Research Article

Can Early First Trial of Void after Elective Spine Surgery Reduce the Incidence of Post-Operative Urinary Retention? - Results from a Cross-Sectional Study of 195 Patients

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Abstract

Study design: Retrospective study

Object: To find the risk factors for post-operative urinary retention (POUR) and identify the controllable factors that can reduce it.

Background: Post-operative urinary retention (POUR) is one of the common postoperative complications and affects the recovery period after surgery. Authors hypothesize that early encouragement of first voiding trial after spine surgery may reduce incidence of POUR. The purpose of this study is to confirm the significance of the previously known risk factors and to evaluate the incidence of POUR according to the management of postoperative foley catheter.

Patients and methods: From June 2014 to August 2014, 215 patients who diagnosed with spinal stenosis and had under 3 levels of surgery under general anesthesia were consecutively extracted and divided as POUR group and non-POUR group. The data includes gender, age, duration of hospital stay, hypertension, diabetes mellitus, preoperative prostate disease, number of operative level, surgical method, operative time,

amount of perioperative fluid, usage of patient controlled analgesia, presence of preoperative foley catheterization, foley removal time, and timing of first trial of void (TOV).

Results: Incidence of POUR is 33 out of 195 (16.9%). The risk factors that showed a significant correlation with POUR were male gender, duration of hospital stay, preoperative prostate disease, operative time, amount of perioperative fluid, long operative level (3 level), and delay of TOV.

Conclusion: This study confirmed the significance of POUR with the previously known risk factors and identified the importance of peri-operative fluid management and shortening of TOV after surgery.

Keywords: Post-operative urinary retention; Timing of first trial of void

1. Introduction

Post-operative urinary retention (POUR), defined as impaired voiding after surgery, is one of the common complications after surgery [1]. The incidence of POUR has been reported to vary from 5 to 70% [2-6]. The strong association between post-op urinary retention (POUR) and spine surgery has long been established by various studies. This postoperative complication prolongs hospital stay after surgery and increases pain, anxiety, bladder distension, renal failure, and morbidity [2, 7], which is a stumbling block to successful surgical treatment, and results in significant anxiety both for the patient and treating surgeon. Especially, spine surgery requires more accurate evaluation, because unlike other general anesthesia operations, iatrogenic nerve injuries that can be occurred during the neurosurgery itself may causes POUR [8]. This has also prompted the development of various peri-operative protocols for prevention and management of POUR. Currently known risk factors associated with POUR include male gender, old age, past history of prostate disease, and amount of perioperative fluid [4, 9]. The purpose of current study is to evaluate the modifiable and non-modifiable risk factors affecting occurrence of POUR after elective spine surgery.

2. Materials and Methods

2.1 Study design

Retrospective study.

2.2 Patient selection and parameters

From June 2014 to August 2014, authors performed a retrospective analysis of prospectively maintained data from 215 patients who underwent three or less level elective spine surgery at a specialist spine center. The analysis specifically included surgeries performed under general anesthesia. Cases of revision surgeries, multi-staged surgical procedures, history of previous urogenital surgery and cauda equine syndrome were specifically excluded. As a result, 195 patients were enrolled in this study. Data analyzed included patient demographics, previous medical/surgical history (hypertension (HTN), diabetes mellitus (DM), urogenital disorders including prostate disease), pre-operative diagnosis, type/level/duration of surgery, perioperative fluid management, timing of insertion/removal of foley's catheter, timing of first trial of void (TOV) after surgery, use of patient-controlled analgesia (PCA), and duration of hospital stay (Table 1).

2.3 POUR

Normally, residual urine is measured by ultrasound in patients with urinary retention [10]. But in many clinical papers, POUR is defined as the use of a straight

catheterization or foley postoperatively [6, 9, 11]. In this study POUR was defined as patients who failed to pass urine voluntarily after surgery and required therapeutic measures (catheterization/medication/both) for the same. The medications included Doxazocin mesylate (Alpha-1 blocker), Tamsulosin HCl (Alpha-1 blocker), and Bethanechol chloride (Para-sympathomimetic choline carbamate).

2.4 Statistical analysis

Statistical analysis was performed using SPSS statistics 24 (*IBM® SPSS®* Statistics *24) and employed* Student's t-test and Chi-square test. P value <0.05 was considered significant.

3. Results

3.1 Demographic data

The final analysis included 195 patients (M=105, F=90) with average of 54 years who underwent either of the following surgical procedures: anterior cervical discectomy and fusion (ACDF), open lumbar microscopic discectomy (OLM), unilateral laminectomy bilateral decompression (ULBD), transforaminal lumbar interbody fusion (TLIF) and anterior lumbar interbody fusion (ALIF). The overall incidence of POUR was 16.9% with 24 males and 9 females. Male percentage of the POUR group (69.7%) was significantly higher than the non-POUR group (50%) (p = 0.017). The duration of hospital stay was also significantly longer in the POUR group (p=0.008). In-terms of pre-morbid medical conditions, prevalence of HTN (p= 0.076) and DM (p= 0.1) was identical in both the groups, whereas prostate disease (p=.000) was significantly more prevalent in the POUR group (Table 1).

3.2 Operative data

There was no significant relationship between surgical method and POUR, but there was a significant correlation between POUR and long level surgery (3 levels) (p=0.034). The operative time of the POUR group was significantly longer than that of the non-POUR group (p= 0.019). As compared to non-POUR group, significantly higher amount of perioperative fluid administration was observed in the POUR group (p= 0.006). However, use of PCA did not seem to affect the occurrence of POUR (p=0.356) (Table 1).

3.3 Urological data

The time for first post-operative TOV was significantly longer in the POUR group (p= 0.028). First foley removal time was similar in both groups. Of the POUR groups, 24 patients (75%) required ward catheterization, and the average time taken to remove them again was 159 [20 - 420] hours. 31 patients (91.7%) received a medication (Table 1).

	POUR group (n=33)	non-POUR group (n=162)	Total (n=195)	p-value
Sex (Male/Female)	24/9	81/81	105/90	0.017
Age (yr)	56.9 ± 15.1	53.4 ± 14.3	54.0 ± 14.4	0.21
Duration of hospital stay (Day)	9.5 ± 14.3	7.5 ± 4.0	7.8 ± 4.1	0.008
Hypertension (%)	15 (45.5)	48 (29.6)	63 (32.3)	0.076
Diabetes mellitus (%)	8/25 (24.2)	20 (12.3)	28 (14.4)	0.1

Preoperative prostate disease (%, among male)		12 (50)	8 (9.9)	20 (19.0)	.000
Operative level (%)	1 level	19 (57.6)	116 (71.6)	135 (69.2)	0.111
	2 levels	9 (27.3)	39 (24.1)	48 (24.6)	0.697
	3 levels	5 (15.1)	7 (4.3)	12 (6.2)	0.034
Surgical method (%)	1.ACDF	2 (6.1)	16 (9.9)	18 (9.2)	0.743
	2.ALIF	3 (9.1)	25 (15.4)	28 (14.3)	0.426
	3.OLM	23 (69.6)	100 (61.7)	123 (63.1)	0.387
	4.TLIF	2 (6.1)	12 (7.4)	14 (7.2)	0.785
	5.ULBD	3 (9.1)	9 (5.6)	12 (6.2)	0.431
Operative time (min)		191 ± 49.7	164 ± 88.4	169 ± 83.6	0.019
Perioperative fluid, cc		1283 ± 503.3	972 ± 866.0	1025 ± 823.3	0.006
Usage of ǂPCA (%)		33 (100)	154 (95.1)	187 (95.9)	0.356
Preoperative foley catheterization (%)		22 (66.7)	80 (49.4)	102 (52.3)	0.07
First foley removal time, hours		31.9 ± 17.1	30.9 ± 18.0	31.1 ± 17.7	0.81
Timing of first trial of void (TOV) (minutes)		460.2 ± 324.5	374.7 ± 167.9	389.2 ± 204.5	0.028
Need for ward catheterization (%)		24 (72.7)			
(Ward foley maintain time, hours)		159 [20-420]			
§Need for ward medication (%)		31 (93.9)			
1.ACDF-Anterior cervical discectomy and fusion					
2.ALIF-Anterior lumbar interbody fusion					
3.OLM-Open lumbar microscopic discectomy					
4.TLIF-Transforaminal lumbar interbody fusion					
5.ULBD-Unilateral laminectomy bilateral decompression					
ǂPCA-Patient controlled analgesia					
§Medication: α-Adrenergic Blockers, Parasympathomimetic choline carbamate					
Pearson's Chi-square test/Student-T test/Fisher test, p-value < 0.05; statistically significant.					

Table 1: Patient's parameters, peri-operative and urologic data.

4. Discussion

POUR is a well established complication of spinal surgery with significant clinical implications. The current study showed significant improvements in incidence of POUR if the time for first TOV was reduced. This can be implemented by encouraging

ambulation and use of general toilet facilities as soon as possible after surgery and discouraging the use of bed pans and similar facilities. These results are thought to be related to the mechanism of POUR development after general anesthesia. The exact patho-physiological mechanism behind the development of POUR is not well understood, yet it is assumed that general anesthetic agents cause bladder atony by interfering with the autonomic nervous system. Diazepam, pentobarbital, propofol, isoflurane, methoxyflurane, and halothane known to have an effect of suppressing detrusor contractions [12]. The effect of these drugs is found to increase the incidence of POUR as the administration dose increased as the operation time prolonged [13]. The reason for the need for an early ambulation and first TOV after surgery is supposed to help with early recovery of this deteriorated bladder function. Medically unnecessary prolongation of post-op bed rest will delay recovery of bowel movement and rectal distension and increase sympathetic tone and stimulation of the α-receptors in the internal urethral sphincter, which will leads to increased pressure on the bladder neck and potentially to POUR [2]. There is currently no standard protocol for optimal foley removal time after surgery. However, many studies have reported that there is no significant difference in the incidence of POUR after removal of foley within 1 day after surgery [14]. However, long-term ambulation with foley insertion state after surgery may lead to urethral stricture, edema due to friction, which may lead to iatrogenic urinary retention after foley removal [15]. In previous studies, male gender, old age, past history of prostate disease, excess amount of perioperative fluid administration, and use of PCA have been found to be associated with higher incidence of POUR [4, 16, 17]. The reason for the higher prevalence of POUR in male patients has mostly been attributed to gender-specific pathologies [13, 18]. Presence of prostate issues (benign prostatic hyperplasia (BPH), prostatitis, and prostate cancer) can result in acute urinary retention and can also affect the recovery of urinary function after non-urological surgery [19]. Incidence of POUR also increases with aging process because of age-related progressive neuronal degeneration leading to bladder dysfunction [16]. Contrary to various studies which related POUR to age, the current study could not find age as contributing factor to the occurrence of POUR.

The probable reason could be non-normal age distribution of study subjects as most of them were above 50 years. If the data of the POUR patient group is more scaled, it is expected that similar will be obtained as in the existing papers. Although DM is known to cause urinary retention due to diabetic neuropathy [20], the current study could not elicit any such association. This could be because only the presence or absence of DM was recorded and no attempt was made to assess the severity of diabetes mellitus. Use of opioids based PCA is also known to make post-surgical spontaneous urination difficult by increasing urinary sphincter's tone while diminishing urethral contractions [21]. However, PCA was used in more than 95% of cases in current study, which makes it difficult to gauge its true contribution to POUR. ULBD has been known to induce iatrogenic compression of the dural sac by use of kerrison punch during contralateral decompression [22]. Authors wanted to investigate whether such complications which vary from operation method, have relation with occurrence of POUR. The results showed no significant difference in POUR according to the operation method, but the number of cases was not sufficient compared to OLM in other operations. If the number of cases of ULBD or other fusion operations is sufficiently cumulative, consider carefully that further

studies may yield different results. Increased surgical levels and prolonged operative time cause peri-operative fluid gain. Significant relation between POUR and 3 levels' long surgery seems to be caused by this reason. Shortening the operative time by surgeon may help lower the incidence of POUR.

The current study identified two significant factors affecting development of POUR in patients undergoing elective spine surgery: timing of first TOV and peri-operative fluid management. They are modifiable and explicit control of these can be the key to management of POUR. Furthermore, pre-operative anticipation and identification of high risk patients (e.g. elderly males with prostate issues) by the surgical team can possibly result in better management of POUR. Despite the inherent design-based (cross sectional and retrospective) and data-dependent (small volume) short-comings of current study, the positive outcomes extracted can guide and encourage better designed, large volume, multi-center futures trials concerning management of POUR in the cohort of spine surgery patients.

5. Conclusion

Male gender, pre-operative prostate disorder, poor peri-operative fluid management, and prolonged timing of first trial of void can be detrimental to the return of voluntary urinary function. Expert fluid management, shortening of operation time and early first trial of void can significantly prevent post-op urinary retention and facilitate post-op rehabilitation.

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