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ORIGINAL ARTICLE

Does spinal anesthesia lead to postoperative urinary retention in same-day urogynecology surgery? A retrospective review

Alexandriah Alas[1] · Ryan Hidalgo[2] · Luis Espaillat[2] · Hemikaa Devakumar[2] · G. Willy Davila[2] · Eric Hurtado[2]

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Abstract

Introduction and hypothesis Spinal anesthesia has been reported to be a risk factor for postoperative urinary retention (POUR) in various surgical specialties. We hypothesized that spinal anesthesia was a risk factor for POUR after outpatient vaginal surgery for pelvic organ prolapse (POP).

Methods This was a retrospective review of an urogynecology database for all outpatient POP vaginal surgeries performed in 2014 to evaluate the risk of POUR after general versus spinal anesthesia. A standardized voiding trial was performed by backfilling the bladder with 300 ml of saline. A successful trial was achieved if the patient voided two-thirds of the total volume instilled, confirmed by bladder ultrasound. Our primary outcome was to compare POUR requiring discharge with a Foley catheter between spinal and general anesthesia. Multivariate logistic regression was performed for variables with significance at $p < 0.1$ at the bivariate level.

Results A total of 177 procedures were included, 126 with general and 51 with spinal anesthesia. The overall POUR rate was 48.9%. Type of anesthesia was not a risk factor for POUR. Multivariate logistic regression demonstrated that age < 55 years (adjusted odds ratio [OR] 3.73; 95% confidence interval [CI], 1.31–11.7), diabetes (adjusted OR 4.18, 95% CI 1.04–21.67), and having a cystocele ≥ stage 2 (adjusted OR 4.23, 95% CI 1.89–10) were risk factors for developing POUR.

Conclusions Acute urinary retention after outpatient vaginal pelvic floor surgery can vary by procedure, but overall is 48.9%. Spinal anesthesia does not contribute to POUR, but rates are higher in those women that are younger than 55 years of age, have a cystocele ≥ stage 2 preoperatively, and a history of diabetes.

Keywords Post-operative urinary retention · Pelvic organ prolapse · Midurethral slings · Spinal anesthesia

Introduction

It is estimated that there is a 11% lifetime risk of having surgery for pelvic organ prolapse (POP) [1]. It is also estimated that from 2010 to 2050, the number of surgeries required for POP will rise by 47.2%, from 166,000 to 245,970 [2]. With the rising cost of health care, there has been a push to perform more procedures on an outpatient day surgery basis since 1980 in the USA, when Congress authorized Medicare to reimburse for outpatient and ambulatory surgery centers [3]. This trend has been seen with an increase in the number of stress incontinence (SUI) procedures being performed in the ambulatory setting from 34,968 in 1996 to 105,656 in 2006 [4–6].

For 2 years, our institution has been performing outpatient SUI and POP surgery under both general and spinal anesthesia. Patients have tolerated going home the same day with minimal complications. However, there has been an observed trend of increasing urinary retention requiring a Foley catheter for a few days after discharge. It was hypothesized by the recovery staff and surgeons that this increase in urinary retention could be attributed to the use of spinal anesthesia.

Our abstract has been presented at the Society of Urodynamics, Female Pelvic Medicine & Urogenital Reconstruction annual meeting (New Orleans, LA, 23–27 February 2016) and at the American Urogynecologic Society PFD Week (Seattle, WA, 13–17 October 2015

✉ Alexandriah Alas
alas@uthscsa.edu

[1] Department of Obstetrics and Gynecology, Division of Female Pelvic Medicine and Reconstructive Surgery, University of Texas Health San Antonio, 7703 Floyd Curl Drive, San Antonio, TX 78229, USA

[2] Department of Gynecology, Division of Female Pelvic Medicine and Reconstructive Surgery, Cleveland Clinic Florida, 2950 Cleveland Clinic Boulevard, Weston, FL 33331, USA

Urinary retention after POP and SUI surgery is often quoted as 2.5 to 24%, but has been reported to be up to 61.9% in patients who have undergone a mid-urethral sling (MUS) with spinal anesthesia [7–9]. Studies in animals and humans have shown that spinal anesthesia can lead to bladder dysfunction and urinary retention [10, 11]. The degree and length are directly related to the dose and type of medication administered. The high rate of variation in urinary retention rates after POP surgery is likely attributed to the lack of standard protocol in the definition of urinary retention, in addition to voiding trial protocols being performed on different post-operative days. To our knowledge, there is a paucity of data regarding evaluation of risk factors for acute post-operative urinary retention (POUR) after same-day POP and SUI vaginal surgery. The objective of the study was to evaluate if spinal anesthesia was a risk factor for POUR. We hypothesized that those undergoing spinal anesthesia might have a higher incidence of POUR after surgery requiring catheterization. The primary outcome was to compare rates of POUR that required discharge with a Foley catheter between spinal and general anesthesia.

Materials and methods

This was a retrospective review of a comprehensive urogynecology database of all subjects who underwent outpatient pelvic floor vaginal surgeries in 2014. The institutional database is managed by the urogynecology department and the Institutional Review Board (IRB) approved it (FLA IRB# 8558). Data are scanned into the database using standardized forms and the information is verified for accuracy by a physician before finalizing and entering into the database system. This study timeframe of 1 year was chosen, as it was the start of transitioning patients from inpatient to outpatient day surgery. Institutional review board approval was obtained (FLA IRB# 15–025). Subjects were included if they were scheduled to undergo outpatient POP or SUI surgery. Exclusion criteria included those subjects requiring an overnight stay, those requiring prolonged bladder decompression, such as vesicovaginal fistula repair, or those who required intermittent self-catheterization or a Foley catheter before surgery. Standard practice at our institution was to perform spinal anesthesia with 14 mg of 0.75% bupivacaine, without added epinephrine or morphine.

Subjects underwent a history, a physical examination and baseline urodynamics (UDS). Vaginal packing with metronidazole was placed at the conclusion of surgery and removed before the voiding trial. It was the standard of care for all vaginal POP surgeries to have packing placed to reduce the risk of hematoma formation. The vaginal packing was removed in the recovery area by the nursing staff at the time of the voiding trial. A standardized voiding trial was performed in the recovery room area 1.5 to 2 h after surgery by backfilling the bladder with 300 ml of saline, or the maximum amount the patient could tolerate. Patients were given 2 h to void. A trial was considered passed if the patient voided two-thirds of the total bladder volume, and had a bladder scan that demonstrated less than one-third of the total volume instilled into the bladder. Patients with a failed trial were given up to 2 h to void, and then a Foley catheter was replaced for discharge.

The primary outcome was to compare rates of POUR that required discharge with a Foley catheter between spinal and general anesthesia. Our secondary outcome was to evaluate POUR rates by procedure type and identify risk factors for POUR. We hypothesized that spinal anesthesia, increasing age, and continence procedures would be risk factors for the development of POUR.

Statistical analysis was completed using JMP Pro Version 10 (SAS Institute, Cary, NC, USA). Continuous data were tested for normality using a Shapiro–Wilk test. Pearson's Chi-squared test was used for categorical variables or Fisher's exact test was used if there was a sample group of <10. Student's *t* test was used for parametric data or the Wilcoxon test for nonparametric continuous data. Statistical significance was considered at an alpha level of less than 0.05. Multivariate logistic regression was performed on variables with significance at $p < 0.1$ at the bivariate level.

Results

A total of 177 procedures were included, 126 with general and 51 with spinal anesthesia. Demographics were similar by age, body mass index (BMI), parity, medical comorbidities, baseline complaints of voiding dysfunction, and UDS (Table 1). In the spinal group, there was noted to be a higher percentage of menopausal women (98% vs 77.1%, $p = 0.008$), a higher number with stage 2 or greater apical prolapse (39.3% vs 12.1%, $p = 0.0015$), higher estimated blood loss (EBL; median 100 cc vs 100 cc, $p = 0.0231$), longer operating times (median 97 min vs 72 min, $p = 0.017$), and more evidence of voiding dysfunction on UDS (78.7% vs 61.2%, $p = 0.0343$).

Our overall POUR rate for all procedures was 48.9%. For the primary outcome, there was a statistically significantly higher rate of POUR in the spinal group (60.8%) compared with the general group (43.7%; $p = 0.0389$). Bivariate analysis demonstrated a significantly lower voiding trial pass rate for those <55 years of age (16.7% vs 83.3%, $p = 0.048$), those with a cystocele (38.8% vs 61.2%, $p = 0.0005$) or apical prolapse (28.6% vs 71.4%, $p = 0.0409$) ≥ stage 2, those with a higher EBL (median 100 cc vs 100 cc, $p = 0.0009$), those with

Table 1 Demographics by anesthesia type

	General (n=126)	Spinal (n=51)	P-value
Age*	63.5 (12.6)	66.5 (11.5)	0.156
Body mass index**	25.9 (23.4, 29.8)	27 (24.2, 30.5)	0.1988
Parity**	2 (2, 3)	2 (2, 3)	0.3181
Menopausal	94 (77.1%)	50 (98.0%)	0.0008
Estimated blood loss**	100 (50, 100)	100 (100, 250)	0.0017
Surgery length**	72 (47, 99)	97 (83, 115)	<0.0001
Hypertension	39 (30.95%)	18 (35.3%)	0.5756
High cholesterol	12 (9.5%)	10 (19.1)	0.0655
Cardiac disease ^	5 (3.9%)	0	0.149
Diabetes^	13 (10.1%)	6 (11.8%)	0.7782
Herniated lumbar disk^	7 (5.6%)	3 (5.9%)	0.932
Spinal stenosis^	2 (1.6%)	1 (1.9%)	0.8616
Previous hysterectomy	46 (36.5%)	20 (39.2%)	0.7358
Complaint voiding dysfunction^	36 (38.7%)	29 (36.3%)	0.7391
Prolapse Stage ≥2			
Cystocele (n=119)	42 (51.2%)	25 (67.6%)	0.0961
Apical (n=111)	10 (12.1%)	11 (39.3%)	0.0015
Rectocele (n=119)	40 (48.8%)	15 (40.5%)	0.404
Urodynamics findings			
Voiding dysfunction	63 (61.2%)	37 (78.7%)	0.0343
Uroflow Peak Flow	18.1 (12.9)	20.0 (13.9)	0.414
Hypocontractile bladder^	3 (2.9%)	0	0.5549
Valsalva voider	65 (63.1%)	24 (52.17%)	0.2087
No urethral relaxation	35 (35.4%)	14 (33.3%)	0.8178
Pdet at max flow	26 (15.7)	25.9 (18.0)	0.9514
Post-void residual >150^	7 (6.62%)	5 (10%)	0.5158

N (%) Pearson Chi-squared test

*Mean (Standard deviation)

**Median (25th percentile, 75th percentile): Wilcoxon

^Fischer exact

longer operating times (median 93 min vs 69 min, $p = 0.001$), those having a history of diabetes (26.3% vs 73.7%, $p = 0.0277$), and those having spinal anesthesia (39.2% vs 60.8%, $p = 0.0389$). There was noted to be no increased risk of POUR by BMI, parity, menopausal status, history of hypertension, cardiac disease, hypercholesterolemia, spinal stenosis, herniated disks, having a previous hysterectomy, or having a complaint of preoperative voiding dysfunction (Table 2). Several UDS parameters were evaluated and there were no identifiable predictors for POUR (Table 2). Individual surgery combinations were evaluated for POUR. There were no statistical differences in POUR for mesh or sling revisions, sacrospinous ligament fixations, obliterative procedures, or procedures with concomitant slings. The procedures with lower pass rates for voiding trials included having a combined anterior and posterior repair (66.2% vs 33.8%, $p < 0.0001$), having a posterior repair (58.2% vs 41.8%, $p = 0.0011$), or having a total vaginal hysterectomy with anterior and posterior repair with a sling (38.6% vs 61.4%, $p = 0.0084$). However, having a sling alone was associated with higher voiding trial pass rates (75% vs 25%, $p = 0.032$). See Table 3 for full details of POUR rates by procedure type.

Multivariate logistic regression was adjusted for age, anesthesia type, having a ≥ stage 2 cystocele, rectocele, or apical prolapse, EBL, operating time, diabetes, and surgery type. Age was evaluated for those <55, <60, and < 65 years. Prolapse stage was evaluated at ≥ stage 2, stage 3, and stage 4. EBL was evaluated at >100 cc and > 150 cc. Surgeries evaluated included anterior and posterior repairs, anterior repairs, posterior repairs, having a sling alone, or having a total vaginal hysterectomy with anterior and posterior repair with a sling. Operating time was evaluated at >60 min, >90 min, and > 120 min. The final model demonstrated that age < 55 years (adjusted odds ratio [OR] 3.73; 95% confidence interval [CI], 1.31–11.7), diabetes (adjusted OR 4.18, 95% CI 1.04–

Table 2 Bivariate analysis for Voiding Trial Pass Rates

	Pass	Fail	P-value
Age*	66.7 (11.9)	62.0 (12.4)	0.011
<55	15 (16.7%)	75 (83.3%)	0.0333
>60	66 (56.4%)	51 (43.6%)	0.0638
>65	49 (55.7%)	39 (44.3%)	0.22585
Body mass index**	26.1 (24.2, 30.3)	26.3 (23.4, 29.7)	0.9634
Parity**	2 (1, 3)	2 (2,3)	0.3583
Menopausal	71 (49.3%)	73 (50.7%)	0.1109
Estimated blood loss**	100 (100, 250)	100 (50, 100)	0.0008
Surgical length**	93 (70.8, 116.3)	69 (43.8, 96.3)	0.0002
>60 minutes	37 (69.8%)	16 (30.2%)	0.001
>90 minutes	62 (60.2%)	41 (39.8%)	0.0043
>120 minutes	8 (30.8%)	18 (69.2%)	0.0244
Hypertension	26 (45.6%)	31 (54.4%)	0.2874
High cholesterol^	9 (40.91%)	13 (59.1%)	0.3639
Cardiac disease ^	3 (60%)	2 (40%)	1
Diabetes^	5 (26.3%)	14 (73.7%)	0.0277
Herniated lumbar disk^	5 (50%)	5 (50%)	1
Spinal stenosis^	2 (66.7%)	1 (33.3%)	1
Previous hysterectomy	33 (50%)	33 (50%)	0.7719
Complaint voiding dysfunction	13 (54.2%)	11 (45.8%)	0.3898
Prolapse Stage ≥2			
Cystocele	26 (38.8%)	41 (61.2%)	0.0005
Apical	6 (28.6%)	15 (71.4%)	0.0409
Rectocele	34 (61.8%)	21 (38.2%)	0.0492
Anesthesia			
Spinal	20 (39.2%)	31 (60.8%)	0.0389
General	71 (56.4%)	55 (43.6%)	0.0389
UDS Findings*			
Detrusor overactivity^	10 (71.4%)	4 (28.6%)	0.1644
Stress urinary incontinence	17 (53.1%)	15 (46.9%)	0.2774
Intermittent flow	38 (52.8%)	34 (47.2%)	0.9548
Prolonged flow^	12 (58.3%0	10 (41.7%)	0.6567
Neurogenic bladder	26 (51%)	25 (49%)	0.9417
Any abnormal voiding	52 (52%)	48 (45%)	0.8171
DSD	19 (61.3%)	12 (38.7%)	0.4524
Uroflow Peak Flow <15	36 (52.9%)	32 (47.1%)	0.9859
Hypocontractile bladder^	2 (66.7%)	1 (33.3%)	1
Valsalva voider	43 (48.3%)	46 (51.7%)	0.317
No urethral relaxation	26 (53.1%)	23 (46.9%)	0.884
Pdet at max flow >20	31 (55.4%)	25 (44.6%)	0.4473
PVR >100	11 (44%)	14 (56%)	0.3755
PVR> 150	5 (41.7%)	7 (58.3%)	0.5536

N(%) Pearson Chi-squared test

*Mean (Standard deviation)

**Median (25th percentile, 75th percentile): Wilcoxon

^Fischer exact

Table 3 Voiding trial by surgery type

	Pass	Fail	P-value
Surgery type			
Sling*	15 (75%)	5 (25%)	0.032
Sling revision*	7 (58.3%)	5 (41.7%)	0.7676
Mesh revision*	3 (50%)	3 (50%)	1
SSLF	9 (40.9%)	13 (59.1%)	0.2922
SSLF Anterior*	0	1 (100%)	0.4859
SSLF, A&P repair*	5 (50%)	5 (50%)	1
SSLF, A&P repair, Sling*	2 (40%)	3 (60%)	0.6752
SSLF, Posterior repair, Sling*	1 (25%)	3 (75%)	0.357
Vaginal Hysterectomy	17 (38.6%)	27 (61.4%)	0.0505
TVH*	4 (80%)	1 (20%)	0.3689
TVH, A&P repair*	7 (35%)	13 (65%)	0.1549
TVH, A&P repair, Sling*	2 (15.4%)	11 (84.6%)	0.0084
TVH, Anterior, Sling*	0	1 (100%)	0.4859
TVH, Posterior repair*	1 (100%)	0	1
TVH, Posterior repair, Sling*	2 (100%)	0	0.4976
Any Anterior repair	62 (66%)	32 (34%)	<0.0001
Anterior repair*	3 (100%)	0	0.2463
Anterior, Sling*	1 (100%)	0	1
Any Posterior repair	46 (41.8%)	64 (58.2%)	0.0011
Posterior repair*	6 (50%)	6 (50%)	1
Posterior repair, Sling*	4 (80%)	1 (20%)	0.3689
Any A&P repair	26 (33.8%	51 (66.2%)	<0.0001
A&P repair*	5 (35.7%)	9 (64.3%)	0.2711
A&P repair, Sling*	5 (33.3%)	10 (66.7%)	0.1806
Obliterative procedures	9 (64.3%)	5 (35.7%)	0.3152
Obliterative*	7 (70%)	3 (30%)	0.3315
Obliterative, Sling *	2 (50%)	2 (50%)	1

SSLF sacrospinous ligament fixation, *TVH* total vaginal hysterectomy, *A* anterior repair, *P* posterior repair, *N (%)* Pearson's chi-squared

*Fischer's exact

21.67), and having a cystocele ≥ stage 2 (adjusted OR 4.23, 95% CI 1.89–10) were risk factors for developing POUR. See Table 4 for full details of the multivariate logistic analysis.

Discussion

The incidence of POUR in our cohort after same-day outpatient vaginal pelvic floor surgery was 48.9%, with no difference noted between anesthesia types. We were able to identify several risk factors for acute POUR after outpatient vaginal pelvic floor surgery, which included being younger than 55 years of age, having a history of diabetes, and having a cystocele ≥ stage 2 preoperatively.

Table 4 Multivariate logistic regression for failed voiding trial

	Adjusted OR	95% confidence interval
Age < 55	3.73	1.31–11.7
Operating time > 90 min	1.83	0.67–5.4
Estimated blood loss >100	0.63	0.23–1.74
Diabetes	4.18	1.04–21.67
Spinal	1.02	0.19–5.67
TVH, A&P repair, sling	0.31	0.04–1.48
Sling alone	1.11	0.8–31.36
Cystocele ≥ stage 2	4.23	1.89–10
Rectocele ≥ stage 2	1.75	0.76–4.12
Apical prolapse ≥ stage 2	0.93	0.14–5.54
Any A repair	1.58	0.5–4.9
Any P repair	2.1	0.88–5.15
Any A&P repair	1.22	0.09–18.29

We had hypothesized that spinal anesthesia might be identified as a risk factor for POUR because spinal anesthesia has been noted to be a risk factor for temporary urinary retention after various surgical procedures [12]. However, in the final model, anesthesia was not a predictor of urinary retention after POP or SUI outpatient surgery. This finding is supported by a study by Hakvoort et al. in which a retrospective review of 345 patients who had undergone POP surgery was performed. They had an overall POUR rate of 29% and did not find a difference in POUR based on anesthesia type ($p = 0.46$), but did identify cystoceles ≥ stage 3, EBL >100 cc, levator plication, and Kelly plication as risk factors for developing POUR [13].

Our POUR rate of 48.9% is higher than those in the literature, which usually range from 2.5% to 24% [7–9, 14]. This is likely secondary to the type of surgery performed, the parameters of the voiding trial, and on which day the voiding trial is performed. However, Pulvino et al. found POUR rates of 40.5% after inpatient urogynecology surgery when the void trial was completed on postoperative day (POD) 1 [15]. Spinal anesthesia can block the afferent bladder stimuli to the pontine micturition center, which has been suggested to lead to urinary retention in women in the postpartum period [16–18]. Depending on the medication and dose of anesthetic, the effects of spinal anesthesia can vary in severity and length. Performing the voiding trial on POD 1 would likely provide enough time for the afferent neural blockade to wear off, allowing more patients to pass their voiding trial, and may explain our higher POUR rates.

It was surprising to find that being younger than 55 years was a risk factor for POUR. This, however, is supported by a study by Ghezzi et al., which evaluated POP and SUI surgery in women 75 years of age and older [19]. The primary aim was to evaluate surgical safety in this patient population, but they did note a low POUR rate (5.8%) after the catheter was removed a few days after surgery, demonstrating that elderly

patients were not at a high risk for POUR. A possible explanation for younger patients being at a higher risk for POUR might be secondary to increased pain and nonrelaxation of the pelvic floor during voiding. We theorize that older patients might have decreased muscle tone and more nerve dysfunction. For these reasons, their perception of pain may be less severe, allowing them to completely relax their pelvic floor during micturition, and pass their voiding trial. However, further studies are needed to verify this hypothesis.

We were not able to demonstrate any UDS findings that were predictors for acute POUR, as has been previously suggested by Bhatia and Bergman and Dawson et al. [20, 21]. They had found that slow flow rates, inadequate detrusor pressures, and Valsalva voiders had a higher rate of POUR in women who underwent incontinence procedures. We evaluated for evidence for detrusor overactivity, SUI, flow patterns including intermittent or prolonged flow, increased electromyography activity, uroflowmetry peak flow, flow time, absence of detrusor contraction or urethral relaxation, detrusor pressures, and elevated post-void residuals. The study by Bhatia and Bergman included only 30 subjects, who underwent incontinence surgeries only. Their findings are consistent with the literature, showing that those with evidence for preoperative UDS findings of a hypocontractile bladder are likely to have increased POUR [22]. Given that evidence for impaired detrusor activity has been associated with higher rates of urinary retention, we were unlikely to perform a sling procedure in women who demonstrated low detrusor pressures during UDS. This is probably why we were unable to identify any UDS parameters as predictors for POUR.

To our knowledge, there is only study that has evaluated anesthesia during outpatient surgery evaluated midurethral slings without POP surgery [9]. They found significantly higher POUR (61.9% vs 24.7%) in the spinal group versus the general group. Although in our study we were unable to identify spinal anesthesia as a risk factor for POUR, further studies need to be conducted because all available evidence is based on retrospective data, and most of the studies evaluated POUR in the inpatient setting on POD 1, 3, or 5 versus outpatient day surgery setting on POD 0. Currently, we are enrolling for a randomized controlled trial: Does spinal anesthesia for prolapse surgery with concomitant sling procedures lead to an increase in urinary retention compared with general anesthesia? (NCT02547155).

The strengths of our study include that it is one of the first to evaluate POUR for outpatient day POP surgery. In addition, we performed multivariate logistic regression to evaluate POUR based on multiple factors.

However, there were several limitations to our studies. First, given the retrospective nature of the study, we were limited to data in the database. The standard of care at our institution is to use bupivacaine only for spinal anesthesia. However, as this was a database, we were not able to verify that additional agents were not used. The addition of morphine or epinephrine has been shown to increase spinal effects and lead to higher rates of POUR [23, 24]. We also acknowledge that our study groups were not identical, which is likely from selection bias from surgeons choosing which subjects would have been better candidates for spinal or general anesthesia. Multivariate logistic regression was conducted to help to control for confounding variables, but the group differences still reduce the overall quality of the study. In addition, we wanted to evaluate the incidence of POUR in same-day surgery; therefore, our results may not be generalizable to patients with an overnight stay or those who undergo a voiding trial on POD 1 or later. We did not include laparoscopic or abdominal procedures either; thus, we are unable to comment on POUR for these procedures, and possible risk factors.

In conclusion, the overall rate of POUR requiring discharge with a Foley catheter after ambulatory vaginal surgery was 48.9% and the rate of POUR was not affected by the type of anesthesia used. Risk factors for the development of POUR included age younger than 55 years, diabetes, and cystocele ≥ stage 2 before surgery. Surgeons can use this information to counsel their patients about their risk of POUR and may want to consider postponing the voiding trial in those undergoing outpatient pelvic floor vaginal surgery for patients who have risk factors for urinary retention.

Compliance with ethical standards

Conflicts of interest None.

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