Efficacy of Unilateral Ilioinguinal Transversus Abdominis Plane Block for Alleviation of Catheter-related Bladder Discomfort in Male Patients after Emergence from General Anesthesia: a Prospective, Randomized Controlled Trial

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Research article

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Abstract

Background: Urinary catheterization frequently leads to catheter-related bladder discomfort (CRBD) in male patients after general anesthesia. This prospective cohort trial aimed to prove the efficacy of unilateral ilioinguinal transversus abdominis plane block (TAPB) in attenuating CRBD in male patients. Methods: Male patients with a severe CRBD were randomized to receive unilateral ilioinguinal TAPB with 0.375% ropivacaine 10mL (group T) or intravenous sufentanil 0.15μg/kg (group D). The primary outcomes were the severity of CRBD at 0.5, 1, 2, and 6 hours after treatment, and the other outcomes included the postoperative adverse events related to treatments. Results: The incidence of moderate-to-severe CRBD in group T was significantly lower than in group C at 0.5 hours (11.5% vs 87.4%, P<0.001), 1 hours (7.6% vs 92.3%, P=0.001), 2 hours (7.6% vs 92.3%, P=0.001), and 6 hours (11.5% vs 100%, P<0.001) after treatment. The postoperative incidences of PONV and respiratory depression were decreased significantly in group T compared to group C (P<0.05). Conclusions: Unilateral ilioinguinal TAPB with ropivacaine can decrease the severity of CRBD and reduce the side effects in male patients after general anesthesia as compared to intravenous sufentanil administration. Trial registration: This trial was registered with Clinicaltrials.gov as ChiCTR1900022869 on April 29, 2019, http://www.chictr.org.cn/showproj.aspx?proj=38516. Keywords unilateral ilioinguinal; transversus abdominis plane block; catheter-related bladder discomfort

Introduction

Intraoperative urinary catheterization frequently leads to catheter-related bladder discomfort (CRBD) during the postoperative period, especially in male patients receiving general anesthesia. Different types of surgeries cause CRBD, which occurs predominantly in males with an incidence ranging from 47% to 90%[1]. A severe CRBD usually makes the patient agitated, with behavioral responses such as loud complaints, restless extremity movements and attempts to pull out the urinary catheter in the post-anesthesia care unit (PACU)[2].

CRBD is associated with muscarinic receptors, and anticholinergic agents have been considered as the first line treatment for CRBD[3]. But these medications usually cause dry mouth, facial flushing, and blurred vision. Anesthetics such as sevoflurane, desflurane, tramadol ketamine and dexmedetomidine showed beneficial effects in reducing CRBD as well[4,5,6]. However, administration of these drugs is meanwhile associated with side effects which may cause unpleasant complications and discounted recovery quality. Hence, new and safer techniques or agents are needed in clinical settings.

With the rapid advancement of nerve block in recent years, dorsal penile nerve block and pudendal nerve block have been demonstrated to be effective in decreasing the incidence and severity of CRBD[7,8]. Moreover, efficacy of the transversus abdominis plane (TAP) block has been proven in various types of abdominal surgery[9] but reports that investigate the effects of TAPB in CRBD are unavailable. We hypothesized that TAPB could be employed to reduce CRBD in male patients after general anesthesia with less side effects.

Methods

This prospective, randomized and controlled study was approved by the Research Ethical Committee of the First Affiliated Hospital of Wenzhou Medical University, and written informed consent was obtained from all participants. Before the patients' enrollment, the trial was registered at Chinese Clinical Trial Registry (http://www.chictr.org.cn, ChiCTR1900022869; principal investigator: Xiyue Zhao; date of registration: April 29, 2019).

Patients

Patients with CRBD after various surgeries under general anesthesia between May and September 2019 were enrolled into our study. The severity of CRBD was assessed with a 4-point scale: none (no discomfort when asked); mild (reported by patient only when asked); moderate (reported by patient without being asked and without any behavioral response); or severe (reported by patient independently along with behavioral responses such as flailing limbs, strong vocal response, and attempts to remove the catheter)[5,13,14]. Inclusion criteria were moderate-severe CRBD status, adult male and American Society of Anesthesiologists physical status I–III. Exclusion criteria were histories of urological surgeries, renal insufficiency, prostate hyperplasia, bladder outflow obstruction, neurogenic bladder, over active bladder (>8 times in 24 hours or frequency>3 times in the night), bleeding disorder, and inability to communicate.

Randomization, Concealment, and Blinding

After screening, fifty-two patients were included in our study and randomly divided into intervention group (group T) and control group (group C) by computer. Patients in group T received unilateral TAPB with 0.375% ropivacaine 10mL[10], and patients in group C received intravenous sufentanil 0.15μg/kg. [11,12]. The investigator who assessed the severity of CRBD was blinded to the group allocation.

Outcomes

The primary outcomes were the severity of CRBD at 0.5, 1, 2, and 6 hours after treatment. All patients were questioned about the symptoms of CRBD by investigators in the PACU and surgical ward. The severity of CRBD was scaled using the methods described above.

Other secondary outcomes were evaluated as follows:

1. Sedation: Postoperative sedation was evaluated by the Ramsay sedation scale, which has been well described. Patients with a sedation scale of >4 were considered sedated.[15]
2. Postoperative nausea and vomiting (PONV): PONV was evaluated by a 4-point ordinal scale from 0 to 3, where 0 meant no nausea, 1 meant mild nausea, 2 meant moderate nausea, and 3 meant severe nausea with vomiting.
3. Respiratory depression: Respiratory depression was defined as oxygen saturation < 90% or respiratory frequency < 8 bpm).

Sample size calculation and randomization

The sample size was planned and calculated according to alleviation of the severity of CRBD in the PACU. The incidence of moderate-to-severe CRBD at 0.5 hour in group T and group C was 11.5% and 84.7%, respectively. Giving α=0.05 and β=0.90, 20 patients in each group were required. Considering a possibility of dropout rate, 26 patients in each group were enrolled.

Statistical analysis

All analyses were conducted using SPSS software (version 17.0). Continuous data were expressed as the mean ± standard deviation (SD), and enumeration data were expressed as a number or ratio. The severity of CRBD was analyzed by the $\chi 2$ test. Comparison of continuous data between two groups were performed by t test. A P value of <0.05 was considered significant.

Results

Study Population

Sixty-four patients were assessed for eligibility in this study, and 4 patients were excluded (Figure 1). After randomization, 4 patients in both groups were excluded because the patients were not compliant with treatment. Therefore, a total of 52 patients were enrolled and analyzed. The patient characteristics were comparable between two groups (Table 1).

Outcomes

The incidence of moderate-to-severe CRBD in group T was significantly lower than in group C at 0.5 hours (11.5% vs 87.4%, P<0.001), 1 hours (7.6% vs 92.3%, P=0.001), 2 hours (7.6% vs 92.3%, P=0.001), and 6 hours (11.5% vs 100%, P<0.001) after treatment (Table 2).

There were no differences in deep sedation in PACU between the two groups (P>0.05), but the incidences of PONV and respiratory depression were decreased significantly in group T compared with group C (P<0.05) (Table 3).

Discussion

This study demonstrated that unilateral ilioinguinal TAPB with ropivacaine can be used as a rescue therapy for moderate or severe CRBD in male patients, it not only reduced the severity of CRBD but also reduced the occurrence of the side effects associated with opioid analgesic drugs for CRBD, including PONV and respiratory depression.

Tramadol, which activates μ-opioid receptors and inhibit M1and M3 muscarinic receptors[16], is commonly used to decrease the incidence and severity of CRBD[1,7,17]. However, as a rescue medication for severe CRBD, tramadol has relatively slow onset and easily causes nausea and vomiting[16]. Here, we chose

equivalent dose of sufentanil instead of tramadol as a control medication, which rapidly relieves CRBD, to test our hypothesis that unilateral ilioinguinal TAPB can provide better effects in reducing CRBD with less side effects.

TAPB was first introduced by Rafi as a landmark-based technique via the triangle of Petit in 2001[18]. TAPB is widely applied in recent years and has become technically easier and safer to perform due to ultrasound guidance... In the field of urology, TAPB has been used as a multi-modal analgesic strategy to improve postoperative pain and reduce opioid consumption[19]. Upon analyzing ten randomized clinical trials, De Oliveira GS Jr found that TAPB can reduce pain after laparoscopic surgical procedures[20]. However, there is no evidence supporting the use of TAPB as a rescue technique for CRBD.

Mechanically, CRBD is mediated by M3 muscarinic receptor activation, which induces involuntary contractions of the bladder detrusor[8]. The bladder receives the pelvic nerves from S2~S4 spinal nerves and the hypogastric nerves from T11~L1 and L2 spinal nerves, thus, blockage of these nerves would theoretically relieve CRBD. Growing evidence has demonstrated TAPB, which mainly covers T12 and L1, is effective for various abdominal surgeries, but its analgesic effect is limited to the abdominal wall[21], and less effective in addressing visceral pain[22]. However, our present study found that unilateral ilioinguinal TAPB with ropivacaine can exert better effects in decreasing the severity of CRBD than intravenous sufentanil, but the exact mechanisms were unexplored. The authors suspected that the unilateral ilioinguinal TAPB may take effect by directly blocking ilioinguinal-iliohypogastric nerve, or by permeation of local anesthetics through transverse abdominis into transversalic fascia, which spread to the much wider retroperitoneal space blocking the nerves[23]. Moreover, our results demonstrated that TAPB attenuated the severity of CRBD, but had no effects on incidence of CRBD. After TAPB performance, most patients still complained of mild CRBD. It may imply that the simple TAPB was incomplete , particularly it did not block the dorsal penile nerve which covers glans penis, and extra dorsal penile nerve block may be considered as a supplement therapy[7].In addition, we found that unilateral ilioinguinal TAPB shared the similar desired effect with bilateral ilioinguinal TAPB in the preliminary test (data not shown). Thus, we decided to perform unilateral block which was more convenient and practical. Besides, we found the incidences of PONV and respiratory depression significantly decreased in patients who received TAPB, which suggested that TAPB could be a safe therapy in treating CRBD.

There are some limitations to this study. First, the efficacy of TAPB in reducing CRBD was found, but theoretical foundation is still missing. Second, a double-blind could not be achieved due to the completely different route of administration . Third, CRBD predominately occurs in male patients and hence the sample size of female patients who suffered from CRBD was not enough.

In summary, unilateral ilioinguinal TAPB with ropivacaine can decrease the severity of CRBD and reduce the side effects in male patients after general anesthesia as compared to intravenous sufentanil administration.

Abbreviations

CRBD = Catheter-related Bladder Discomfort; ChiCTR = Chinese Clinical Trial Registry; PACU = Post-anesthesia care unit; PONV = Postoperative nausea and vomiting; SD = standard deviation; TAPB = Transversus abdominis plane block.

Declarations

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Availability of data and materials

The datasets generated and/or analyzed during the current study are not publicly available due to them containing information that could compromise research participant privacy, but might be made available from the corresponding author on reasonable request.

Authors' contributions

Study concept and design: XYZ and LC. Acquisition of data: YH and XYZ. Analysis and interpretation of data: LRW. Drafting of the manuscript: XYZ and LRW. Statistical analysis: LC. Administrative, technical, and material support: XYZ and LC. XYZ and LRW were co-first authors and contributed equally to this study. All authors have read and approved the manuscript for publication.

Ethics approval and consent to participate

This study was approved by the ethics committee of the First Affiliated Hospital of Wenzhou Medical University and written informed consent was obtained from all patients according to international guidelines.

Consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.

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Tables

Table 1. Clinical and Surgical Characteristics

	group T (n=26)	group C (n=26)	*p*-Value
Age(y)	65 ±8	63 ±13	0.573
BMI (kg/m^2)	23.8±2.5(21.3-26.1)	22.6±3.2(19.4-25.8)	0.192

Data are expressed as mean ± standard deviation. Group T, TAP block; group C, intravenous sufentanil.

Table 2. Severity of Catheter-Related Bladder Discomfort

Severity of CRBD	group T (n=26)	group C (n=26)	*p*-Value
Post-treatment hour0.5			0.000
None	5(19.2)	0(0.0)	
Mild	18(69.2)	4(15.4)	
Moderate	1(3.8)	20(77)	
Severe	2(7.7)	2(7.7)	
Post-treatment hour1			0.001
None	5(19.2)	0(0.0)	
Mild	19(73.1)	2(7.7)	
Moderate	1(3.8)	19(73.1)	
Severe	1(3.8)	5(19.2)	
Post-treatment hour2			0.001
None	5(19.2)	0(0.0)	
Mild	19(73.1)	2(7.7)	
Moderate	1(3.8)	19(73.1)	
Severe	1(3.8)	5(19.2)	
Post-treatment hour6			0.000
None	2(7.7)	0(0.0)	
Mild	21(80.8)	0(0.0)	
Moderate	1(3.8)	21(80.8)	
Severe	2(7.7)	5(19.2)	

Data are expressed as number (%).Group T, TAP block; group C, intravenous sufentanil. Data were compared using the $\chi 2$ test or Fisher exact test.

able 3. Incidences of Side Effects

	group T (n=26)	group C (n=26)	*p*-Value
postoperative nausea and vomiting	1(3.8)	3(11.5)	0.610
Respiratory depression	0(0.0)	8(30.8)	0.002
Sedation	0(0.0)	7(26.9)	0.005

ata are expressed as number (%). Group T, TAP block; group C, intravenous ıfentanil.

Figures

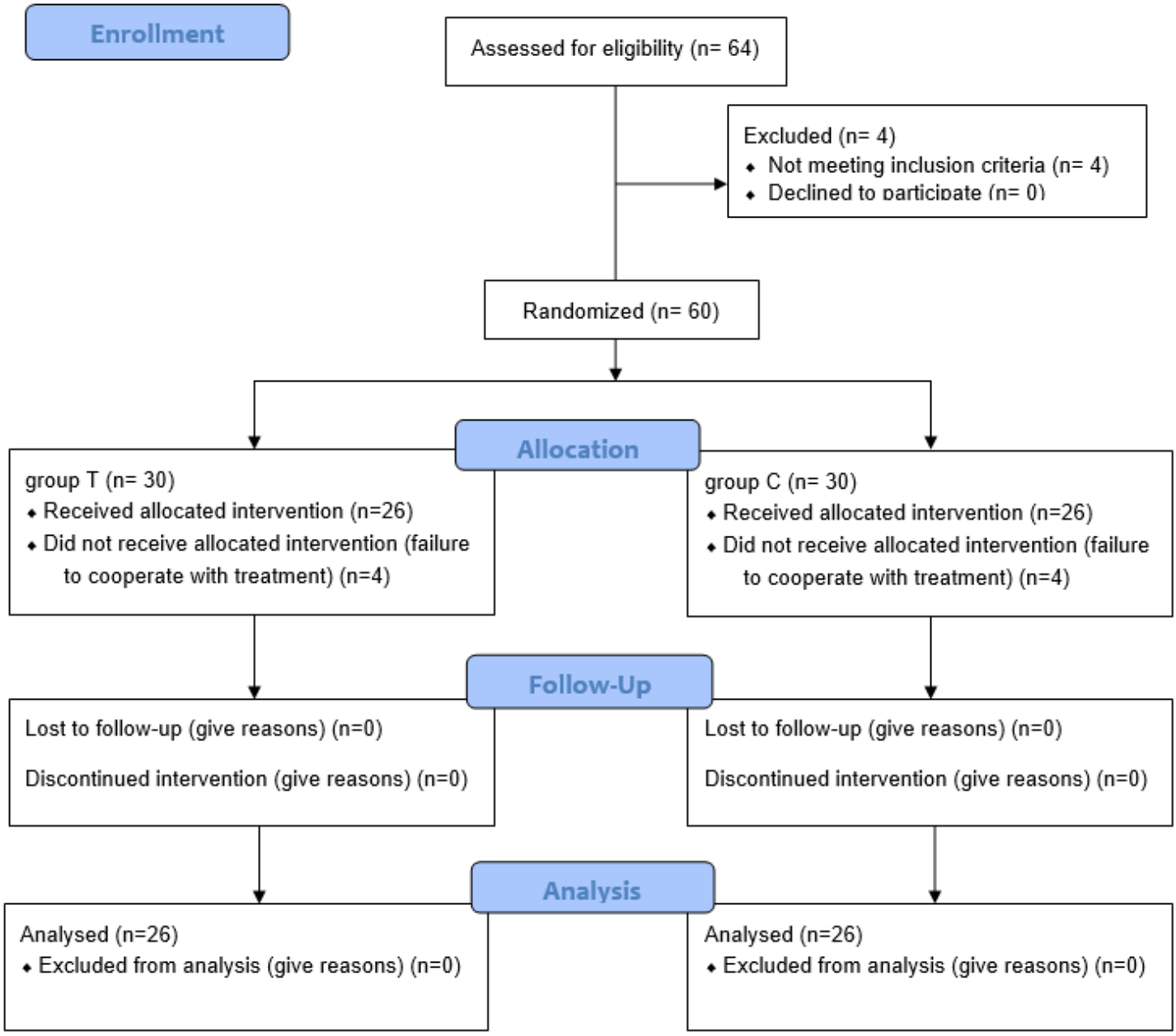

Figure 1

CONSORT flow diagram of patients included in the study. Group T comprised patients who received unilateral TAP block with 0.375% ropivacaine 10mL, group C comprised patients who received intravenous sufentanil 0.1μg/kg. CONSORT indicates Consolidated Standards of Reporting Trials.