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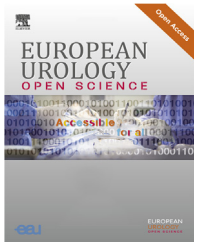

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Sexual Medicine

Sexual Activity and Dyspareunia After Pelvic Organ Prolapse Surgery: A 5-Year Nationwide Follow-up Study

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Abstract

Background: Even though surgery generally improves sexual function and alleviates dyspareunia related to pelvic organ prolapse (POP), knowledge of the long-term effects is scarce.
Objective: To describe changes in sexual activity and dyspareunia rates after POP surgery and to identify potential risk factors for the occurrence of dyspareunia.
Design, setting, and participants: This was a prospective longitudinal cohort study of women aged over 18 yr undergoing POP surgery in Finland during 2015. Out of 3515 participants, sexual activity and dyspareunia data were available at baseline, 6 mo, 2 yr, and 5 yr for 79%, 68%, 63%, and 57%, respectively.
Intervention: Native tissue, transvaginal mesh, and abdominal mesh repair.
Outcome measurements and statistical analysis: Rates of sexual activity and dyspareunia were assessed using the Pelvic Organ Prolapse/Urinary Incontinence Sexual Questionnaire (PISQ-12) at baseline and at 6 mo, 2 yr, and 5 yr after surgery. As a secondary outcome, risk factors for overall, persisting, and de novo dyspareunia were assessed using logistic regression models.
Results and limitations: The proportion of sexually active women increased from 40.7% to 43% after surgery. Preoperative dyspareunia resolved in >50% of cases during the first 6 mo, irrespective of the surgical approach. De novo dyspareunia rates were low at all time points (1.9–3.1%). Several potential risk factors associated with preoperative and postoperative dyspareunia were identified: younger age, lower preoperative body mass index, lower prolapse stage at baseline, either pelvic pain or dyspareunia at baseline, prior surgery (stress urinary incontinence surgery, posterior colporrhaphy, POP surgery, hysterectomy), and posterior repair.
Conclusions: Dyspareunia is significantly reduced after POP repair irrespective of the surgical approach. However, multiple factors seem to be associated with

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persisting and de novo symptoms, which should be considered in preoperative counseling.

Patient summary: Our 5-year follow-up study demonstrates that surgery to repair pelvic organ prolapse (POP) in women improves sexual activity and reduces painful intercourse. Multiple factors, such as preoperative pain, previous POP surgery, and prolapse stage, may be associated with painful intercourse after surgery.

1. Introduction

Pelvic organ prolapse (POP) is a complex and multifactorial condition, resulting in physical changes to women's genitalia, negatively affecting their body image and reducing libido and genital sensation [1,2]. Studies have reported 50–83% incidence of sexual dysfunction among women with pelvic floor disorders such as POP [1–5], whereas the estimated prevalence in general female population is approximately 30–50% [6]. Furthermore, it has been found that advanced prolapse is correlated with a higher rate of dyspareunia [3].

Prolapse surgery generally improves sexual function, including alleviation of dyspareunia [5,7]. However, vaginal tissue scarring and changes in vaginal anatomy may increase postoperative sexual dysfunction and result in increased or de novo dyspareunia. Mesh complications, such as mesh shrinkage, erosion, and extensive fibrosis, are also a plausible cause of postoperative dyspareunia.

The incidence of postoperative dyspareunia varies in the literature, depending on the surgical approach. Posterior colporrhaphy, especially combined with either Burch colposuspension or levator plication, and transvaginal mesh (TVM) repair (especially posterior mesh repair) have been associated with a higher risk of postoperative dyspareunia [7–9]. In addition, the occurrence of preoperative dyspareunia is strongly associated with postoperative dyspareunia [10]. Most previous studies did not report preoperative dyspareunia rates, making it difficult to distinguish between persisting and de novo dyspareunia [11]. Furthermore, sexual function is often under-reported [12] or reported as a secondary outcome [7], and follow-up for most studies has been short [10,11,13,14].

In this prospective nationwide cohort study, we describe changes in sexual activity and dyspareunia rates during 5-yr follow-up after native tissue repair (NTR), TVM, and abdominal mesh (AM) surgery for POP. To improve preoperative counseling, our secondary aim was to identify potential risk factors for the occurrence of dyspareunia.

2. Patients and methods

2.1. Setting

This was a primary analysis of women enrolled in the Finnish Pelvic Organ Prolapse Surgery Survey Study (FINPOP), a nationwide longitudinal cohort (ClinicalTrial.gov NCT02716506). A total of 41 of the 45 Finnish hospitals performing POP surgery in 2015 participated in recruitment of the study population.

The study was organized and funded by the Finnish Society for Gynecological Surgery. Additional funding was received from the Finnish Cultural Foundation, state research funding, and the Finnish Society of Obstetrics and Gynecology Research. The research ethics committee of the Northern Savo Hospital District (reference number 5/2014), the Ministry of Social Affairs and Health, and the institutional review board of each participating hospital approved the protocol. The ethical standards for human experimentation established by the Declaration of Helsinki of 1964 and revised in 2013 were followed. Each participant gave written informed consent.

2.2. Inclusion criteria and data collection

The study design and data collection have already been described in detail [15]. Preoperative and operative data were obtained from questionnaires filled out by patients and surgeons. The degree of prolapse was assessed by surgeons at baseline using the simplified Pelvic Organ Prolapse Quantification (POP-Q) system [16]. The participants were asked to fill out validated questionnaires in either Finnish [17] or Swedish [18] at baseline and at 6 mo, 2 yr, and 5 yr after surgery: The Pelvic Floor Distress Inventory (PFDI-20) and the Pelvic Organ Prolapse/Urinary Incontinence Sexual Questionnaire (PISQ-12).

2.3. Data handling and analysis

The PISQ-12 questionnaire evaluates sexual function in women with urinary incontinence and/or pelvic organ prolapse [19]. Sexual activity and dyspareunia were assessed using a screening question (Supplementary Fig. 1) and item number 5 of the PISQ-12 questionnaire at baseline and at each time point during the 5-yr follow-up. Definitions of sexual activity, dyspareunia, and pelvic pain are shown in Fig. 1.

Only women who had responded to the screening question or had at least partly filled out the PISQ-12 questionnaire were included in the analysis. We report the rates of sexually active women overall and with or without pain, as well as overall, resolved, persisting, and de novo dyspareunia at each time point for the entire study population and the three surgical subgroups (NTR, TVM, and AM). The surgical methods used in the FINPOP cohort have already been reported by Mattsson et al. [15].

Baseline and surgical characteristics were compared between women with and without dyspareunia at baseline using a χ^2 test or Fisher's exact test for categorical measures, and a Student t test for continuous measures. A χ^2 test or Fisher's exact test was used for between-group comparisons at each time point. The generalized estimated equation method was used to assess differences between surgical groups over time.

Logistic regression analysis was used to assess risk factors for overall and persisting dyspareunia at baseline and at 6 mo, 2 yr, and 5 yr after surgery using clinically important baseline characteristics and those that were significant on bivariate analysis. For de novo dyspareunia, multivariable models were constructed only for 6-mo and cumulative 5-yr follow-up data, as univariate modeling showed no statistically significant predictive factors at 2-yr and 5-yr follow-up. We evaluated possible

- **Sexually active:** Women with a response of "Yes" to screening question[a] or no response, but had completed PISQ-12 questionnaire at least partially.
- **Sexually active with pain:** Sexually active women reporting pain "often or always" during intercourse.
- **Sexually inactive due to pain:** Women responding to screening question[a] "No, I have too much pain" or being sexually inactive for another reason, and reporting pain "often or always" during intercourse.
- **Dyspareunia:** Sexually active women, with a response of "usually or always" to the PISQ-12 question "Do you feel pain during sexual intercourse?".
- **Persisting dyspareunia:** Women reporting dyspareunia at baseline and at any time during follow-up.
- **Resolved dyspareunia:** The resolution of symptoms at each timepoint compared to that previously reported.
- **De novo dyspareunia:** According to IUGA/ICS guidelines[b] "dyspareunia first reported after surgery or other interventions". (Only assessed in women who were sexually active at baseline).
- **Baseline pelvic pain: A** response of "moderately or quite a bit" bother on the PFDI-20, item number 20: "Do you usually experience pain or discomfort in the lower abdomen or genital region? If yes, how much does it bother you?"

Fig. 1 – Definitions of sexual activity, dyspareunia, and pelvic pain. PFDI-20 = Pelvic Floor Distress Inventory; PISQ-12 = Pelvic Organ Prolapse/Urinary Incontinence Sexual Questionnaire. [a]Supplementary Fig. 1. [b]International Urogynecological Association (IUGA)/International Continence Society (ICS) [41].

collinearity between different variables using Spearman's ρ testing (with $r > 0.4$ as a cutoff; Supplementary Table 1). Strongly correlated predictors were not included in the same model.

The data were analyzed using SPSS version 27.0 (SPSS Inc., Chicago, IL, USA). The mean and standard deviation are reported for normally distributed continuous variables. Odds ratio (OR) estimates are reported with the 95% confidence interval (CI). A p value <0.05 was considered statistically significant for all analyses.

3. Results

Table 1 shows the baseline and surgical characteristics of the study population. Baseline data for sexual activity status and dyspareunia were available for 2785 (79%) of the 3515 women enrolled in the FINPOP trial. Data availability during the 5-yr follow up is shown in Fig. 2.

3.1. *Sexual activity*

At baseline, 1133 women (40.7%) were sexually active, of whom 85 (7.5%) had pain (Table 2). At 6-mo follow-up, the proportion of sexually active women had increased by 3%. This change was only significant in the NTR group ($p = 0.006$). At 5-yr follow-up the number of sexually active women had significantly decreased in all surgical groups in comparison to baseline. When considering only women with complete follow up data ($n = 1570$), the percentage of sexually active women overall and within surgical subgroups remained similar (data not shown). The proportion of women reporting sexual inactivity due to pain decreased by more than half after surgery.

Women in the TVM group were significantly less likely to be sexually active at baseline compared to both the NTR and AM groups and remained so throughout the 5-yr follow-up. The surgical groups did not differ in the proportions of women who were sexually active with pain or sexually inactive due to pain. There was no significant difference between the surgical groups in the change in the proportion of sexually active women over time ($p = 0.517$).

3.2. *Dyspareunia*

At baseline, 206 (7.4%) of 2785 women reported dyspareunia (Table 2). Women reporting baseline dyspareunia were significantly younger and less likely to use local or oral estrogen replacement therapy in comparison to those without dyspareunia (Table 1). They were also more likely to report baseline pelvic pain or have undergone prior hysterectomy or incontinence surgery and a lower prolapse stage at baseline.

A 6 mo after surgery the dyspareunia rate had decreased significantly from 7.4% to 4.3%. In the NTR and AM groups the rate remained significantly lower throughout the 5-yr follow-up in comparison to baseline. There were no significant differences in dyspareunia rates between the surgical groups at any time point, nor was the change over time among surgical groups significantly different during the 5-yr follow-up.

The highest rate of dyspareunia resolution was at 6 mo after surgery, with 132 women (64%) reporting symptom resolution. During further follow-up, an additional 37 women reported resolution of their dyspareunia (NTR 27, TVM 5, and AM 5). Dyspareunia persisted in 52 women (25%) during follow-up. However, 12 women (36%) with persisting dyspareunia at 6 mo reported resolution of their symptoms at 2 yr, and a further six (18%) with persisting dyspareunia at 6 mo and 2 yr reported resolution of their symptoms at 5 yr.

Younger age, lower prolapse stage, baseline pelvic pain, prior hysterectomy, and prior incontinence surgery were associated with baseline dyspareunia (Table 3 and Supplementary Tables 2 and 3). Lower prolapse stage at baseline, baseline dyspareunia, prior posterior colporrhaphy, and posterior repair predicted the occurrence of dyspareunia at 6 mo after surgery. Baseline dyspareunia was the only factor associated with postoperative dyspareunia at 2-yr follow-up. Lower preoperative body mass index (BMI), baseline dyspareunia, and posterior repair were related to a higher risk of dyspareunia at 5 yr.

Lower prolapse stage at baseline and baseline pelvic pain were predictors for persisting dyspareunia throughout the 5-yr follow-up (Table 3 and Supplementary Tables 4 and

Table 1 – Baseline and surgical characteristics of women with and without preoperative dyspareunia

Parameter[a]	No dyspareunia (*N* = 2579)	Dyspareunia (*N* = 206)	Total (*N* = 2785)	*p* value
Age (yr)	63.9 ± 10.3	60.0 ± 10.8	63.6 ± 10.4	<0.001
Weight (kg)	72.1 ± 11.6	71.9 ± 11.8	72.0 ± 11.8	0.847
Body mass index (kg/m^2)	26.9 ± 4.1	27.0 ± 4.1	26.9 ± 4.1	0.740
Parity (*n*)	2.6 ± 1.4	2.8 ± 1.4	2.6 ± 1.4	0.084
Current smoker, *n* (%)	234 (9.1)	16 (7.8)	250 (9.0)	0.613
Diabetes, *n* (%)	243 (9.4)	20 (9.7)	263 (9.4)	0.901
Estrogen replacement therapy, *n* (%)				0.013
Local	1794 (69.8)	124 (60.5)	1918 (69.1)	
Oral	118 (4.6)	7 (3.4)	125 (4.5)	
Both	158 (6.1)	17(8.3)	175 (6.3)	
POP-Q stage, *n* (%)				<0.001
1	16 (0.6)	2 (1.0)	18 (0.6)	
2	1292 (50.1)	133 (64.6)	1425 (51.2)	
3–4	1261 (48.9)	71 (34.5)	1332 (47.8)	
POP-Q point Ba ≥0, *n* (%)	1627 (63.1)	116 (56.3)	1743 (62.6)	0.046
POP-Q point Bp ≥0, *n* (%)	1105 (42.8)	94 (45.6)	1199 (43.1)	0.375
POP-Q point C ≥0, *n* (%)	1009 (39.1)	63 (30.6)	1072 (38.5)	0.011
Baseline pelvic pain, *n* (%)	443 (17.2)	73 (35.4)	516 (18.5)	<0.001
Prior POP surgery, *n* (%)	640 (24.8)	54 (26.2)	694 (24.9)	0.676
Prior hysterectomy, *n* (%)	834 (32.3)	82 (39.8)	916 (32.9)	0.031
Prior SUI surgery, *n* (%)[b]	137 (5.3)	21 (10.2)	158 (5.7)	0.006
Prior anterior colporrhaphy, *n* (%)	410 (15.9)	28 (13.6)	438 (15.7)	0.427
Prior posterior colporrhaphy, *n* (%)	289 (11.2)	27 (13.1)	316 (11.3)	0.424
Prior mesh surgery, *n* (%)	71 (2.8)	5 (2.4)	76 (2.7)	0.833
Type of surgery, *n* (%)				0.272
Native tissue repair	2086 (80.9)	166 (80.6)	2252 (80.9)	
Transvaginal mesh repair	310 (12.0)	20 (9.7)	330 (11.8)	
Abdominal mesh repair	183 (7.1)	20 (9.7)	203 (7.3)	
Concomitant hysterectomy, *n* (%)	1037 (40.2)	76 (36.9)	1113 (40.0)	0.375
Concomitant SUI surgery, *n* (%)	22 (0.9)	3 (1.5)	25 (0.9)	0.426

POP-Q = Pelvic Organ Prolapse Quantification; POP = pelvic organ prolapse; SUI = stress urinary incontinence.
[a] Results for continuous variables are presented as the mean ± standard deviation.
[b] Preoperative data on the type of prior SUI surgery were only available for four women: three prior Burch colposuspensions and one prior tension-free vaginal tape procedure.

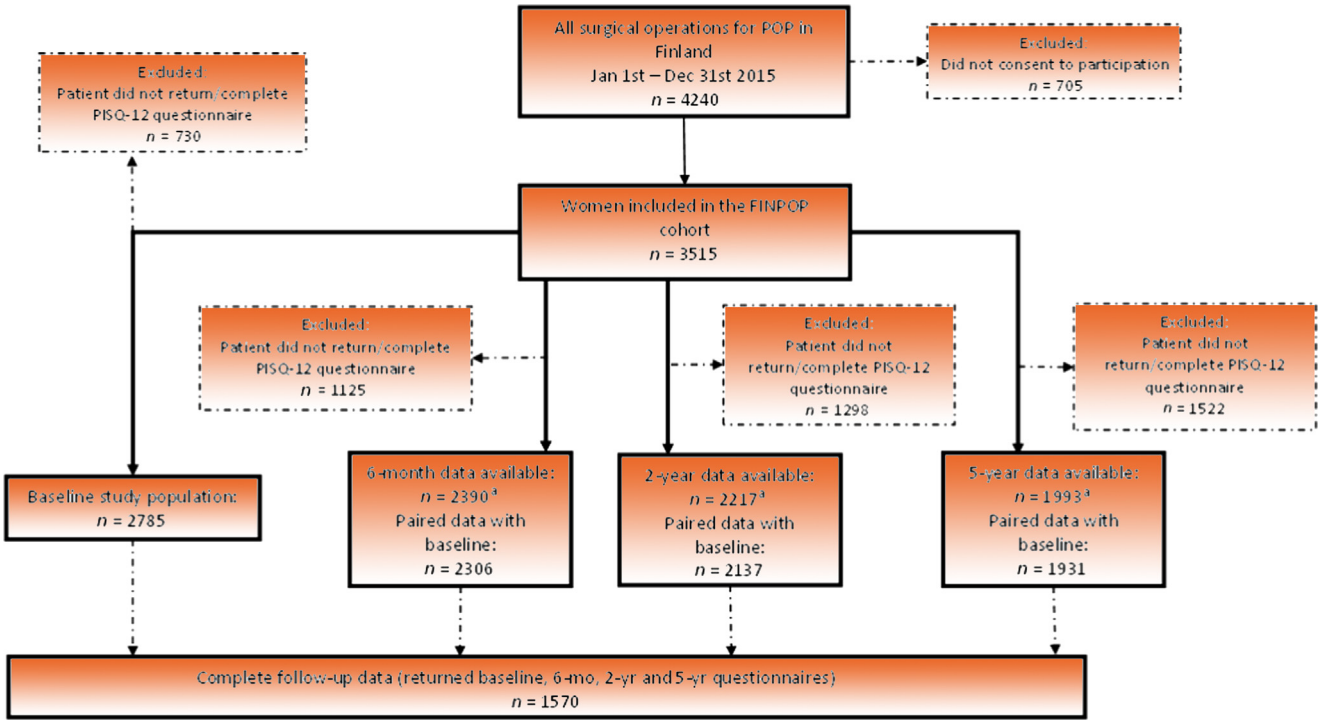

Fig. 2 – Flow diagram of study enrollment and data availability. POP = pelvic organ prolapse; PISQ-12 = Pelvic Organ Prolapse/Urinary Incontinence Sexual Questionnaire. [a]Baseline sexual activity and dyspareunia data were not available for all women.

Table 2 – Sexual activity, dyspareunia, and de novo dyspareunia during 5-yr follow-up

	Patients, *n*/*N* (%)				*p* value	
	Total	Native tissue repair	Transvaginal mesh repair	Abdominal mesh repair	Between groups[a]	Change over time[b]
Sexually active[c]						0.517
Baseline	1133/2785 (40.7)	945/2252 (42.0)	100/330 (30.3)	88/203 (43.3)	<0.001[d]	
6 mo	1028/2390 (43.0)[e]	852/1911 (44.6)[e]	99/296 (33.4)	77/183 (42.1)	0.001[f]	
2 yr	880/2217 (39.7)	717/1755 (40.9)	92/290 (31.7)	71/172 (41.3)	0.012[g]	
5 yr	708/1993 (35.5)[e]	599/1603 (37.4)[e]	54/234 (23.1)[e]	55/156 (35.5)[e]	<0.001[h]	
SAP[i]						0.144
Baseline	85/1133 (7.5)	72/945 (7.6)	5/100 (5.0)	8/88 (9.1)	0.545	
6 mo	55/1028 (5.4)	49/852 (5.8)	3/99 (3.0)	2/77 (2.6)[e]	0.408	
2 yr	46/880 (5.2)[e]	36/717 (5.0)[e]	8/92 (8.7)	2/71 (2.8)	0.227	
5 yr	30/708 (4.3)[e]	26/599 (4.3)[e]	2/54 (3.7)	2/55 (3.6)	1.00	
SIDP[j]						0.812
Baseline	121/1652 (7.3)	94/1307 (7.2)	15/230 (6.5)	12/115 (10.4)	0.386	
6 mo	48/1362 (3.5)[e]	38/1059 (3.6)[e]	6/197 (3.0)	4/106 (3.8)[e]	0.896	
2 yr	41/1337 (3.1)[e]	34/1038 (3.3)[e]	3/198 (1.5)[e]	4/101 (4.0)[e]	0.323	
5 yr	46/1285 (3.6)[e]	33/1004 (3.3)[e]	7/180 (3.9)	6/101 (5.9)	0.324	
Overall DYSP						0.540
Baseline	206/2785 (7.4)	166/2357 (7.4)	20/330 (6.1)	20/203 (9.9)	0.272	
6 mo	103/2390 (4.3)[e]	88/1911 (4.6)[e]	9/296 (3.0)[e]	6/183 (3.3)[e]	0.369	
2 yr	87/2217 (3.9)[e]	70/1755 (4.0)[e]	11/290 (3.8)	6/172 (3.5)[e]	0.960	
5 yr	76/1993 (3.8)[e]	59/1603 (3.7)[e]	9/234 (3.8)	8/156 (5.1)[e]	0.668	
Persisting DYSP[k]						0.208
6 mo	33/165 (20.0)	24/135 (17.8)	4/16 (25.0)	5/14 (35.7)	0.209	
2 yr	27/144 (18.8)	22/112 (19.6)	2/16 (12.5)	3/16 (18.8)	0.930	
5 yr	19/136 (14.0)[l]	11/107 (10.3)[l]	3/14 (21.4)	5/15 (33.3)	0.032[m]	
De novo DYSP[n]						<0.001
6 mo	66/2141 (3.1)	61/1716 (3.6)	5/264 (1.9)	0/175 (0)	0.023[o]	
2 yr	38/1993 (1.9)[l]	29/1589 (1.8)[l]	7/251 (2.8)	2/153 (1.3)[l]	0.510	
5 yr	35/1784 (2.0)[l]	29/1444 (2.0)[l]	5/203 (2.5)	1/137 (0.7)[l]	0.518	

DYSP = dyspareunia; SAP = sexually active with pain; SIDP = sexually inactive due to pain; NTR = native tissue repair; TVM = transvaginal mesh; AM = abdominal mesh.

[a] Differences between groups at each time point were assessed using either a χ^2 test or Fisher's exact test.

[b] Generalized estimated equation testing was used to assess differences between surgical groups over time.

[c] Answered "Yes" to "Are you sexually active" OR did not answer but completed the Pelvic Organ Prolapse/Urinary Incontinence Sexual Questionnaire at least in part.

[d] Significant difference between NTR and TVM (pairwise testing, $p < 0.001$). Significant difference between TVM and AM (pairwise testing, $p = 0.003$).

[e] Statistically significant change from baseline ($p < 0.05$).

[f] Significant difference between NTR and TVM (pairwise testing, $p < 0.001$).

[g] Significant difference between NTR and TVM (pairwise testing, $p = 0.003$). Significant difference between TVM and AM (pairwise testing, $p = 0.044$).

[h] Significant difference between NTR and TVM (pairwise testing, $p < 0.001$). Significant difference between TVM and AM (pairwise testing, $p = 0.011$).

[i] Sexually active women reporting dyspareunia often/always during intercourse.

[j] Not sexually active due to pain or not sexually active for another reason AND often/always experience pain during intercourse.

[k] Only women with reported baseline dyspareunia and paired data available at each time point were included.

[l] Statistically significant change versus 6 mo ($p < 0.05$).

[m] Significant difference between NTR and AM (pairwise testing, $p = 0.010$).

[n] Dyspareunia first reported after surgery or other intervention [41].

[o] Significant difference between NTR and AM (pairwise testing, $p = 0.007$).

5). In addition, prior POP surgery predicted dyspareunia persisting at 6-mo follow-up, and prior hysterectomy predicted dyspareunia persisting at 5-yr follow-up.

3.3. *De novo dyspareunia*

Overall, 139 women reported de novo dyspareunia during the 5-yr follow-up period (Table 2). At 6-mo follow-up, 3.6% of women in the NTR group reported de novo dyspareunia, with the only significant difference in comparison to the AM group (0%). The de novo dyspareunia incidence had decreased significantly in the NTR group at 2 yr and 5 yr in comparison to 6 mo after surgery. This decrease remained significant throughout the 5-yr follow-up in comparison to the other surgical groups.

Younger age, lower prolapse stage, prior incontinence surgery, and posterior repair were identified as risk factors for de novo dyspareunia at 6 mo after surgery (Table 3 and Supplementary Tables 6 and 7). Only posterior repair was associated with a higher risk of cumulative de novo dyspareunia incidence during 5-yr follow-up. Women who had an AM repair had a lower risk of de novo dyspareunia in comparison to NTR (OR 0.26, 95% CI 0.08–0.82).

4. Discussion

The impact of POP surgery on sexual activity and function remains controversial, with many studies reporting improvement, while others showed either no difference or even a deterioration in sexual function postoperatively [11]. Our longitudinal follow-up study reveals improvements in both sexual activity and dyspareunia after POP repair. We also identified several factors associated with

Table 3 – Factors predictive for overall, persisting, and de novo dyspareunia.

	Baseline dyspareunia		Dyspareunia at 6 mo		Persisting dyspareunia at 6 mo		De novo dyspareunia at 6 mo	
	OR (95% CI)	aOR (95% CI)[a]	OR (95% CI)	aOR (95% CI)[b]	OR (95% CI)	aOR (95% CI)[c]	OR (95% CI)	aOR (95% CI)[d]
Age	**0.96 (0.95–0.98)**	**0.97 (0.95–0.98)**	0.97 (0.95–0.98)	0.98 (0.96–1.00)	0.98 (0.95–1.01)	0.99 (0.95–1.03)	**0.96 (0.94–0.98)**	**0.97 (0.95–0.99)**
MDP of any compartment	**0.84 (0.76–0.93)**	**0.87 (0.78–0.97)**	**0.69 (0.59–0.80)**	**0.77 (0.65–0.91)**	**0.65 (0.50–0.86)**	**0.72 (0.54–0.97)**	**0.74 (0.61–0.89)**	**0.77 (0.63–0.94)**
Dyspareunia at baseline	NA	–	**7.72 (4.93–12.07)**	**6.36 (3.85–10.52)**	NA	–	NA	–
Pelvic pain at baseline	**2.65 (1.95–3.58)**	**2.65 (1.92–3.66)**	1.74 (1.11–2.71)	1.19 (0.72–1.98)	**2.25 (1.08–4.67)**	**2.17 (1.00–4.70)**	NA	–
Prior hysterectomy	**1.35 (1.01–1.80)**	**1.94 (1.36–2.77)**	0.90 (0.59–1.38)	–	1.88 (0.95–3.75)	–	0.63 (0.35–1.11)	–
Prior POP surgery	1.08 (0.78–1.49)	–	1.22 (0.79–1.89)	–	**2.24 (1.12–4.50)**	**2.40 (1.11–5.20)**	0.96 (0.54–1.70)	–
Prior SUI surgery	**1.96 (1.22–3.18)**	**1.89 (1.12–3.19)**	2.01 (1.05–3.85)	1.40 (0.66–3.00)	1.08 (0.25–4.53)	–	**2.37 (1.10–5.08)**	**2.72 (1.46–5.06)**
Prior posterior colporrhaphy	1.16 (0.76–1.77)	1.12 (0.66–1.88)	**1.67 (1.01–2.82)**	**2.54 (1.40–4.60)**	2.04 (0.88–4.75)	–	1.69 (0.89–3.21)	–
Posterior repair	NA	–	**2.08 (1.36–3.18)**	**2.30 (1.37–3.85)**	1.22 (0.61–2.44)	–	**2.87 (1.62–5.07)**	**2.72 (1.45–5.06)**

OR = odds ratio; aOR = adjusted odds ratio; CI = confidence interval; MDP = most distal point; POP = pelvic organ prolapse; SUI = stress urinary incontinence; NA = not available (no cases for this variable); – = variable not included in the multivariable model; BMI = body mass index.

The bolded figures indicate statistical significance in both uni- and multivariable analysis (i.e. OR and aOR are significant).

[a] Adjusted for age, BMI, parity, current smoker, MDP of any compartment, pelvic pain at baseline, prior hysterectomy, prior mesh repair, prior SUI surgery, prior anterior colporrhaphy, and prior posterior colporrhaphy (complete data shown in Supplementary Table 3).

[b] Adjusted for age, BMI, parity, current smoker, MDP of any compartment, dyspareunia at baseline, pelvic pain at baseline, prior SUI surgery, prior posterior colporrhaphy, anterior repair, posterior repair, and concomitant hysterectomy (complete data shown in Supplementary Table 3).

[c] Adjusted for age, BMI, parity, current smoker, MDP of any compartment, pelvic pain at baseline, prior POP surgery, apical repair, and posterior transvaginal mesh (complete data shown in Supplementary Table 5).

[d] Adjusted for age, BMI, parity, current smoker, MDP of any compartment, prior SUI surgery, anterior repair, posterior repair, concomitant hysterectomy, and concomitant SUI surgery (complete data shown in Supplementary Table 7).

preoperative and postoperative dyspareunia: younger age, lower preoperative BMI, lower prolapse stage at baseline, either pelvic pain or dyspareunia at baseline, prior surgery (stress urinary incontinence [SUI] surgery, posterior colporrhaphy, POP surgery, hysterectomy), and posterior repair.

The proportion of women who were sexually active was significantly higher at 6 mo than at baseline, after which the rate steadily decreased. Other studies have reported similar trends, albeit with shorter follow-up [20,21]. The proportion of women who were sexually active increased significantly only in the NTR group, but the smaller number of women in the other surgery groups may explain this. We also did not observe significant differences between the surgical subgroups over the 5-yr follow-up, supporting the hypothesis that an increase also occurred in the other groups. The proportions of women who were sexually active at each time point and within each surgical subgroup remained similar when analyzing only women with complete follow-up data, indicating that the results were not affected by those lost to follow-up.

It is widely accepted that several concomitant factors, such as menopausal status, medications, multimorbidity, changes in libido, and relationship status, could interfere with postoperative assessment of sexual activity and function in the long term. Therefore, it seems that the optimal period for assessment of postoperative sexual function lies between 6 and 12 mo after surgery [11]. Considering the aforementioned confounders, it is evident that the cause of lower sexual activity rates after 6-mo follow-up is multifactorial and no definite conclusions on the long-term effects of POP surgery on sexual activity can be drawn. However, the significant postoperative decrease in the proportions of women who were sexually active with pain and sexually inactive due to pain indicate long-term improvements in sexual dysfunction related to POP.

The preoperative dyspareunia rates were low in our study, decreased by more than half postoperatively, irrespective of surgical approach, and remained significantly lower throughout the 5-yr follow-up in comparison to baseline. In total, 82% of women obtained symptom resolution during 5-yr follow-up, with no significant differences between the surgical groups. Slightly higher rates of baseline dyspareunia (14–29%) but similar trends postoperatively have been reported [10,20,21]. In addition, the rates of de novo dyspareunia were low and comparable to the prevalence of 0–9% reported in the literature [22].

Vaginal dryness and dyspareunia affect approximately one-third of women going through menopausal transition [23]. A cross-sectional study of 500 peri- and postmenopausal women revealed higher dyspareunia incidence in the perimenopausal group than in the menopausal group (18% vs 8%) [24]. In our study, younger age was associated with baseline dyspareunia and de novo symptoms at 6-mo follow-up. Women with baseline dyspareunia were significantly younger than those without dyspareunia, indicating that they were more likely to still be experiencing perimenopausal symptoms. They were also less likely to use local or oral estrogen replacement therapy, which alleviate the symptoms of menopausal transition.

We found that lower prolapse stage was associated with the presence of preoperative and postoperative dyspareunia, as well as persisting and de novo dyspareunia at 6 mo after surgery. A smaller genital hiatus size has been associated with lower prolapse stage [25–28], and Lukacz et al. [10] reported an association between smaller genital hiatus size and postoperative dyspareunia. In addition, the sensation of the vaginal introital caliber being too tight has been related to postoperative dyspareunia [8]. By contrast, Handa et al. [3] reported that higher rates of dyspareunia were associated with advanced POP stages. However, advanced POP stages have been associated with reduced genital sensation [29], which could account, at least in part, for our results.

Preoperative pain and dyspareunia have previously been associated with persisting symptoms in several studies [10,30]. Our results also show a strong association between baseline pelvic pain and persisting dyspareunia after POP surgery. Remarkably, the association between baseline and postoperative dyspareunia remained significant throughout the 5-yr follow-up. Prior studies in the fields of anesthesia and surgery have reported preoperative pain as a significant predictor of postoperative pain, while the presence and duration of preoperative pain has been associated with the development and persistence of chronic postsurgical pain [31,32].

Previous studies have shown that hysterectomy is related to improvements in sexual function and lower rates of dyspareunia [5,10,11]. Controversially, we found that prior hysterectomy was a risk factor for baseline dyspareunia and persisting symptoms at 5-yr follow-up. Also, unlike Lukacz et al. [10], prior POP surgery was associated with persisting dyspareunia at 6-mo follow-up. Prior POP surgery was also associated with baseline dyspareunia on bivariate analysis; however, owing to collinearity it was not included in the multivariable model. Even though higher dyspareunia rates have been reported after TVM repair [33], we found that neither TVM nor AM repair was a risk factor for baseline or postoperative dyspareunia. Interestingly, AM repair was associated with a significantly lower risk of de novo dyspareunia during 5-yr follow-up in comparison to NTR.

Dyspareunia following POP surgery has often been attributed to posterior colporrhaphy with levator plication [9,34]. Even though levator plication has largely been abandoned, a higher risk of postoperative dyspareunia remains a concern after traditional posterior compartment repair, especially when combined with Burch colposuspension [5,9,35]. Posterior repair and prior SUI surgery, but not concomitant SUI surgery, were strongly associated with baseline and de novo dyspareunia in our study. Even though it has been reported that chronic pain after SUI surgery is a rare outcome [36], dyspareunia, worsening of orgasm and satisfaction, and sling revisions because of pain have been reported in several studies comparing SUI procedures [37–40]. Unfortunately, we lack sufficient data on the type of prior SUI surgery to analyze this further.

The strengths of this study are the large nationwide study population and the use of validated condition-specific questionnaires. To the best of our knowledge, only a few studies have reported sexual activity status, dyspareunia, and de novo dyspareunia rates for such a long follow-up period. However, we did not ask the patients about their relationship status and we have no information on how much bother the presence of dyspareunia caused for these women. In addition, some women may have undergone reoperation for recurrent POP, which naturally could influence sexual function. Unfortunately, at the time of this study we lacked sufficient data on reoperations. Owing to the low rate of de novo dyspareunia in our study population, it is likely that there was insufficient power for detection of predictive factors after 6-mo follow-up.

5. Conclusions

On the basis of our findings and the literature, it seems clear that POP surgery has beneficial effects on women's sexual wellbeing. Posterior POP repair remains a significant risk factor for the occurrence of dyspareunia, while preoperative dyspareunia and pelvic pain should be taken into consideration in patient counseling and surgical planning. So far, the mechanisms underlying the relationship between dyspareunia and prolapse stage and prior SUI surgery remain unknown.

Author contributions: Olga Wihersaari had full access to all the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.

Study concept and design: Wihersaari.
Acquisition of data: Wihersaari, Karjalainen, Mattsson.
Analysis and interpretation of data: Wihersaari, Tolppanen.
Drafting of the manuscript: Wihersaari.
Critical revision of the manuscript for important intellectual content: Jalkanen, Nieminen, Tolppanen, Karjalainen, Mattsson.
Statistical analysis: Wihersaari, Tolppanen.
Obtaining funding: Wihersaari, Karjalainen.
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Supervision: Jalkanen.
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Appendix A. Supplementary data

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