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Risk factors for persistent, de novo and overall overactive bladder syndrome after surgical prolapse repair

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ABSTRACT

Objective: Overactive bladder (OAB) symptoms are frequently associated with pelvic organ prolapse (POP) and both postoperative improvement and de novo onset of OAB symptoms have been described. The aim of the study is to identify risk factors for persistent, de novo and overall postoperative OAB after POP repair.

Study design: This was a retrospective study including patients who underwent primary POP surgery. Medical interview, urogenital examination and urodynamics were performed preoperatively; patients were examined one and six months after surgery and then yearly.

Results: 518 patients were included. 36.1% of women preoperatively complained of OAB symptoms while detrusor overactivity was found in 20.5%. The rate of persistent and de novo OAB after surgery were respectively 14.1% and 13.5%. Multivariate analysis found age, BMI, preoperative OAB, sling placement and postoperative SUI as independent risk factors for overall OAB after surgery. Moreover, preoperative OAB and postoperative constipations were associated with OAB persistence after surgery. Finally, age, sling placement, postoperative SUI and voiding symptoms were independently associated with de novo OAB.

Conclusion: Preoperative OAB symptoms are associated with OAB persistence after POP surgery, while age and sling placement correlate with de novo OAB. Finally, increased BMI is related to postoperative OAB.

Introduction

Pelvic organ prolapse (POP) is defined as the descent of any vaginal compartment. Pathogenesis is not completely understood, but risk factors for development and recurrence involve obstetrical history, chronic increased abdominal pressure and altered collagenic patterns [1–3]. Affected patients often complain of impaired quality of life due to bulging symptoms and urinary, sexual or bowel dysfunction [4]. In particular symptoms of an overactive bladder (OAB) are frequently reported by patients affected by POP, up to 88% [5]. OAB syndrome is defined by The International Continence Society (ICS) as "urgency, with or without urge incontinence, usually with frequency and nocturia" [6]. Since both POP and OAB are prevalent disorders that increase with age, they are frequently encountered in the same patients. Different studies report a direct association between the two conditions, since the prevalence of OAB results significantly higher in patients with POP compared to controls without POP [7,8]. However pathophysiology of OAB in patients with POP is still not well defined [9]. In particular, the role of detrusor overactivity is not clear, since it can be found only in about half of women with OAB complaints [10]. Another issue with OAB is the relationship with surgical POP repair. While there is some evidence to suggest that OAB symptoms tend to improve after POP surgery, also de novo symptoms have been reported [9,11]. In particular, the mechanism related to the persistence or resolution of OAB after POP repair is still unclear [9].

The aim of this study was to identify risk factors for persistent OAB, de novo OAB and overall (persistent + de novo) postoperative OAB after POP repair with respect to population characteristics, baseline symptoms, preoperative urodynamics findings and surgical procedures performed.

Material and methods

Patients who underwent primary POP repair between 2008 and 2013 were retrospectively analyzed. Data were available from

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dedicated hospital software for outpatient, surgery and recovery. Patients with a history of previous surgery for pelvic floor disorders were excluded. Preoperative evaluation included a medical interview to investigate the presence of urinary, sexual and bowel disorders. OAB syndrome was defined according to ICS as "urgency, with or without urge incontinence, usually with frequency and nocturia" [6]. Urogenital examination was performed and POP staged according to Pelvic Organ Prolapse Quantification system (POP-Q) [12]. In the given period all patients underwent preoperative urodynamic evaluation according to ICS standards [6,13]. In particular detrusor overactivity was defined as "involuntary detrusor contractions during the filling phase which may be spontaneous or provoked". Voiding dysfunction was defined as post-void residual >100 ml.

All patients underwent native-tissue repair through vaginal hysterectomy followed by high uterosacral ligaments suspension for pelvic organ prolapse. In the given period this procedure represented our standard procedure for uterovaginal prolapse repair in case of menopausal women or reproductive age women not requiring uterine preservation [14,15]. Bilateral oophorectomy was performed – when technically feasible - according to menopausal status, age, adnexal pathology, oncologic risk and patients will. After hysterectomy, the vaginal suspension was performed through high uterosacral suspension according to the previously described technique [16]. Additional surgical procedures such as anterior repair, posterior repair or anti-incontinence procedure (single-incision sling) were performed when indicated.

Patients were followed up one and six months after surgical repair, then annually. For the analysis we considered the last available follow-up. Follow-up visits included a clinical interview to investigate the presence of urinary symptoms. De novo OAB was defined as postoperative OAB in a patient without preoperative OAB. Persistent OAB was defined as postoperative OAB in a patient with preoperative OAB. Overall postoperative OAB resulted as the combination of de novo and persistent OAB. A complete urogenital examination according to POP-Q system was also performed. A postoperative descent $\geq$ stage II according to the POP-Q system in any vaginal compartment or reoperation for POP were considered as recurrences.

The study was approved by the Ethics Committee of San Gerardo Hospital in Monza, Italy. Data were entered into the database by one author and double checked by one other author. Statistical analysis was performed using JMP software version 9.0 (SAS, Cary, USA). Data are reported as mean ± standard deviation. Differences were tested with the Student *T*-test for continuous parametric data, with the Wilcoxon test for continuous non-parametric data and with Pearson's chi-squared test for non-continuous data. For multivariate analysis, a logistic regression model was applied. We retained in the model only those variables that were significantly associated with at least one outcome in the univariate analysis. Odds ratios (OR) were used to assess the association between variables and outcomes measures. In the cases OR was not indicated, the association was expressed with the relative risk (RR). A $p < 0.05$ was considered statistically significant.

Results

A total of 533 women underwent a vaginal hysterectomy and high USLs suspension during the study period. Patients demographic characteristics are shown in Table 1. Overall 518 patients had preoperative data, urodynamic evaluation, operative data and follow-up available for the study. Dropout rate was 2.8% accounting for patients living outside the administrative region or followed up outside the hospital by private gynaecologists. Baseline symptoms and preoperative urodynamic findings are shown in Table 2. In particular, preoperative OAB was reported by 187 patients, corresponding to 36.1% of the population. On the converse, detrusor overactivity was observed during urodynamics evaluation only in 106 patients (20.5%). Specifically, urodynamic detrusor overactivity resulted in a 31.0% (58/187) sensitivity, 85.5% (283/331) specificity and 65.8% agreement with respect to OAB. The preoperative pelvic support according to POP-Q resulted similar in patients with and without OAB and with or without detrusor overactivity. Specifically, 243 (46.9%) patients resulted as stage II, 224 (43.2%) as stage III, and 51 (9.9%) as stage IV prolapse. The surgical procedures performed are listed in Table 3. Suburethral slings were positioned in 101 patients (19.5%). Mean follow up was 32 ± 19 months (median follow-up 30 months). Overall POP recurrence was observed in 71 patients (13.7%), with the anterior compartment as the site with the highest rate (9.5%). Reoperation for symptomatic prolapse recurrence was required in 5 patients (1%). After surgery OAB was reported by 143 patients (27.6%), with a significant reduction compared to the baseline ($p = 0.004$). In particular postoperative OAB was persistent in 73 (14.1%) and de novo in 70 (13.5%) patients. Univariate analysis of risk factors for persistent and de novo OAB is shown in Table 4. Preoperative POP stage did not affect overall ($p = 0.81$), persistent ($p = 0.74$), or de novo OAB rate ($p = 0.54$). Multivariate analysis is shown in Table 5. In particular increasing age ($p = 0.0003$, OR = 1.04 per year) and BMI ($p = 0.0396$, OR = 1.06 per kg/m^2), preoperative OAB ($p = 0.0024$, OR = 2.00), concomitant anti-incontinence procedure ($p = 0.0031$, OR = 2.37) and postoperative stress urinary incontinence ($p = 0.0076$, OR = 1.96) resulted as independent risk factors for OAB after POP repair. Moreover, preoperative OAB ($p < 0.0001$, RR = 3.90) and postoperative constipation ($p = 0.0242$, OR = 2.30) resulted independently associated with persistence of OAB after POP surgery. Lastly, de novo OAB was found to be related to age ($p = 0.0055$, OR = 1.04 per year), suburethral sling placement ($p = 0.0038$, OR = 2.92) and postoperative SUI ($p = 0.0017$, OR = 2.59) and voiding symptoms ($p = 0.0243$, OR = 2.09).

Table 1
Populations characteristics. Data as mean ± standard deviation.

Demographics	533 patients
Age (years)	63.4 (± 10.5)
Non-menopausal status or oestrogenization	48 (9.0%)
Body mass index (BMI)	25.0 (± 3.8)
Number of vaginal delivery	2.1 (± 1.1)
Operative vaginal delivery	80 (15.4%)
Birth weight of largest baby (grams)	3615 (± 500)

Table 2
Baseline symptoms and preoperative urodynamic findings.

Bulging symptoms	486 (93.8%)
OAB	187 (36.1%)
Urinary stress incontinence	202 (39.0%)
Voiding symptoms	237 (45.8%)
Constipation	153 (29.5%)
Sexual inactivity	229 (44.2%)
Urodynamic stress urinary incontinence	143 (27.6%)
Detrusor overactivity	106 (20.5%)
Positive post-void residual	93 (18.0%)

Table 3
Surgical procedures.

Hysterectomy	518 (100%)
High uterosacral ligaments suspension	518 (100%)
Anterior repair	453 (87.5%)
Posterior repair	377 (72.8%)
Suburethral slings	101 (19.5%)

Table 4
Risk factors for postoperative OAB: univariate analysis. OAB = overactive bladder; SUI = stress urinary incontinence; DO = detrusor overactivity; PVR = postvoid residual; POP = pelvic organ prolapse; Qmax = maximum flow; PDet@Qmax = detrusor pressure at maximum flow.

	Postoperative OAB			Persistent OAB			De novo OAB		
	Yes 143 pts	No 375 pts	P value	Yes 73 pts	No 445 pts	P value	Yes 70 pts	No 448 pts	P value
Age (years)	65.7 ± 9.9	62.6 ± 10.6	**0.0013** *	65.0 ± 9.9	63.2 ± 10.6	0.12	66.5 ± 9.8	63.0 ± 10.5	**0.0087** *
Parity (n)	2.2 ± 1.1	2.1 ± 1.0	0.94	2.1 ± 1.3	2.1 ± 1.0	0.71	2.2 ± 1.0	2.1 ± 1.1	0.62
Operative vaginal delivery	18 (12.6%)	62 (16.5%)	0.27	10 (13.7%)	70 (15.7%)	0.66	8 (11.4%)	72 (16.1%)	0.32
Birth weight of largest baby (g)	3663 ± 518	3599 ± 493	0.16	3657 ± 589	3609 ± 485	0.64	3669 ± 431	3608 ± 510	0.17
Menopausal status	134 (93.7%)	34 (90.7%)	0.27	67 (91.8%)	407 (91.5%)	0.93	67 (95.7%)	407 (90.9%)	0.17
BMI (kg/m^2)	25.9 ± 4.1	24.7 ± 3.6	**0.0034** *	26.6 ± 4.7	24.8 ± 3.5	**0.0011** *	25.2 ± 3.2	25.0 ± 3.9	0.61
Preoperative OAB	73 (51.1%)	114 (30.4%)	<**0.0001** *	73 (100%)	114 (25.6%)	<**0.0001** *	–	–	–
Preoperative SUI	67 (46.9%)	135 (36.0%)	**0.0236** *	42 (57.5%)	160 (36.0%)	**0.0005** *	25 (35.7%)	177 (39.5%)	0.54
Preoperative voiding symptoms	66 (46.2%)	171 (45.6%)	0.91	33 (45.2%)	204 (45.8%)	0.92	33 (47.1%)	204 (45.6%)	0.80
Preoperative bulging symptoms	132 (92.3%)	354 (94.4%)	0.38	67 (91.8%)	419 (94.2%)	0.43	65 (92.9%)	421 (94.0%)	0.72
Preoperative sexual inactivity	64 (44.8%)	165 (44.0%)	0.88	28 (38.4%)	201 (45.2%)	0.28	36 (51.4%)	193 (43.1%)	0.19
Preoperative constipation	39 (27.3%)	114 (30.4%)	0.49	25 (34.3%)	128 (28.8%)	0.34	14 (20.2%)	139 (31.0%)	0.06
Preoperative Aa point	1.0 ± 1.5	1.0 ± 1.5	0.48	1.2 ± 1.4	0.9 ± 1.5	0.29	0.9 ± 1.7	1.0 ± 1.5	0.88
Preoperative Ba point	1.3 ± 1.8	1.3 ± 1.6	0.78	1.4 ± 1.8	1.3 ± 1.7	0.77	1.2 ± 1.8	1.3 ± 1.7	0.95
Urodynamic SUI	48 (33.6%)	95 (25.3%)	0.06	23 (31.5%)	120 (27.0%)	0.42	25 (35.7%)	118 (26.3%)	0.10
Occult SUI	22 (15.4%)	56 (14.9%)	0.90	12 (16.4%)	66 (14.8%)	0.72	10 (14.3%)	68 (15.2%)	0.85
DO	39 (27.3%)	67 (17.9%)	**0.0177** *	21 (28.8%)	85 (19.1%)	0.06	18 (25.7%)	88 (19.6%)	0.24
Qmax (ml/sec)	18.6 ± 8.6	18.0 ± 8.4	0.55	18.2 ± 8.9	18.1 ± 8.4	0.81	18.9 ± 8.2	18.0 ± 8.5	0.30
PDet@Qmax (cmH_2O)	24.7 ± 9.8	24.7 ± 10.1	0.94	26.1 ± 10.6	24.5 ± 9.9	0.22	23.3 ± 8.8	24.9 ± 10.2	0.18
Absolute PVR (ml)	53.6 ± 107.1	44.6 ± 90.4	0.43	47.8 ± 82.1	47.0 ± 97.4	0.45	59.7 ± 128.5	45.1 ± 89.0	0.80
Positive PVR	27 (18.9%)	66 (17.6%)	0.73	14 (19.2%)	79 (17.8%)	0.77	13 (18.6%)	80 (17.9%)	0.88
Anterior repair	126 (88.1%)	327 (87.2%)	0.78	64 (87.7%)	389 (87.4%)	0.95	62 (88.6%)	391 (87.3%)	0.76
Posterior repair	51 (69.9%)	326 (73.3%)	0.55	51 (69.9%)	326 (73.3%)	0.55	52 (74.3%)	325 (72.5%)	0.76
Suburethral sling	40 (28.0%)	61 (16.3%)	**0.0026** *	21 (28.8%)	80 (18.0%)	**0.0310** *	19 (27.1%)	82 (18.3%)	0.08
Postoperative SUI	40 (28.0%)	68 (18.1%)	**0.0159** *	17 (23.3%)	91 (20.5%)	0.58	23 (32.9%)	85 (19.0%)	**0.0112** *
Postoperative voiding symptoms	32 (22.4%)	50 (13.3%)	**0.0117** *	13 (17.8%)	69 (15.5%)	0.62	19 (27.1%)	63 (14.1%)	**0.0053** *
Postoperative bulging symptoms	10 (7.0%)	20 (5.3%)	0.47	6 (8.2%)	24 (5.4%)	0.34	4 (5.7%)	26 (5.8%)	0.98
Postoperative sexual inactivity	70 (49.9%)	216 (57.6%)	0.08	37 (50.7%)	249 (56%)	0.40	33 (47.1%)	253 (56.5%)	0.14
Postoperative constipation	41 (28.7%)	78 (20.8%)	0.06	26 (35.6%)	93 (20.9%)	**0.0056** *	15 (21.4%)	104 (23.2%)	0.74
POP Recurrence	18 (12.6%)	53 (14.1%)	0.65	9 (12.3%)	62 (13.9%)	0.71	9 (12.9%)	62 (13.8%)	0.82
POP Anterior Recurrence	15 (10.5%)	34 (9.1%)	0.62	7 (9.6%)	42 (9.4%)	0.97	8 (11.4%)	41 (9.2%)	0.55
Postoperative Aa point	−2.1 ± 0.8	−2.2 ± 0.8	0.06	−2.1 ± 0.8	−2.2 ± 0.8	0.19	−2.1 ± 0.8	−2.2 ± 0.8	0.28
Postoperative Ba point	−2.1 ± 0.8	−2.2 ± 0.8	0.05	−2.1 ± 0.8	−2.2 ± 0.8	0.19	−2.1 ± 0.8	−2.2 ± 0.8	0.23

Discussion

The aim of the study was to identify risk factors for overall postoperative OAB, persistent OAB and de novo OAB after POP repair, with respect to population characteristics, baseline symptoms, preoperative urodynamics findings and surgical procedures performed.

We found that age and BMI, preoperative OAB, concomitant suburethral sling procedure and postoperative stress urinary incontinence were independent risk factors for OAB after POP

Table 5
Risk factors for postoperative OAB: multivariate analysis. OAB = overactive bladder; SUI = stress urinary incontinence; DO = detrusor overactivity; OR = odds ratio. For age and BMI odds ratio are expressed per unit. *Expressed as relative risk.

	Postoperative OAB		Persistent OAB		De novo OAB	
	P value	OR	P value	OR	P value	OR
Age (years)	**0.0003**	**1.04**	0.39	1.02	**0.0055**	**1.04**
BMI (kg/m^2)	**0.0396**	**1.06**	0.08	1.07	0.99	1.00
Preoperative OAB	**0.0024**	**2.00**	<**0.0001**	**3.90***	–	–
Preoperative SUI	0.96	1.01	0.75	0.89	0.08	0.55
DO	0.14	1.45	0.52	0.80	0.30	1.38
Suburethral sling	**0.0031**	**2.37**	0.27	1.60	**0.0038**	**2.92**
Postoperative SUI	**0.0076**	**1.96**	0.79	1.11	**0.0017**	**2.59**
Postoperative voiding symptoms	0.10	1.59	0.52	1.36	**0.0243**	**2.09**
Postoperative constipation	0.05	1.61	**0.0242**	**2.30**	0.79	0.92

repair. Moreover, preoperative OAB and postoperative constipation resulted independently associated with persistence of OAB after POP surgery. Lastly, de novo OAB was found to be related to age, suburethral tape placement and postoperative SUI and voiding symptoms.

In our series, we registered a prevalence of OAB in patients with symptomatic POP of 36,1%, which is consistent with previous reports [17,18]. However urodynamic detrusor overactivity poorly correlates with the symptom of OAB, since only 36.1% of these patients demonstrated involuntary detrusor contractions during the filling phase. This is not completely unexpected since a previous experience evaluating 4500 women pointed out that only about a half of women with OAB complaints demonstrate detrusor overactivity on urodynamics [10]. Moreover, our study confirmed the previous observation that a consistent proportion of patients showing detrusor overactivity is asymptomatic for OAB [10]. After POP surgical repair we registered a significant reduction in OAB rate. This finding is not surprising since it was already reported by previous papers. In particular, Baessler and Maher in a systematic review found that preoperative bladder overactivity may resolve in 40% of women undergoing POP surgery [19]. Interestingly, the same review evaluated de novo bladder overactivity occurring in 12% of patients which is consistent with the 13.7% rate we found in our series [19].

Basing on the multivariate analysis we found a series of risk factors for postoperative OAB. About population characteristics, age results as an independent risk factor for postoperative OAB symptoms and for de novo OAB subgroup. Also increased BMI resulted as an independent risk factor for postoperative OAB. Hence, these two population characteristics confirmed to be risk factors for OAB, which was previously reported by de Boer et al. [20].

Moreover, preoperative OAB showed to be an independent risk factor for postoperative OAB. In particular, this results as the strongest risk factor for postoperative OAB persistence. This finding is consistent with the previous study by de Boer et al. in which the best predictor for the absence of postoperative symptoms was the absence of preoperative bothersome OAB symptoms [21].

On the contrary, urodynamics failed again to be a reliable predictor of either de novo or persistent OAB. This is consistent with previous papers which showed that urodynamics performance is poor in identifying patients with OAB [10,22]. Hence, the relationship between OAB and detrusor overactivity is still far to be clear and needs further investigations.

Additional procedures for prolapse repair such as anterior and posterior repair do not seem to affect the risk of postoperative OAB. These data are consistent with the previous paper by Dieter et al which did not find any differences in OAB scores in patients who underwent anterior and apical repair versus isolated posterior repair [23]. On the contrary, concomitant anti-incontinence procedure showed to be an independent risk factor for postoperative OAB. In particular, resulted as the factor increasing mostly the risk of de novo OAB. This finding was previously reported by Diez-Itza et al, who observed that women operated for POP and SUI were more at greater risk of developing OAB after surgery [24]. This might be due to tissue dissection / foreign-body reaction at the bladder neck-urethral site or to non-optimal tape placement. However, since the debate about the most appropriate surgical approach in case of coexisting clinical or occult stress urinary incontinence is still opened, these data suggest caution when indicating concomitant anti-incontinence procedure [25].

Lastly, based on postoperative symptoms, constipation resulted associated with the persistence of OAB after surgical repair and this is might be related to the side effect induced by antimuscarinic drugs. On the contrary, postoperative stress urinary incontinence and voiding dysfunction resulted associated to de novo OAB. This indicates that in some patients after surgery de novo OAB and other lower urinary tract symptoms can cluster. The explanation might be that during prolapse repair hypercorrection, tissue over-tensioning or improper sling placement may introduce some alteration in the micturition process.

At the best of our knowledge, this was the largest study evaluating OAB in patients with POP before and after surgery. Other strengths of our study account the homogeneity of the population and multimodal evaluation including population characteristics, symptoms, POP-Q assessment, urodynamic evaluation and postoperative clinical assessment. Limitations include the retrospective study design and the lack of OAB quality of life assessment. Moreover the lack of data about medical condition such as mellitus diabetes and neurological diseases may limitate the interpretation of the data.

In conclusion, our study showed that preoperative OAB symptoms are associated with OAB persistence after POP surgery, while age and sling placement represent risk factors for de novo OAB. In addition, also increased BMI is related to postoperative OAB. On the contrary, urodynamic evaluation was not able to predict postoperative OAB. These finding may be helpful during preoperative counselling in women with POP, especially when evaluating pros and cons of concomitant anti-incontinence surgery.

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None.

Author's contribution

M Frigerio Project development, Data Collection, Manuscript writing.

S Manodoro Project development, Data Collection, Manuscript writing.

A Cola Project development, Data Collection, Manuscript writing.

S Palmieri Project development, Data Collection, Manuscript writing.

F Spelzini Project development, Data Collection, Manuscript writing.

R Milani Project development, Data Collection, Manuscript writing.

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