

Does Transverse Abdominis Plane Block Increase the Risk of Postoperative Urinary Retention after Inguinal Hernia Repair?

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ABSTRACT

Background and Objective: Postoperative urinary retention (POUR) is a common adverse event after inguinal hernia repair (IHR), with an incidence of up to 22.2%. The aim of this study is to determine if pre-operative transverse abdominis plane (TAP) block increases the incidence of POUR.

Methods: A retrospective review was performed for all patients who underwent IHR (open or laparoscopic) at this institution, from January 1, 2016 to December 31, 2017. Patients were divided into two groups: Patients that had a TAP block before surgery (group 1) and patients with no TAP block (group 2). Common demographics and comorbidities were collected along with postoperative outcomes and POUR incidence rates for every group to determine procedural influence.

Results: From 276 patients reviewed, 28.2% (N=78) underwent TAP block before surgery. The patient cohort mean age was 61.1 ± 14.4 years. Most the interventions were laparoscopic (81.2%) and an overall POUR incidence rate of 7.6% (N=21) was observed. Comparatively, common demographics and comorbidities were statistically similar for both groups, with the exception of type 2 diabetes

mellitus ($p=0.049$). Individually, group 1 and 2 presented POUR incidence rates of 14.1% and 5.05%, respectively. While intraoperative fluid administration, early readmission rate, and length were similar in both groups, there was a significant difference in POUR incidence rates ($p=0.01$).

Conclusion: Patients undergoing TAP block during IHR might have an increased risk of developing POUR. Further larger, prospective, and randomized controlled studies are necessary to better assess these findings.

Key Words: Postoperative urinary retention, Inguinal hernia repair, TAP block.

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Disclosure: none.

Funding sources: none.

Conflict of interests: none.

Informed consent: Dr. Emanuele Lo Menzo declares that written informed consent was obtained from the patient/s for publication of this study/report and any accompanying images.

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DOI: 10.4293/JSLs.2021.00015

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INTRODUCTION

Inguinal hernia repair (IHR) is the most common surgical procedure performed in the US, with extremely low complication and morbidity rates. A common adverse event after this procedure is postoperative urinary retention (POUR), with an incidence ranging from 0.37% to 22.2%.^{1,2} Postoperative urinary retention has taken on so many definitions in the literature due to its physiological and mechanical implications. However, it can be best described as the inability to spontaneously and adequately empty the bladder.³ This postoperative complication is related to evident pain and discomfort to the patient, with prolonged length of stay, emergency department visits, and significant increase in institutional costs. Several factors have been associated with POUR following IHR. Numerous studies identify an age over 50 to 60 years, prolonged anesthesia time, benign prostatic hyperplasia, and opioid use as independent risk factors in the development of this complication.^{1,4-6}

In recent years, several institutions have adopted transversus abdominis plane (TAP) block as a novel procedure for pain management after unilateral, bilateral, open, and laparoscopic IHR. TAP blocks are performed under general anesthesia, either prior to incision or at the end of the procedure

following skin closure. Multiple studies report a strong association between TAP block and good postoperative analgesia with reduction of analgesic requirements, consequently providing a significantly superior pain management. Furthermore, complications rates related to TAP block are negligible.⁷⁻¹⁰

While the pain control effects of this technique are promising, the incidence of complications such as POUR have not been well established in the literature. The aim of this study is to determine the impact of TAP block in the incidence of POUR after an inguinal hernia repair.

METHODS

Following Institutional Review Board approval, a retrospective review of prospectively collected charts on all patients who underwent IHR from January 1, 2016 to December 31, 2017 was conducted. Patients older than 18 years of age undergoing elective unilateral, bilateral, open, or laparoscopic IHR were included in the patient cohort. Patients with a history of prostate hyperplasia, opioid use/dependency, under tamsulosin treatment, recurrent groin hernias, patients undergoing emergent procedures, and patients with a known connective tissue disease, were excluded from the cohort.

Common demographics and comorbidities were collected as short-term outcomes including age, body mass index (BMI), gender, race, insurance, operative approach, unilateral or bilateral repairs, hypertension (HTN), obstructive sleep apnea, and type 2 diabetes mellitus (T2DM). In order to determine the impact of TAP block in the incidence rates of POUR following IHR, patients were divided into two groups: Patients receiving a TAP block before surgery (group 1) and patients with no TAP block (group 2).

The TAP block was performed in every case under ultrasound guidance before incision by the anesthesia team. Every patient undergoing laparoscopic repair received a urinary catheter. On the contrary, no urinary catheter was used in the open cases. For the purposes of this study, POUR was defined as the inability to spontaneously and adequately empty the bladder. All patients with POUR underwent bladder scanning prior to catheterization. Early readmission was defined as a readmission occurring during the first 30 postoperative days.

Length of stay (LOS), use of intraoperative fluids, and early admission rates were determined and analyzed for both groups.

ULTRASOUND-GUIDED TAP BLOCK: DESCRIPTION OF THE TECHNIQUE

The ultrasound-guided approach begins by placing the transducer in an axial plane between the iliac crest and the subcostal margin at the level of the midaxillary line (Figure 1). Upon identification of the muscle layers, a 22G spinal needle is advanced between the internal oblique and transverse abdominis muscles. The adequate position of the tip of the needle is confirmed by injection of saline and visualization of the intermuscular plane expansion on ultrasound images. A total of 30 mL of ropivacaine (0.25%) is injected per side of hernia.

DATA ANALYSIS

Data was described using mean and standard deviation for continuous variables and counts and percentages for categorical variables. Outcomes of clinical characteristics and postoperative results were described using the χ^2 , Fisher exact, and t-tests. All analyses were performed on a complete-case basis. All tests were two-tailed and performed at a significance level of 0.05. Statistical software R, version 3.30.1 (2016-06-21) was used for all analyses.

RESULTS

A total of 276 patients met inclusion criteria, of which 28.2% (N=78) patients received a TAP block before

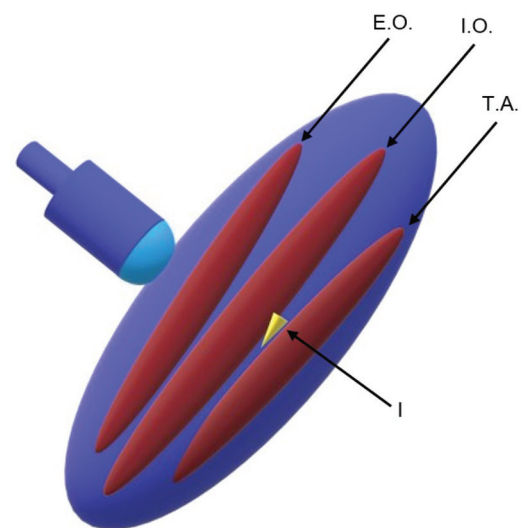


Figure 1. Schematic view of the site of injection of local anesthesia during an ultrasound guided transversus abdominis plane block. E.O. = external oblique muscle; I.O. = internal oblique muscle; T.A. = Transversus abdominis muscle; I = injection site.

Table 1.
Common Demographics

	Total Population N = 276	Group 1% (N = 78)	Group 2% (N = 198)	p Value*
Age (years)	60.5 ± 14.5	58.9 ± 14.6	62.0 ± 14.3	0.101
Body Mass Index (kg/m ²)	25.7 ± 3.9	25.6 ± 3.8	25.9 ± 4.0	0.585
Gender (Male)	90.9% (n = 251)	93.6 (73)	89.9 (178)	0.336
Race (White)	83.3% (n = 230)	87.17 (68)	81.8 (162)	0.282
Commercial insurance	65.9% (n = 182)	73.1 (57)	63.1 (125)	0.116
Laparoscopic approach	81.2% (n = 224)	80.7 (63)	81.3 (161)	0.917
Unilateral hernia repair	59.1% (n = 163)	60.3 (47)	58.6 (116)	0.803
Hypertension	34.7% (n = 94)	29.5 (23)	38.4 (73)	0.246
Obstructive Sleep Apnea	9.7% (n = 27)	6.4 (5)	11.1 (22)	0.237
Type 2 Diabetes Mellitus	12.7% (n = 35)	6.4 (5)	15.2 (30)	0.049

*P value determined with a confidence interval of 95% ($\alpha = 0.05$).

surgery (group 1), while the remaining 71.7% (N = 198) did not (group 2). Male and White patients composed 90.9% (N = 251) and 83.3% (N = 230) of our total population, respectively. Type 2 diabetes mellitus was present in 12.7% of our patients, while HTN was present in 34.7%. The entire patient cohort mean age was 60.5 ± 14.5 years. Most of the hernia repairs were approached laparoscopically (81.2%; N = 224) and reported a collective POUR incidence of 7.6% (N = 21). **Table 1** presents the common demographics and comorbidities.

All pre-operative common demographics and comorbidities were statistically similar (**Table 2**), with the exception of T2DM, which was higher in group 2 ($P = .049$). In terms of POUR, group 1 had a significantly higher incidence rate in comparison to group 2 (14.1% versus 5.1%; confidence interval [CI]: 95%, $P = .01$). Intraoperative fluid administration, early readmission rate, and LOS were all

similar for both groups (CI: 95%, $P = .569$; 0.920; 0.067, respectively).

DISCUSSION

Inguinal hernia repair is the most common surgery in the US, with more than 10.5 million procedures performed each year.¹¹ Most herniorrhaphies are conducted in the outpatient setting and it has been associated with low morbidity rates. Although there is an ongoing lack of consensus on the definition of POUR, it has been generalized as the inability to spontaneously and adequately empty the bladder.³ Reported incidence rates of POUR are heterogeneous, ranging from 0.37 to 22%.^{1,2,6} While POUR is regarded as a minor complication, POUR following herniorrhaphy can be a significant source of patient morbidity.¹² It has been well established that POUR causes

Table 2.
Postoperative Outcomes

	TAP Block (Group 1)% (N = 78)	Non-TAP Block (Group 2)% (N = 198)	p Value*
ASA score	2.0 ± 0.6	2.1 ± 0.7	0.118
POUR	14.1 (11)	5.1 (10)	0.011
LOS (days)	0.4 ± 0.2	0.6 ± 0.6	0.067
Overall POUR	7.6 (21)		
Intraoperative fluids (mL)	1120.8 ± 384.1	1157.5 ± 515.9	0.569
Early readmission	16.7 (13)	17.2 (34)	0.920

TAP, transabdominal plane; ASA, American Society of Anesthesiologists; POUR, postoperative urinary retention; LOS, length of stay.

*P value determined with a confidence interval of 95% ($\alpha = 0.05$).

significant discomfort, pain, and can often lead to anxiety. The aim of this study was to determine if pre-operative transverse abdominis plane (TAP) block increases the incidence of POUR.

Age and history of benign prostatic hyperplasia are some of the most important risk factors for developing POUR, whilst anesthesia time and opioid consumption are considered relevant modifiable factors.^{1,4-6} Further identified risk factors for POUR include both patient and operative variables, not limited to patient age, BMI, medical history, intraoperative fluid volume, opioid consumption, and bilateral herniorrhaphy.^{1,4,6} Moreover, there are insufficient comparative trials comparing rates of POUR associated with laparoscopic and open techniques.¹⁶ Postoperative urinary retention after inguinal hernia repair has been reported in up to 22% of cases.^{1,2} This is comparative to previously reported incidences.

Most procedures in both groups were laparoscopic (group 1: 80.7% [N=63]; group 2: 81.3% [N=161]), and the repair was unilateral (group 1: 60.3% [N=47]; group 2: 58.6% [N=116]). This observation suggests that, in regard to POUR incidence rates, the postoperative complication will seemingly occur in patients undergoing a laparoscopic, unilateral IHR. Similarly, an age over 50 years, male gender, and a White race seem to follow the same tendency. This, however, is merely an observation that deems a multivariate analysis.

Postoperative pain after inguinal hernia repair affects between 0 and 43% of patients.¹⁴ As per the international guidelines for groin hernia management, groin herniorrhaphy postoperative pain prevention measures include the use of pre-operative and intraoperative local anesthetic infiltration and/or pre-operative or intraoperative field block and paravertebral block and conventional nonsteroid anti-inflammatory drugs or selective cyclooxygenase 2 inhibitors.¹⁵ TAP block is a regional anesthetic technique which blocks neural afferents from the anterolateral abdominal wall.¹⁶ This preventive measure has proven to be superior to placebo or no treatment for the reduction of early postoperative pain scores and the necessity of supplementary postoperative analgesics.¹⁷⁻²¹

TAP block was performed to identify its impact on the incidence rate of POUR. Seventy-eight inguinal hernia repairs that had TAP block before surgery were identified, and these patients were subsequently matched with 198 non-TAP block patients. Comorbidities and pre-operative demographics were statistically similar with the exception of T2DM (higher in group 2). Although T2DM has been identified as an independent risk factor for POUR, there

were few patients with both POUR and T2DM in our population to draw any conclusive statements. The mean incidence of POUR in our TAP block groups was significantly higher than the control group (14.10% vs 5.1%).

The best perioperative pain management for groin hernia repairs, including inguinal hernias, has been examined in an international consensus from both the Americas Hernia Society (AHS) and the European Hernia Society (EHS). Five randomized controlled studies have demonstrated strong evidence for perioperative inguinal field blocks and wound infiltration in the management of associated postoperative pain.^{7-10,22} Furthermore, other clinical trials assessing the analgesic effects of TAP blockade have shown a positive effect for up to 24 hours postoperatively.²³⁻²⁵ Despite the aforementioned, the quality of the reported randomized controlled trials is heterogenous and there is insufficient evidence on the impact of TAP block in POUR and pain control after inguinal hernia repairs. Winslow and colleagues reported a significant association of increased POUR risk following laparoscopic compared to open repair (7.9 vs 1.1%).¹³ Conversely, meta-analyses of prospective randomized controlled trials of laparoscopic versus open inguinal hernia repairs have disagreed with the previous statement.^{26,27} Despite the controversial evidence, surgical laparoscopic technical aspects may have an inadvertent influence on developing said complication. Hence, some authors have suggested that associated complications with the laparoscopic approach of groin hernias (i.e. transabdominal preperitoneal vs totally extraperitoneal) warrant further attention before establishing updates on clinical guidelines.^{28,29}

Another potential factor that could influence the incidence of POUR is the use of a urinary catheter. As mentioned before, every patient who had a laparoscopic approach received a urinary catheter, whereas no urinary catheter was used in the open cases. Crain N. et al., in a retrospective review of 27,012 hernias, found that although the laparoscopic approach had a higher incidence of POUR, the use of a Foley catheter was not a risk factor for infections or POUR.

Operative times longer than 120 to 240 minutes increase the risk of POUR 3-fold.^{30,31} Similarly, a single institution prospective study observed that for every 10-minute increase in the operative time, an 11% increase in POUR can be expected.⁶ The overall POUR incidence rate for both groups was 7.6% (N = 21). This study showed comparative results on both postoperative comorbidities after surgery and the POUR incidence on patients undergoing TAP block prior to surgery, as the ones

reported in current literature. It is unclear why TAP block could determine POUR, as the block should not affect any of the neural voiding pathways. In fact, the reduction of postoperative narcotic medication should decrease the incidence of POUR. Additional studies should be conducted to understand the relationship, and potential mechanism POUR is most likely the byproduct of the interaction of multifactorial mechanical, physiological, and pathological variables.

Despite these institutional findings, this study entails shortcomings in terms of sample size, double-blinding, and presence of a placebo group. More so, the authors did not take into account some of the reported risk factors for the risk of developing POUR, such as narcotic use and urinary catheter use. Furthermore, this study excluded patients with a history of benign prostate hyperplasia, which could introduce selection bias. However, this study raises the question of whether TAP blockage is a dependent or independent factor in the development of POUR following IHR. It is important to recognize that POUR is most likely a multifactorial phenomenon that remains common following IHR despite the preventive analgesic techniques. Nonetheless, this study can be a relevant step in the reduction of a clinically relevant postoperative complication after inguinal hernia repair.

Due to the heterogeneity in the definition of POUR and the lack of complementing imagery studies to confirm diagnosis, it is likely that this as well as other series in the literature undermine the true incidence of POUR. Due to the exclusion criteria of this study, true POUR incidence rates may have not been captured in its totality in patients who presented to the emergency department. Ultimately, this condition deems further anatomical, physiological, mechanical, and epidemiological understanding to draw finite conclusions on the direct or indirect impact of this technique on POUR incidence rates.

CONCLUSION

In conclusion, our study suggests that TAP block during inguinal hernia repairs may result in an increased risk of developing POUR. Our results are comparable to previous reports on both POUR incidence and TAP block implications during inguinal hernia repairs. Further prospective and randomized controlled studies should be performed to better assess the outcomes and provide adequate evidence-based feedback for future clinical guidelines on pain and complications management after groin hernia repairs.

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