]Manchester procedure (MP) vs Sacrospinous hysteropexy with graft (SSHP+graft)				
Recurrent POP surgery	MP	97 (5.4)	1.4 (1.0–2.0)	1.2 (0.9–1.7)
	SSHP+graft	48 (7.3)		
Sensation of a bulge Daily/1–3 times/week	MP	227 (16.0)	1.1 (0.8–1.4)	0.8 (0.5–1.2)
	SSHP+graft	83 (16.4)		
Operative time (min)	MP	55 (36–75)	−1[b] (−4–2)	8[b] (4 - 11)
	SSHP+graft	54 (40–73)		
Estimated blood loss (mL)	MP	25 (15–50)	1[b] (−3–3)	8[b] (5–11)
	SSHP+graft	25 (20–50)		
Complications in total 1-year postoperative	MP	257 (17.6)	1.4 (1.1–1.7)	1.6 (1.1–2.2)
	SSHP+graft	118 (22.4)		
[a]Manchester procedure (MP) vs Sacrospinous hysteropexy without graft (SSHP−graft)				
Recurrent POP surgery	MP	97 (5.4)	3.1 (2.4–4.1)	2.6 (2.0–3.5)
	SSHP−graft	138 (15.1)		
Sensation of a bulge Daily/1–3 times/week	MP	227 (16.0)	2.5 (2.1–3.1)	2.0 (1.6–2.6)
	SSHP−graft	238 (32.6)		
Operative time (min)	MP	55 (36–75)	10[b] (8–12)	15[b] (11–18)
	SSHP−graft	65 (50–84)		
Estimated blood loss (mL)	MP	25 (15–50)	1[b] (−2–2)	3[b] (1 – 5)
	SSHP−graft	25 (15–50)		
Complications in total 1-year postoperative	MP	257 (17.6)	1.8 (1.5–2.2)	2.0 (1.6–2.6)
	SSHP−graft	211 (27.6)		
[a]Manchester procedure (MP) vs Lap/Rob hysteropexy (SHP)				
Recurrent POP surgery	MP	97 (5.4)	4.8 (3.2–7.2)	2.6 (1.8–3.7)
	SHP	37 (21.4)		
Sensation of a bulge Daily/1–3 times/week	MP	227 (16.0)	2.3 (1.4–3.5)	1.8 (1.1–3.1)
	SHP	31 (30.1)		
Operative time (min)	MP	55 (36–75)	65[b] (58–72)	74[b] (60–88)
	SHP	120 (90–150)		
Estimated blood loss (mL)	MP	25 (15–50)	−5 (−11–1)	−8[b] (−12 to −4)
	SHP	20 (5–30)		
Complications in total 1-year postoperative	MP	257 (17.6)	1.0 (0.6–1.5)	0.9 (0.5–1.4)
	SHP	26 (17.4)		
[a]Sacrospinous hysteropexy with graft (SSHP+graft) vs Sacrospinous hysteropexy without graft (SSHP−graft)				
Recurrent POP surgery	SSHP+graft	48 (7.3)	2.3 (1.6–3.2)	2.1 (1.5–3.1)
	SSHP−graft	138 (15.1)		
Sensation of a bulge Daily/1–3 times/week	SSHP+graft	83 (16.4)	2.5 (1.9–3.3)	2.6 (1.7–3.8)
	SSHP−graft	238 (32.6)		
Operative time (minutes)	SSHP+graft	54 (40–73)	11[b] (8–14)	7[b] (3–11)
	SSHP−graft	65 (50–84)		
Estimated blood loss (ml)	SSHP+graft	25 (20–50)	1[b] (−3–3)	−5[b] (−8 to – 2)
	SSHP−graft	25 (15–50)		
Complications in total 1-year postoperative	SSHP+graft	118 (22.4)	1.3 (0.5–1.2)	1.3 (0.9–1.8)
	SSHP−graft	211 (27.6)		

TABLE 3 (Continued)

Outcome	Primary operation	*n* (%) /median (IQR)	cOR/Coef Q[b] (95% CI)	aOR/Coef Q[b] (95% CI)
[a]Sacrospinous hysteropexy with graft (SSHP+graft) vs Lap/Rob hysteropexy (SHP).				
Recurrent POP surgery	SSHP+graft	48 (7.3)	3.5 (2.2–5.5)	2.1 (1.4–3.1)
	SHP	37 (21.4)		
Sensation of a bulge Daily/1–3 times/week	SSHP+graft	83 (16.4)	2.2 (1.4–3.6)	2.3 (1.2–4.3)
	SHP	31 (30.1)		
Operative time (min)	SSHP+graft	54 (40–73)	66[b] (59–73)	66[b] (52–81)
	SHP	120 (90–150)		
Estimated blood loss (mL)	SSHP+graft	25 (20–50)	−5[b] (−11–1)	−16[b] (−21 to −11)
	SHP	20 (5–30)		
Complications in total 1-year postoperative	SSHP+graft	118 (22.4)	0.7 (0.5–1.2)	0.5 (0.3–1.0)
	SHP	26 (17.4)		
[a]Lap/Rob hysteropexy (SHP) vs Sacrospinous hysteropexy without graft (SSHP−graft)				
Recurrent POP surgery	SHP	37 (21.4)	0.7 (0.1–0.3)	1.0 (0.7–1.4)
	SSHP−graft	138 (15.1)		
Sensation of a bulge Daily/1–3 times/week	SHP	31 (30.1)	1.1 (0.7–1.8)	1.1 (0.6–1.9)
	SSHP−graft	238 (32.6)		
Operative time (min)	SHP	120 (90–150)	−55[b] (−62 to −48)	−58[b] (−74 to −42)
	SSHP−graft	65 (50–84)		
Estimated blood loss (mL)	SHP	20 (5–30)	5[b] (−1–11)	11[b] (7 – 15)
	SSHP−graft	25 (15–50)		
Complications in total 1-year postoperative	SHP	26 (17.4)	1.8 (1.1–2.8)	2.4 (1.4–3.9)
	SSHP−graft	211 (27.6)		

Figures are frequencies (proportions) and median (interquartile range).

n = frequencies of outcome.

cOR = crude odds ratio.

aOR = adjusted odds ratio. All variables from Table 1 were adjusted for and then stepwise excluded if *P*-value >0.25. For a detailed description of variables included in the final analysis, see supplementary material.

95% CI = 95% confidence interval.

Lap/Rob = Laparoscopic/robotic.

[a]Reference.

[b]Coef *Q* = Coefficient in quantile regression (50).

beneficial unless there is an indication for hysterectomy.[17-19] A concomitant hysterectomy did not alter the reoperation rate in patients with a uterine prolapse undergoing hysterectomy with SCerP or VH with SSLF or uterosacral ligament fixation in our study. In an RCT, in which 80% had a hysterectomy, the anatomical result after SCerP performed with laparotomy was better compared with vaginal uterosacral ligament fixation despite there being no subjective difference.[20] In line with our results, longer operative time, lower estimated blood loss and a reduced postoperative complication rate 1-year after surgery in laparoscopic and robotic hysterectomy compared with VH with uterosacral ligament fixation have been reported in a previous RCT from Sweden.[21] If there is an indication for a concomitant hysterectomy in women with uterine prolapse, an SSLF might not be necessary, given that this only prolongs the operative time and does not improve the relapse rate. Optimally, this should be studied further in large RCTs.

It is especially striking that an old surgical technique, the MP, had a favorable outcome compared with both vaginal and abdominal meshes in this study. This technique was associated with a low rate of symptomatic recurrence, less recurrent prolapse procedures, and a reduced rate of surgical morbidity. In a Danish register study[7] the risk of reoperation within 5 years post-surgery was higher in SSLF (30%) than in the MP (7%), which agrees with our results. Moreover, studies of the MP have showed a lower risk of recurrence and complications than with VH.[5] Our study also revealed that, despite a lower surgeon volume in the MP group than in the other surgical procedures, the differences in surgical outcomes in favor of the MP did not diminish. Surprisingly, in the subgroup analyses of the challenging group of women with previous prolapse surgery or stage IV prolapse, the favorable outcomes of the MP were maintained. We contend that cervical amputation with uterosacral ligament fixation should be among the preferred

surgical options in patients with uterine prolapse and for whom childbearing is complete.

Inspired by mesh used in surgery for stress urinary incontinence, several meshes were introduced in 2000 in POP surgery. Mesh exposure, when the mesh is visualized through the vaginal epithelium, is a known complication with exposure rates range from 2% to 30% following prolapse surgery or sling surgery.[22] This study showed a low reoperation and symptomatic recurrence rate when using vaginal lighter mesh in SSHP in uterine prolapse compared to other methods. Notably, the MP was not inferior to SSHP with graft in the primary outcome. Also, estimated blood loss was lower in the MP group than in SSHP with graft. We did see a high rate of postoperative complications (including pain and mesh erosion) in both SSHP with and without graft.

The frequency of recurrent POP surgery was 15.1% in SSHP without graft, which is higher than in other studies.[13,23] In a large RCT comparing SSHP without graft and VH the authors reported a recurrent POP surgery in SSHP without graft of 3.9% (3/102).[13] This finding could be explained by dedicated experienced surgeons with a standardized technique in the RCT as compared with this study with a national setting, a variation of surgeons and different types of sutures. Intriguingly, the SSHP without graft group in our study showed almost the same frequency (27.6%) of 1-year postoperative complications (including pain) as SSHP with graft. Accordingly, these procedures should be used with caution in smaller settings. In addition, the reoperation rate and symptomatic recurrences in SSHP and SSLF without graft were high, leading us to question the need for this procedure in uterine prolapse repair.

SHP was an established method when the Cochrane review was published in 2016.[14] The authors showed a 92%–95% cure rate both regarding symptoms and objectively after SCP/SHP. This result does not agree with our 22.4% recurrence rate of POP surgery in 2 years. In the Cochrane review, minimally invasive SCP/SHP was performed in only two of the original studies and the vaginal procedures were a heterogeneous mix of different vaginal techniques. Furthermore, most of the patients included were patients with vaginal vault prolapse. In our study, three of the centers started surgery with minimally invasive SHP during the study period and the results could be due to a learning curve. Also, some centers used SHP to fix the uterus to the sacrum and then performed a planned second step procedure a few weeks or months later. In this second step, the anterior or posterior defect was repaired as needed. The low numbers of concomitant vaginal surgery in the SHP group confirm this. Uterine preservation techniques have become more popular but keeping the uterus in place might increase the risk of a postoperative anterior wall failure, in some studies with up to 30% recurrence.[24–26] In other studies, there is often simultaneous vaginal surgery at the time of the SHP procedure, with concomitant procedures as high as 54.4%,[27] making comparisons with other international publications difficult. In light of our results, SHP might not be the first option in patients seeking help for apical prolapse symptoms but is still a useful technique in patients planning to conceive in the future.

A strength of this study is the nationwide setting with data retrieved from a national register (GynOp), with almost full coverage of all POP surgery in Sweden. In addition, data were collected to the register prospectively, reducing the risk of recall bias. However, there is always a risk of selection bias when the surgeon chooses a surgical technique, and this issue is built into the study's observational design. Moreover, the surgical techniques are not standardized. In general, the rate of missing data was low, and we validated several baseline characteristics by reviewing 450 medical records (Table S3). However, this validation was only performed on a part of the population in the study (SCerP/SHP). The rate of missing patients responding to the questionnaire 1 year after surgery in the vaginal group (20%–23%) is very low compared with other studies with patient-reported data; however, in the SCerP/SHP group, missing data was higher (34%–41%).[28] We subanalyzed this group of missing patients (see Supporting Information) but we can never be sure they are missing completely at random. There is no information about postoperative anatomical measurements in the GynOp register, but the goal of prolapse surgery is symptom relief. Another limitation of the register concerns the lack of information about the position of the isthmus and the cervical length. The impact of cervical elongation is not possible to evaluate. However, cervical elongation has no clear definition in the literature and is common in uterine prolapse.[29]

5 | CONCLUSION

In this population-based register study, the relapse rate in patients with uterine prolapse undergoing prolapse surgery was low with the MP, which also showed a reduced rate of surgical morbidity. Both sacrospinous ligament fixation with and without lightweight graft had a high rate (almost 30%) of 1-year postoperative complications (including pain and mesh erosion).

CONFLICT OF INTEREST

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AUTHOR CONTRIBUTIONS

MB designed the study together with ME and MS. MB applied for ethical approval and collected data from the registers and medical records with support from ME, AD and MS. MB analyzed the data with support from biostatistician AW, ME, MS and UJ. MB wrote the manuscript. The manuscript was revised by ME, MS, UJ, AD, AW and IB, who also approved the final version.

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SUPPORTING INFORMATION

Additional supporting information may be found in the online version of the article at the publisher's website.

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