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Article

Anesthesia-Related Risk Factors and Health Outcomes of Postoperative Urinary Retention in Appendectomy Patients

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Abstract: Background: postoperative urinary retention (POUR) can delay recovery after appendectomy and may increase catheter-related complications. This study evaluated anesthesia-related factors and early urinary outcomes in appendectomy patients. Methods: a study of 100 appendectomy patients was analyzed. Variables included anesthesia type, surgical approach, catheter use, time to first void, and POUR status. Association between POUR and categorical variable were tested using Chi-square and Fisher's exact tests as appropriate. Time to first avoid was compared between anesthesia group using Student's t-tests with Mann-Witney U as sensitivity analysis, binomial logistic regression assessed anesthesia type and surgical approach as predictors of POUR. Results: POUR occurred in 7/100 (7.0%) patients. General anesthesia was used in 84% and spinal anesthesia was used in 16%: surgery was laparoscopic in 82% and open in 18%. POUR rates were 6.0% (5/84) under general anesthesia and 12.5% (2/16) under spinal anesthesia, with no significant association (χ^2 p=0.347: Fisher p=0.311). POUR occurred in 8.5% (7/82) of laparoscopic cases and 0% (0/18) od open cases (χ^2 p= 0.995: Fisher p=0.345). time to first void did not differ significantly between anesthesia groups (t (98) = -1.04, p=0.302: Mann-Whitney U p=0.449). logistic regression showed no significant predictors (Spinal vs General: β=0.742, p=0.407: open vs laparoscopic β= -17.137, p=0.995: AIC=53.2: McFadden R^2= 0.069), with spare data instability due to zero POUR events in open group. Conclusion: POUR incidence was 7% with no statistically significant association with anesthesia type or surgical approach. Larger prospective studies with standardized definitions are warranted.

Keywords: Postoperative urinary retention; Appendectomy; General anesthesia; Spinal anesthesia; Urinary catheterization; Time to first void

Introduction

Post urinary retention (POUR) is an important early postoperative complication, broadly described as inability to void despite a full bladder during immediate recovery period. Clinically POUR matters because it can increase pain and distress, delay discharge, and often lead to urinary

catheterization, which may interduce catheter-related complications such as urinary tract infection and urethral trauma. Reported incidence varies widely across studies, largely because definition and surveillance pathway differ between hospitals (for example, symptom-based diagnosis versus bladder scanning thresholds and different time cut-offs). These differences make-procedures -specific and pathway-specific data valuable for improving local perioperative practice [1].

POUR is considered multifractional. Patients characteristics such as age and baseline lower urinary tract symptoms, together with perioperative factors (type of surgery, anesthetic technique analgesic strategy, fluids, and catheter policy), combined to shape risk. Evidence synthesis in ambulatory general surgery suggests that certain patient-level factors, particularly increasing age and pre-existing urinary symptoms, are consistently associated with POUR, while other associations vary depending on perioperative protocols. Prospective general-surgery data also supports that POUR is relevant cause of unplanned admission and that risk is influenced by perioperative management, not only by surgical procedure itself [2, 3].

Anesthesia-related mechanisms are especially relevant to POUR. Neuraxial techniques may reduce detrusor contractility and blader sensation, whole opioid exposure can worsen retention through autonomic effect and impaired voiding reflexes. Beyond anesthesia type alone, medication choices surrounding anesthesia may matter for example anticholinergic agents used with reversal regimens have been discussed as contributors, and large cohort work suggest that neuromuscular blockade reversal strategy can be associated with POUR risk in practice. Recent observational evidence also continues to identify perioperative and patients' factors as contributors across different surgical populations[4-6].

Appendectomy is a useful setting to study POUR because it is common, includes both laparoscopic and open approaches, and frequently managed under standardized perioperative pathways. However, urinary catheter practice around appendectomy is not uniform, and procedure-focused evidence indicates that catheter use is itself an exposure with potential downstream harm rather than natural step. In addition, systematic review evidence from major abdominal surgery populations highlights the role of male sex, older age, diabetes, urologic disease, fluid volume, and catheter timing, reinforcing that need to evaluate local practice patterns and outcomes [7-9]. Therefore, this prospective multicenter study in Iraq aims to evaluate anesthesia-related risk factors and early postoperative outcomes of POUR in appendectomy patients by examining anesthesia type, surgical approach, catheter use, and time to first void using consistent operational definition and standardized data collection across participating hospitals[1, 6, 9].

Materials and Methods

This prospective observational study was conducted a cross hospital in Iraq to evaluate anesthesia-related factors and early postoperative urinary outcomes in appendectomy patients. Consecutive patients undergoing laparoscopic or open appendectomy were enrolled during the study period, and data were documented contemporaneously using a tenderized case report form to ensure consistent recording between sites. Patients were included when appendectomy was completed and postoperative urinary outcomes could be assessed and were excluded if they had a pre-existing urinary catheter, known neurogenic bladder, or baseline condition requiring catheterization before surgery, or if postoperative follow-up for voiding outcomes was not feasible.

Anesthesia type was classified as general or spinal according to the anesthesia record, and surgical approach was classified as laparoscopic or open based on the operative note. The primary outcome was postoperative urinary retention (POUR), recorded as binary variable using a single operational definition applied to all participants. POUR was considered present when postoperative inability to void required urinary catheterization in accordance with the participating ward protocol, with the timing and indication documented on the study form. Time to first void was recorded in hours as interval from the documented end of surgery to the first spontaneous urination, post operative urinary catheter use was recorded as binary variable, and catheterization events were recorded at the time of care.

Analysis were performed using Jamovi [10-12]. Categorical variable was summarized as counts and percentages, and continues variable were summarized using mean, standard deviation and median (interquartile range) where appropriate. Association between POUR and categorical exposure were assessed using chi-square tests, with Fisher's exact test used when expected counts were small. Time to first void was compared between anesthesia group using independent-t test, with the Mann-Whitney U test used as non-parametric sensitivity analysis. A binomial logistic regression model was fitted with POUR as the dependent variable and anesthesia type and surgical approach as predictors: results were interpreted cautiously when spare data were present. Statistical significance was set at $p<0.05$. all data were de-identified prior to analysis and handled in accordance with institutional ethical requirements.

Results

A total of 100 appendectomy patients were included, with no missing data for first voiding. The mean to first time void was 3.94 hours (SD 1.58), with a median of 3.90 hours. The observed values ranged from 1.00 to 7.40 hours. Among 100 patients 84% underwent surgery under general anesthesia and 16% underwent spinal anesthesia. Most procedures were laparoscopic (82%), while 18% were performed as open surgery. Urinary catheterization was required in 9 % of patients. overall post-operative urinary retention (POUR) was observed in 7% (Table1).

Table 1, Distribution of anesthesia type, surgical approach, urinary catheter uses and post-operative urinary retention (POUR).

Variable	Category	Number
Anesthesia type	General	84
	Spinal	16
Surgery type	Laparoscopic	82
	Open	18
Catheter use	No (0)	91
	Yes (1)	9
POUR	No (0)	93
	Yes (1)	7

Postoperative urinary retention occurred in 5/84 of patients who received general anesthesia and 2/16 (12.5%) of those who received spinal anesthesia. However, the association between anesthesia and POUR were not statistically significant (X^2 (1) =0.885, p=0.347:Fishers exact p=0.311) (Table 2).

Table 2. Association between anesthesia type and POUR among our population. Data were presented as n (within anesthesia group), Chi-square and Fisher's exact tests were applied

POUR	General	Spinal	Total
0 (No)	79 (94.0)	14 (87.5)	93
1 (Yes)	5 (6.0)	2 (12.5)	7
Total	84 (100)	16 (100)	100

Tests= (X^2 (1) =0.885, p=0.347: Fishers exact p=0.311).

Postoperative urinary retention was observed in 7/82 (8.5 %) of patients who underwent laparoscopic appendectomy, while no cases (0/18, 0%) were recorded among those who underwent open appendectomy. The differences, however, were not statistically significant Test= (X^2 (1) =1.65, p=0.199: Fishers exact p=0.345) (Table3).

Table 3. Association between surgical approach and POUR among our population. Data were presented as n (within anesthesia group), Chi-square and Fisher's exact tests were applied

POUR	Laparoscopic n (%)	Open n (%)	Total
0 (No)	75 (91.5)	18 (100.0)	93
1 (Yes)	7 (8.5)	0 (0.0)	7
Total	82	18 (100)	100

Test= (X^2 (1) =1.65, p=0.199: Fishers exact p=0.345).

There was no statistically significant difference in time to first avoid between patients who received general anesthesia and those who received spinal anesthesia (t (98) = -1.04, p= 0.302). These findings were consistent using the non-parametric approach (Mann-Whitney U=592, p=0.499). in the binomial logistic regression model including anesthesia type and surgical approach, neither predictor showed a statistically significant association with POUR. Spinal anesthesia was not significantly associated with higher odds of POUR compared with general anesthesia (β= 0.742, SE= 0.894, p= 0.407). Similarly, open surgery was not associated with POUR compared with laparoscopic surgery (β= -17.137, SE= 2521.241, p=0.995). The model demonstrated modest explanatory power (McFadden R^2 = 0.0694: AIC =53.2, Deviance =47.2).

Table 4. Binomial logistic regression evaluating anesthesia type and surgical approach as predictors of POUR among our population. Model fit indices (Deviance, AIC, and McFadden R^2) are reported.

Predictor	Estimate (β)	SE	Z	p-value
Surgery type	-17.137	2521.241	-0.007	0.995
Ansthesia	0.742	0.894	0.830	0.407

Model fit indices, McFadden R^2 = 0.0694: AIC =53.2, Deviance =47.2

Discussion

Postoperative urinary retention (POUR) is a clinically relevant complication after abdominal surgery because it may increase discomfort, delay discharge, and expose patients to catheter-related harm such as urinary tract infection and urethral trauma: therefore, investigating anesthesia-related factors in appendectomy is justified even when statistically significant association are not demonstrated, provided in the findings are reported clearly with appropriate limitations[1, 5, 13]. In this study (N=100), POUR accrued in 7 % which is plausible because reported incidence varies widely across procedures and depends strongly on operational and local bladder-managements pathways (e.g., bladder scanning thresholds, timing rules, and catheterization criteria)[1, 5]. No statistically significant association was observed between anesthesia type (general vs spinal) and POUR, and no significant association was observed between surgical approach (laparoscopic vs open) and POUR using χ^2 and Fisher's exact tests: however, these findings should be interrupted as imprecise estimate rather than evidence of no effect, given the low event count and sparse cells, the raw proportions should still be stated and interpreted cautiously: POUR was 6.0% under general anesthesia versus 12.5 % under spinal anesthesia, and 8.5 % after laparoscopic surgery versus 0% after open surgery, but these differences remain statistically uncertain with only 7 events overall. In logistic regression, the extremely large coefficient and very large standard error for open-laparoscopic reflects quasi-complete separation because no POUR events occurred in the open group, meaning standard maximum-like hood logistic

regression cannot provide stable or clinically interpretable estimates for that comparison: accordingly, Fisher's exact test is more appropriate for sparse cells, and future work should consider a larger samples and or penalized methods (e.g., Firth) to obtain finite estimates when separation is present[3], the absence of a significant deference's in time to first avoid between anesthesia group may reflect similar postoperative care protocols rather than the absence of physiologic effects, and the finding should be presented as evidence that the study did not demonstrate a clear association under current practice rather than as proof of equivalence[3, 7, 9, 10, 14-17] . Overall, these data provide a useful local incidence estimate and transparent null comparison: large event counts and inclusion of key cofounders (age, male sex, diabetes, lower urinary tract symptoms/BPH, intraoperative fluids, opioid dose, and catheter protocol) are needed for stronger interference and more stable effect estimation [4, 8, 18].

Conclusion

In conclusion, POUR occurred in 7% of appendectomy patients in this study, and statistically significant association was observed between POUR and anesthesia type or surgical approach, while time to first avoid did not differ significantly between anesthesia group. These findings should be interpreted as imprecise estimate rather than evidence of no effect because the number or POUR events was small and spare subgroup data limited stable regression estimation. Larger prospective studies with standardized POUR definitions and inclusion of key cofounders are needed to clarify independent risk factors and optimize postoperative bladder managements in appendectomy patients.

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