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ORIGINAL ARTICLE

Risk factors for unplanned admission following surgical repair of apical prolapse

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Abstract

Introduction and hypothesis Same-day discharge (SDD) is increasing in popularity following surgical repair of pelvic organ prolapse. The aim of this study was to evaluate factors associated with unplanned admission (UA) in women undergoing apical prolapse repair.

Methods This retrospective, observational cohort study included patients who underwent apical prolapse repair and planned same-day discharge (SDD) between March 2019 and December 2021. The cohort was divided into two groups: patients who were discharged on the same day as surgery (SDD group) and patients who had an unplanned admission (UA group). Demographic, pre-, intra-, and post-operative data were collected. Risk factors associated with unplanned admission were evaluated using univariate and multivariate analyses.

Results One-hundred and eighty-four cases of apical prolapse repair met the criteria for inclusion in the final analysis; this included 142 in the SDD group and 42 in the UA group. Patients in the UA group had significantly increased estimated blood loss, longer total operative time, later time arriving to the Post-Anesthesia Care unit (PACU) and longer overall stay in the PACU. No differences were observed in the 30-day complication rate, or 30-day unanticipated healthcare encounters, between groups. Multivariate analysis revealed that receiving ketorolac post-operatively was associated with a higher likelihood of SDD (OR=2.6, 95% CI 1.032–6.580, p=0.043).

Conclusions Among women undergoing apical prolapse repair, same-day discharge was associated with comparable immediate and 30-day complication rates. Within our cohort, post-operative treatment with ketorolac was associated with greater likelihood of SDD.

Keywords Same-day discharge · Unplanned admission · Pelvic organ prolapse · Apical prolapse repair · Ketorolac

Introduction

Pelvic organ prolapse (POP) is a debilitating condition that has a detrimental effect on the lives of women worldwide [1, 2]. Although conservative treatments are available, surgical treatment remains, for many, the treatment of choice. Approximately 11–19% of women are expected to undergo surgical treatment of POP [3, 4].

It has been common practice following gynecological surgery to admit patients overnight for observation, initiated and continued out of concern for patient safety, along with potentially better pain and nausea control [5–7]. In recent years, same-day discharge (SDD) following such procedures has been growing in popularity among patients, caregivers, and providers. This transition was informed by data supporting the safety and feasibility of SDD in gynecological surgery [8, 9]. Furthermore, lower costs and high patient satisfaction following SDD have contributed to this trend [10–12].

To date, risk factors for unplanned admission in the setting of same-day discharge have not been assessed specifically in patients undergoing apical POP repair. The aim of this study was to evaluate factors associated with unplanned

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admission (UA), meaning admission with overnight stay in patients planned for SDD, following apical prolapse repair. We further compared unanticipated health care encounters and complications within 30 days following surgery in women with SDD and those with an UA.

Materials and methods

This is a retrospective, observational cohort study at a tertiary, university-affiliated, teaching institution. Included were all patients who underwent apical prolapse repair and who had planned for same-day discharge between March 2019 and December 2021. Excluded were patients under the age of 18, cases with a planned admission, surgeries performed in conjunction with another surgical service, and planned open procedures. The study was approved by the NorthShore University HealthSystem Institutional Review Board (EH22-132).

As part of our clinical routine, all patients discharged on the same day of surgery were contacted via phone call on post-operative day 1. During this conversation patients were asked about their general wellbeing, pain control, voiding, and bowel movements. Strategies on how to avoid constipation were reviewed as well.

The cohort was divided into two groups: patients who were discharged on the same day as surgery (SDD group) versus patients who had an UA following their surgery (UA group). Data were collected from electronic medical records (EMR) and included patients' demographic, pre-, intra-, and post-operative data. Demographic and pre-operative information included age, parity, smoking status, menopausal status, comorbid medical conditions, body mass index (BMI), Pelvic Organ Prolapse Quantification (POP-Q), and Pelvic

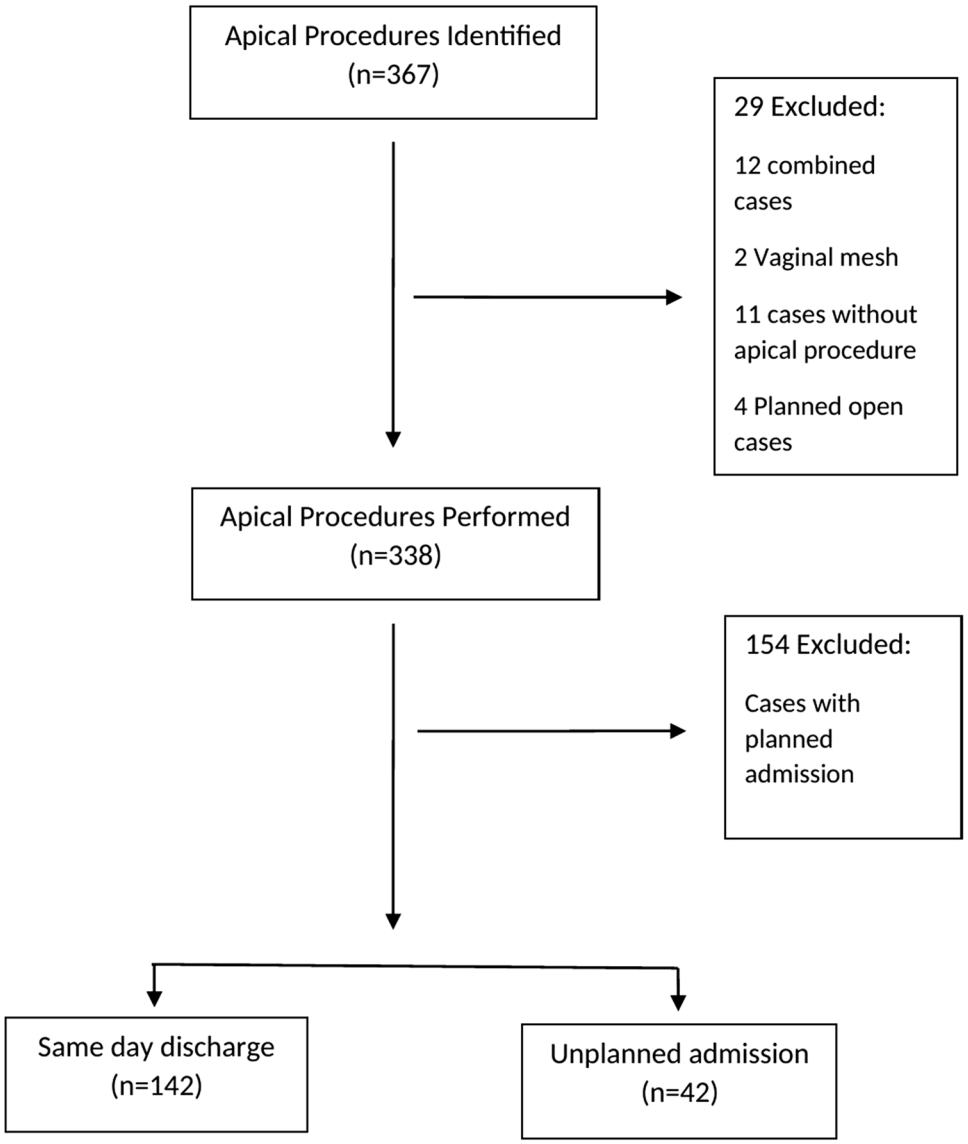

Fig. 1 Cohort construction

Floor Distress Inventory (PFDI-20) scores. Data regarding the surgical procedure such as procedure time, estimated blood loss (EBL), intra-operative and peri-operative complications, concomitant procedures, surgeon experience, and time of day of the procedure, were extracted from operative reports, and postoperative office visit notes.

Table 1 Demographic and past medical and surgical history of patients following same day discharge vs. unplanned admission

	Same-day discharge (*N*=142)		Unplanned admission (*N*=42)		*p* value
	n	Percentage	*n*	Percentage	
Demographics					
Age at time of surgery, mean ± SD	64.8 ± 11.2		63.4 ± 12.7		0.504
Gravidity, median (range)	3 (0–12)		3 (1–7)		0.284
Parity, median (range)	2 (0–7)		3 (1–6)		0.079
Race					
Caucasian	102	71.8	29	69.1	0.912
Black/AA	2	1.4	1	2.4	
Asian	10	7.1	3	7.1	
Native American	0	0.0	0	0.0	
Other	27	19.0	9	21.4	
Declined/unknown	1	0.7	0	0.0	
Ethnicity					
Non-Hispanic	129	90.9	38	90.5	0.818
Hispanic	12	8.4	4	9.5	
Declined/unknown	1	0.7	0	0.0	
Smoking status					
Never	87	65.9	28	68.3	0.264
Former	45	34.1	12	29.3	
Current	0	0.0	1	2.4	
Menopausal status					
Pre	16	11.9	7	17.5	0.353
Post	119	88.1	33	82.5	
BMI, mean ± SD	26.3 ± 5.3		27.3 ± 5.5		0.294
<18.5	4	2.8	1	2.4	0.204
18.5–24.9	65	45.8	15	35.7	
25–29.9	49	34.5	12	28.6	
30–34.9	16	11.3	11	26.2	
35–39.9	5	3.5	1	2.4	
>40	3	2.1	2	4.8	
Comorbid conditions					
IDDM	4	2.9	0	0.0	0.575
DM	10	7.2	4	9.5	0.741
HTN	34	24.5	12	28.6	0.592
Cardiovascular disease	19	13.7	9	21.4	0.223
Respiratory disease	11	7.9	3	7.1	1.000
Obstructed sleep apnea	11	7.9	5	11.9	0.534
Chronic pain conditions	13	9.3	5	11.9	0.571
Depression/Anxiety	25	18.0	9	21.4	0.617
Surgical history					
Prior hysterectomy	39	27.7	5	11.9	0.036
Prior abdominal surgery	67	49.6	20	51.3	0.856
Prior prolapse surgery	17	12.4	3	7.3	0.573
Prior SUI surgery	15	10.9	3	7.3	0.768

AA African American, *BMI* body mass index, *IDDM* insulin-dependent diabetes mellitus, *DM* diabetes mellitus, *HTN* hypertension, *SUI* stress urinary incontinence

Patient records were reviewed for patient-initiated office telephone calls, urogynecology office visits, urgent/immediate care visits, emergency department (ED) visits, and hospital admissions.

The main goal of this study was to evaluate risk factors associated with UA following apical prolapse repair. Secondary outcomes included comparison of unanticipated health care encounters and complications within 30 days following surgery in patients in the SDD and UA groups. Unanticipated health care encounters included urogynecology office visits, ED visits, urgent/immediate care visits, readmissions, or patient-initiated phone calls. Encounters for planned voiding trials and routine post-operative appointments were excluded. Complications assessed included reoperation, culture-positive urinary tract infections (UTIs), blood transfusion, and development of venous thromboembolism.

Differences between groups were compared using Student's *t* test (parametric) or Mann–Whitney *U* test (nonparametric) for continuous variables and Chi-squared test or Fisher's exact test for categorical variables. Statistical significance was defined as $p<0.05$. Included in the multivariate analysis were variables clinical significance with a p value < 0.2. Data were analyzed using SAS 9.4 (SAS Inc., Cary, NC, USA).

Results

Three-hundred and sixty-seven apical procedures were identified during the study period. Following implementation of the exclusion criteria, 184 cases were included in the final analysis, out of which 142 were discharged on the same day as surgery (SDD group) and 42 had an UA (UA group) (Fig. 1).

Information on demographics and past medical and surgical history are presented in Table 1. Patients in the UA group were more likely to have undergone a prior hysterectomy than those in the SDD group (27.7% vs 11.9% respectively, $p=0.036$). No other differences, including medical comorbidities, were observed between the groups.

Pre-operative clinical data are presented in Table 2. No differences were noted with regard to pre-operative POP-Q measurements. Patients in the UA group had a higher mean PFDI-20 (110.06 ± 57.91 vs 83.93 ± 53.11, $p=0.034$) and Pelvic Organ Prolapse Distress Inventory (POPDI; 43.11 ± 24.46 vs 32.67 ± 20.89, $p=0.036$) scores compared with the SDD group.

Intra-operative characteristics are described in Table 3. Patients in the UA group were more likely to have a concomitant hysterectomy (71.4% vs 48.6%, $p=0.009$), and to have a sacrocolpopexy as their apical procedure (45.2% vs 33.8%, $p=0.037$). Furthermore, patients in the UA group had increased EBL, a longer procedure length, later time arriving to the Post-Anesthesia Care Unit (PACU) and longer overall stay in the PACU.

Comparison of the 30-day complication rate and 30-day unanticipated health care encounters are tabulated in Table 4. There were no statistically significant differences in the number of unanticipated urogynecology office visits, ED visits, urgent/immediate care visits, readmissions, or patient-initiated phone calls between groups. Similar findings were noted upon comparison of post-operative complications between groups.

Univariate and multivariate analyses for the dependent parameters of UA were performed (Table 5). This analysis included parameters that were statistically significant within the univariate analysis as well as variables that appeared to

Table 2 Pre-operative clinical characteristics of patients following same-day discharge versus unplanned admission

	Same-day discharge (*N*=142)		Planned admission (*N*=42)		*p* value
	n	Percentage or mean ± SD	*n*	Percentage or mean ± SD	
POP-Q					
Aa	93	0.7 ± 1.4	34	0.6 ± 1.6	0.839
Ba	93	1.1 ± 2.0	34	1.0 ± 2.1	0.680
C	92	−1.1 ± 3.9	34	−1.7 ± 3.7	0.508
GH	92	4.4 ± 1.1	34	4.3 ± 0.9	0.627
PB	92	3.4 ± 0.8	34	3.4 ± 0.5	0.987
TVL	90	9.4 ± 1.2	33	9.4 ± 1.2	0.890
Ap	92	−1.0 ± 1.3	34	−1.1 ± 1.0	0.572
Bp	90	−0.9 ± 1.5	34	−1.0 ± 1.1	0.707
D	50	−4.9 ± 2.6	18	−4.7 ± 3.1	0.726
Prolapse stage					
2	49	53.3	17	54.8	1.000
3	40	43.5	13	41.9	
4	3	3.2	1	3.2	
ASA grade					
1	14	10.0	3	7.1	0.406
2	105	75.0	31	73.8	
3	21	15.0	7	16.7	
4	0	0.0	1	2.4	
Preoperative hemoglobin	126	13.3 ± 1.2	40	13.0 ± 1.0	0.174
PFDI-20 (0–300)	83	83.9 ± 53.1	26	110.1 ± 57.9	0.034
POPDI-6 (0–100)	83	32.7 ± 21.1	26	43.1 ± 24.5	0.036
CRADI-8 (0–100)	82	19.3 ± 17.2	26	26.4 ± 25.4	0.191
UDI-6 (0–100)	82	32.6 ± 23.9	25	42.1 ± 20.4	0.074

GH genital hiatus, *PB* perineal body, *TVL* total vaginal length, *POP-Q* pelvic organ prolapse quantification, *ASA* American Society of Anesthesiology, *PFDI-20* Pelvic Floor Distress Inventory, *POPDI* Pelvic Organ Prolapse Distress Inventory, *CRADI* Colorectal-Anal Distress Inventory, *UDI* Urinary Distress Inventory

be potentially clinically significant. This analysis revealed that spending less time in the PACU (OR=0.99, 95% CI 0.981–0.995, $p<0.001$) and receiving ketorolac post-operatively (OR=2.6, 95% CI 1.032–6.580, $p=0.043$) were associated with SDD.

Discussion

The main findings of this study include similar 30-day complication rates and 30-day unanticipated health care encounters between patients discharged the same day of surgery and those with an UA following apical prolapse repair. Receiving ketorolac post-operatively was associated with a significantly increased likelihood of successful SDD.

Previous studies have identified pre-operative and peri-operative risk factors for post-operative admission following minimally invasive gynecological procedures. These include increased age, procedure for a malignant indication, planned concomitant procedures, postoperative pain, urinary retention, nausea, hypotension, and later surgery end times [13–15]. One systematic review focusing on SDD following minimally invasive hysterectomy found older age, beginning surgery later than 1 pm, completing surgery later than 6 pm, longer duration of operation, and higher EBL were associated with decreased possibility of SDD [15]. In another more recent study, implementation of enhanced recovery was assessed in an attempt to improve SDD rates in a gynecological oncology setting. Longer surgery, timing of surgery, and narcotic use were associated with overnight admission [16].

Table 3 Peri-operative characteristics of patients following same-day discharge versus unplanned admission

	Same-day discharge (*N*=142)		Unplanned admission (*N*=42)		*p* value
	n	Percentage or mean ± SD	*n*	Percentage or mean ± SD	
Apical prolapse approach					
Vaginal	91	64.5	23	54.8	0.251
Abdominal	50	35.5	19	45.2	
Apical procedure					
SSVVS	65	45.8	10	23.8	0.037
USLS	29	20.4	13	31	
Sacrocolpopexy	48	33.8	19	45.2	
Concomitant hysterectomy	69	48.6	30	71.43	0.009
Concomitant hysterectomy type					
None	73	51.4	12	28.6	0.023
Abdominal	38	26.8	19	45.2	
Vaginal	31	21.8	11	26.2	
Incontinent procedure	67	47.2	25	59.5	0.160
Anterior repair	75	52.8	14	33.3	0.026
Posterior repair	64	45.1	19	45.2	0.985
Procedure length (min)	139	144.2 ± 80.0	42	176.4 ± 78.0	0.023
EBL (ml)	133	75.2 ± 72.3	41	108.8 ± 82.0	0.013
<100	87	65.4	22	53.7	0.174
≥100	46	34.6	19	46.3	
Surgeon experience (years)					
<5	52	36.6	18	42.9	0.464
≥5	90	63.4	24	57.1	
Surgical start time (h), median (range)	142	9 (7–15)	42	9.5 (7–16)	0.033
<11 am	98	69.0	23	54.8	0.087
≥11 am	44	31.0	19	45.2	
Time arriving to PACU (h), median (range)	141	12 (8–18)	42	13 (9–19)	0.003
Total time in PACU (min)	141	95.4 ± 43.5	42	140.5 ± 74.6	<0.001
Ketorolac given	112	78.9	28	66.7	0.103
Post-operative urinary retention	54	38.0	18	42.9	0.573

SSVVS sacrospinous vaginal vault suspension, *USLS* uterosacral ligament suspension, *EBL* estimated blood loss, *PACU* Post-Anesthesia Care Unit

Table 4 Unanticipated use of medical system and 30-day complications in patients following same-day discharge versus unplanned admission

	Same-day discharge (*N*=142)	Unplanned admission (*N*=42)	*p* value
Unanticipated health care encounters, mean ± SD			
Number of unanticipated urogynecology office visits	0.18 ± 0.54	0.07 ± 0.34	0.111
Number of ED visits	0.06 ± 0.27	0.05 ± 0.22	0.731
Number of urgent care/immediate care visits	0.01 ± 0.12	0.00 ± 0.00	0.158
Number of readmissions	0.02 ± 0.14	0.00 ± 0.00	0.083
Number of patient-initiated phone calls	0.86 ± 1.31	1.07 ± 2.20	0.555
Complications 30 days after d/c[a], *n* (%)			
None	135 (95.1)	40 (95.2)	1.000
UTI	4 (2.8)	1 (2.4)	1.000
Reoperation	2 (1.4)	0 (0)	1.000
VTE	0 (0.0)	0 (0)	–
Blood transfusion	1 (0.7)	1 (2.4)	0.405
Fistula	0 (0.0)	0 (0)	–

ED emergency department, *UTI* urinary tract infection, *VTE* venous thromboembolism, *d/c* discharge

[a]May have multiple responses so percentages do not add up to 100%

Prior hysterectomy, lower POPDI and PFDI-20 scores, and not having a concomitant hysterectomy and sacrospinous vaginal vault suspension were associated with SDD. However, following multivariate analysis they were no longer statistically significant. Such factors are important as they enable appropriate patient counseling and joint decision making. Specifically, the question of surgical approach is key because for certain patients, knowing that one procedure increases their chance of SDD may impact their decision-making process. Future research on a larger scale is warranted in order to reevaluate these and other parameters.

Our finding that post-operative treatment with ketorolac increases the probability of SDD is in accordance with previous literature on this topic. Lee et al. reported on 200 patients who underwent robot-assisted total laparoscopic hysterectomy, out of which 157 (78%) achieved SDD. Operative time, surgery ending before 6 pm, and intra-operative ketorolac were associated with SDD [7]. A recent Cochrane review evaluating single-dose intravenous ketorolac for acute post-operative pain in adults concluded that although ketorolac offers substantial pain relief, adverse events appear to occur at a slightly higher rate than with placebo and other nonsteroidal anti-inflammatory drugs (NSAIDS). Furthermore, it does not have a clear advantage over other NSAIDS with respect to pain management [17]. Future studies are needed to better define the role ketorolac plays in SDD in patients undergoing POP repair.

Amongst our findings, increased time in the PACU was associated with an increased risk of UA. However, this does not seem to be a true causal association because patients who spent more time in the PACU were likely to be in need of increased medical attention (nausea, pain control, etc.). Furthermore, once a decision regarding admission was reached, other factors such as patient transfer and placement may have influenced this parameter.

Over the past decade, numerous studies have presented data supporting the safety of SDD in minimally invasive gynecological surgery [8, 9]. Our results support these findings, with similar 30-day complication rates and 30-day unanticipated health care encounters for patients following SDD versus UA. For many institutions this transition has been expedited by the COVID-19 pandemic, and the strain it has had on inpatient resources. We expect this trend to continue and to eventually become the gold standard in patients undergoing surgical repair of POP.

Limitations of this study include its retrospective design, small sample size, and the variety of surgeries performed. The decision

Table 5 Multivariate analysis of possible predictors for same-day discharge

	OR	95% CI		*p* value
Prior history of hysterectomy	2.513	0.579	10.911	0.219
Apical procedure				
Sacrospinous	–	–	–	–
USLS	0.332	0.056	1.987	0.227
Sacrocolpopexy	0.797	0.116	5.463	0.817
Concomitant hysterectomy				
None (reference)	–	–	–	–
Abdominal	1.450	0.175	12.038	0.730
Vaginal	3.230	0.402	25.926	0.270
Procedure length (min)	0.998	0.987	1.009	0.692
Surgical start time (h)				
<11 am (reference)	–	–	–	–
≥11 am	0.790	0.135	4.615	0.794
Time arriving at PACU (h)	0.851	0.599	1.208	0.366
Total time in PACU (min)	0.988	0.981	0.995	<0.001
Ketorolac given	2.606	1.032	6.580	0.043

USLS uterosacral ligament suspension, *PACU* post-anesthesia care unit

to offer SDD to patients may have been influenced by a variety of factors leading to possible selection bias. A larger study population may enable assessment of specific risk factors for UA according to surgery type. We could not account for patients who may have sought medical care at other institutions. Indication for UA was unclear for many patients, leading to an inability to evaluate this parameter. Last, we did not have access to information regarding pain scores and patient satisfaction following surgery.

In summary, we found that administration of ketorolac post-operatively is associated with successful SDD following apical POP repair. We further found a comparable 30-day complication rate and 30-day unanticipated health care encounters between groups. These results support the use of ketorolac post-operatively in women following apical prolapse repair and contribute to accumulating data on the safety of SDD in this clinical setting.

Authors' contributions H.H. Chill: project development, data collection, data analysis, manuscript writing and editing; N.P. Moss: project development, data collection, data analysis, manuscript writing and editing; C. Chang: data analysis; J. Winer: manuscript writing and editing; R.P. Goldberg: project development, data analysis, manuscript writing and editing.

Declarations

Conflicts of interest None.

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