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Efficacy of USG Guided Obturator Block to Prevent Obturator Jerk during TURBT Operation

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Abstract **Original Research Article**

Background: The obturator nerve, from lumbar segments L2-L4, innervates thigh adductor muscles. During transurethral procedures, its accidental stimulation can cause "obturator jerks," risking complications like bladder perforation. To prevent this, obturator nerve blocks (ONB) are used with spinal anesthesia in TURBT, with ultrasound-guided ONB preferred for precision and safety. ***Aim of the study:*** This study aims to evaluate the efficacy of ultrasound-guided obturator nerve blocks in preventing obturator jerk, thereby enhancing surgical safety and outcomes for patients undergoing TURBT operation. ***Methods:*** This prospective observational study was conducted at the Department of Surgery, Shahid Sk. Abu Naser Specialized Hospital, Khulna Medical College Hospital and two private Hospitals, Khulna, Bangladesh from January 2019 to December 2023. Using purposive sampling, 65 patients with endovesical tumors on the lateral and posterolateral bladder walls scheduled for TURBT were recruited. Inclusion criteria were patients aged 31-70 with ASA I-III classification. Exclusion criteria included inguinal lymphadenopathy, obturator nerve injury, coagulation disorders, infection, or allergy to local anesthetics. Spinal block anesthesia was administered, and the obturator nerve was visualized via ultrasound for precise anesthetic deposition. Data on demographics, surgery details, and outcomes were collected and analyzed using SPSS version 26. ***Result:*** The study included 65 participants with a mean age of 55.58±6.75 years. The majority were males (70.77%) and aged 51–60 years (44.62%). The mean BMI was 23.41±2.36 kg/m², with most patients classified as ASA II (63.08%). The obturator nerve block procedure involved identifying key thigh muscles and the anterior branch of the obturator nerve. Motor block onset averaged 13.67±1.25 minutes, with a success rate of 78.46%. Surgery duration averaged 38.18±5.79 minutes, with 76.92% completed within 30–45 minutes. Postoperative complications occurred in 63.08% of cases, predominantly bleeding, with high satisfaction rates from both patients (87.69%) and surgeons (93.85%). ***Conclusion:*** The study shows that ultrasound-guided obturator nerve block (USG-ONB) is highly effective and safe for preventing obturator jerk during TURBT operations, with a 78.46% motor block success rate, high satisfaction rates (87.69% for patients, 93.85% for surgeons), and reduced complications, enhancing surgical safety and efficiency.

Keywords: Efficacy, USG Guided, Obturator Block, Obturator Jerk and TURBT.

INTRODUCTION

The obturator nerve originates from the second, third, and fourth lumbar segments and descends into the pelvis, passing over the psoas major muscle before entering the medial aspect of the thigh to innervate the adductor muscles. Its anatomical proximity to the bladder wall makes it susceptible to accidental stimulation during transurethral procedures. This inadvertent stimulation can cause adductor muscle spasms, commonly known as an "obturator jerk," which may lead to severe complications such as bladder perforation, excessive bleeding, or interruption of the procedure [1]. To mitigate this, selective obturator nerve blocks (ONB) are frequently used alongside spinal anesthesia during transurethral resection of bladder tumors (TURBT) [2]. The obturator nerve block is an essential regional anesthesia technique that prevents these spasms by blocking motor and sensory transmission through local anesthetic injection around

the nerve [3]. This enhances surgical conditions, preventing involuntary muscle contractions and improving patient safety during TURBT [4]. Bladder cancer, for which TURBT is a primary treatment, is the tenth most common cancer worldwide, with approximately 573,000 new cases and 213,000 deaths annually [5]. Globally, bladder cancer is more prevalent in older populations, particularly males, with over half of cases occurring in individuals over 75 years old [6]. TURBT is essential for both diagnosing and treating bladder cancer, allowing for histopathological evaluation and local tumor control. It also provides crucial information on tumor staging and muscle invasiveness, guiding subsequent treatments such as intravesical therapy, systemic chemotherapy, or radical cystectomy [5,7]. However, successful TURBT requires a stable, pain-free operative field to minimize patient movement and complications [8]. The obturator jerk significantly increases the risk of bladder perforation, particularly when resecting tumors on the lateral bladder wall, highlighting the need for effective preventive strategies [9]. Traditionally, general anesthesia with muscle relaxants has been used to prevent adductor spasms, but this approach may not be suitable for all patients and can have limitations [1]. Spinal anesthesia, supplemented with bilateral obturator nerve blocks, has been proposed as a more effective alternative, ensuring better prevention of obturator nerve stimulation compared to other methods, such as reducing electro-coagulation voltage or incomplete bladder filling, which may compromise the completeness of tumor resection [2]. Various techniques have been developed for blocking the obturator nerve, including the “3-in-1” block, which aims to simultaneously block the femoral, lateral femoral cutaneous, and obturator nerves, though its efficacy for obturator nerve block remains debated [10]. The conventional, landmark-based techniques for obturator nerve blocks rely on surface anatomy and often use nerve stimulation. However, these methods are associated with high variability and potential complications due to their "blind" nature [11-14]. In recent years, ultrasound-guided obturator nerve block (USG-ONB) has emerged as a more precise and safer alternative. This technique allows for real-time visualization of the nerve, reducing the risk of damaging adjacent structures and ensuring the accurate spread of the anesthetic solution [12-14]. Given the potential for significant complications associated with obturator nerve stimulation during TURBT, the development and validation of effective nerve block techniques are crucial. This study aims to evaluate the efficacy of ultrasound-guided obturator nerve blocks in preventing obturator jerk, thereby enhancing surgical safety and outcomes for patients undergoing TURBT operation.

METHODOLOGY & MATERIALS

This rigorously conducted prospective observational study was carried out at the Department of Surgery, Shahid Sk. Abu Naser Specialized Hospital, Khulna Medical College Hospital and two private Hospitals, Khulna, Bangladesh from January 2019 to December 2023. A purposive sampling strategy was employed to recruit a well-defined cohort of 65 patients presenting with echographic evidence of endovesical tumors located on the lateral and posterolateral walls of the bladder and scheduled for TURBT. The inclusion of participants followed meticulously defined criteria to enhance the reliability and clinical relevance of the findings.

- **Inclusion Criteria:** Patients aged 31 to 70 years with echographic evidence of an endovesical tumor localized to the lateral or posterolateral bladder wall, requiring TURBT, and classified as ASA I–III were eligible for inclusion.

- **Exclusion Criteria:** Patients were excluded if they presented with any of the following: inguinal lymphadenopathy, preexisting obturator nerve injury, coagulation disorders, localized infection or hematoma at the injection site, documented allergy to local anesthetic agents.

Surgical Approach

During preoperative evaluations, patients were thoroughly assessed, and the procedure was explained in detail. No premedication or sedation was administered. Anesthesia was achieved using a spinal block performed with a 25-gauge Quincke needle inserted at the L3–L4 or L4–L5 interspace with the patient in a seated position. A dose of 3 mL of 0.5% hyperbaric bupivacaine was administered, targeting anesthesia at the T10 level. Patients were positioned supine with the leg slightly abducted (approximately 30°) and externally rotated. The inguinal region was disinfected using 2% chlorhexidine, and an ultrasound (US) probe (5–10 MHz linear transducer, Aloka Prosound SSD 3500SX) was employed under sterile conditions to visualize the obturator nerve (ON). The nerve’s anterior and posterior divisions were identified within the muscle compartments (adductor longus, adductor brevis, and adductor magnus) approximately 2–3 cm below the inguinal crease. A 22-gauge, 80-mm insulated stimulating needle was advanced under US guidance, moving from lateral to medial, to reach the anterior division of the obturator nerve, located between the adductor longus and adductor brevis muscles. Following negative aspiration, 5 mL of 0.5% bupivacaine was administered. The needle was then repositioned to target the posterior division of the nerve between the adductor brevis and magnus muscles, where an additional 5 mL of 0.5% bupivacaine was injected. Real-time visualization ensured precise deposition of the anesthetic. Motor blockade was assessed five minutes post-injection and at subsequent intervals (10 and 15 minutes) using a grading system:

- 0 = Adductor spasm.
- 1 = Reduced adductor spasm (approximately 50% reduction).
- 2 = No adductor spasm.

A score of 2 was considered indicative of a successful block. Following confirmation of the block, the surgeon initiated TURBT.

Data Collection

Data were systematically gathered using a structured questionnaire designed to capture a broad range of variables, including demographic characteristics (age, gender, BMI), ASA status, ease of block approach, number of needle passes, surgery duration, complications, and satisfaction rates. Prior to enrollment, all participants were thoroughly briefed on the study's objectives, methods, and potential implications. Informed written consent was obtained, ensuring voluntary participation. Baseline demographic and clinical data were kept strictly confidential, and the study was approved by the institutional ethics review board, ensuring adherence to ethical research principles.

Statistical Analysis

The collected data were meticulously organized into tables and figures for clarity and thorough interpretation. Statistical analysis was performed using SPSS version 26. Continuous variables were summarized as mean ± standard deviation (SD), while categorical variables were presented as frequencies and percentages.

RESULT

The study included 65 participants. Figure 1 illustrates the anatomical structures involved in the obturator nerve block procedure. It shows key muscles, including the adductor longus (AL) at the top, the adductor brevis (AB) below it, and the pectineus (PEC) muscle on the right side, indicating the medial region of the thigh. The anterior branch of the obturator nerve is identified by the arrow, situated between the muscles. Triangles mark the needle's trajectory, demonstrating its path toward the nerve. Table 1 states the demographic characteristics of the study populations. The mean age of participants in this study was 55.58 ± 6.75 years. The majority of patients were in the 51–60 age group (44.62%), followed by 61–70 years (24.62%), 41–50 years (18.46%), and 31–40 years (12.31%). The population was predominantly male (70.77%), with females making up 29.23%. The mean BMI was 23.41± 2.36 kg/m², and the majority were classified as ASA II (63.08%), followed by ASA III (30.77%), and ASA I (6.15%) (Table 1). Motor block characteristics revealed a mean onset time of 13.67± 1.25 minutes, and the block performance time averaged 3.26± 0.36 minutes. The motor block success rate was 78.46%, with 51 out of 65 participants achieving a successful block (Table 2). Regarding the ease of approach for the obturator nerve block, 69.23% patients found the procedure easy. The mean number of needle passes was 2.84 ± 1.21, with 30.77% patients requiring between three and ten needle passes (Table 3). The mean surgery duration was 38.18± 5.79 minutes, with 76.92% of surgeries completed within 30–45 minutes. A small proportion of surgeries were completed in less than 30 minutes (16.92%), while 6.15% exceeded 45 minutes. Postoperative complications, predominantly bleeding, were observed in 63.08% of cases, with 29.23% of patients requiring blood transfusions. In contrast, 36.92% of patients experienced no complications (Table 4). Table 5 presented that satisfaction rates were high, with 87.69% of patients and 93.85% of surgeons expressing positive feedback on the procedure.

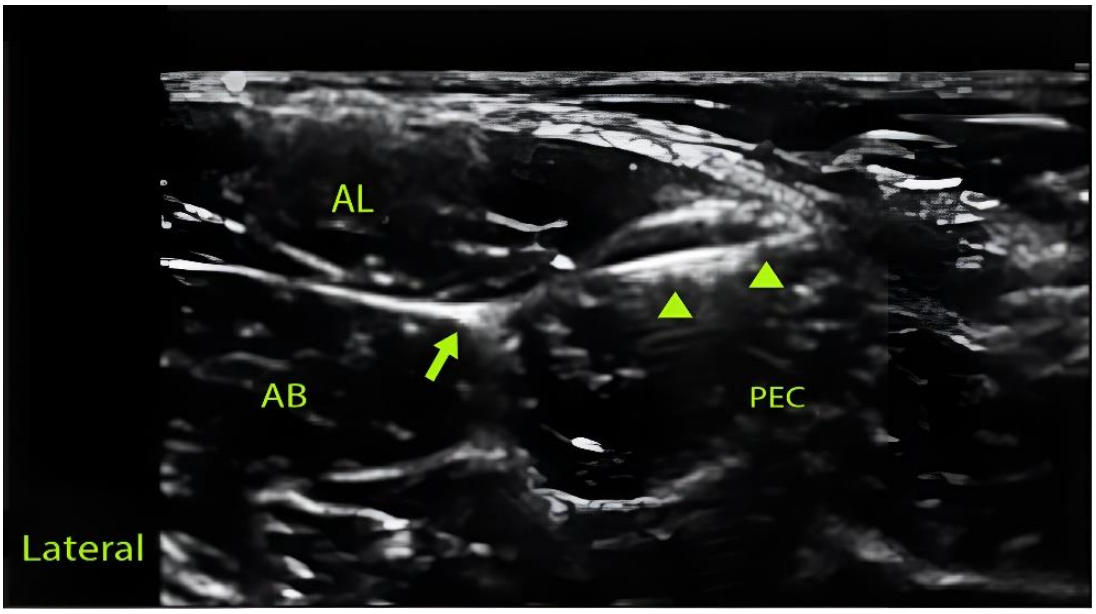

Figure 1: Ultrasound image of the obturator nerve. AL: adductor longus muscle; AB: adductor brevis muscle; PEC: pectineus muscle; Triangles point at the needle; The arrow indicates the location of the anterior branch of the obturator nerve

Table 1: Demographic characteristics of the study population (N=65)

Variables	Frequency (N)	Percentage (%)
Age (years)		
31-40	8	12.31
41-50	12	18.46
51-60	29	44.62
61-70	16	24.62
Mean±SD	55.58±6.75	
Gender		
Male	46	70.77
Female	19	29.23
BMI (kg/m^2)		
Mean±SD	23.41±2.36	
ASA status		
I	4	6.15
II	41	63.08
III	20	30.77

Table 2: Descriptive statistics of motor block onset time, block performance time, and motor block success rate (N=65)

Variables	Frequency (N)	Percentage (%)
	Mean±SD	
Motor block onset time (min)	13.67±1.25	
Block performance time (min)	3.26±0.36	
Motor block success rate	51	78.46

Table 3: Distribution of ease of approach for obturator nerve block and number of needle passes (N=65)

Variables	Frequency (N)	Percentage (%)
Ease of approach to perform block		
Easy (≤2)	45	69.23
Difficult (3-10)	20	30.77
Number of needle passes		
Mean±SD	2.84±1.21	

Table 4: Surgery duration and postoperative complications in patients (N=65).

Variables	Frequency (N)	Percentage (%)
Duration of surgery		
<30 minutes	11	16.92
30-45 minutes	50	76.92
>45 minutes	4	6.15
Mean±SD	38.18±5.79	
Complications		
Bleeding	41	63.08
No complication	24	36.92
Blood transfusion	19	29.23

Table 5: Satisfaction rate between patient and surgeon (N=65).

Variables	Frequency (N)	Percentage (%)
Patient	57	87.69
Surgeon	61	93.85

DISCUSSION

Peripheral nerve blocks are cost-effective anesthetic techniques that provide anesthesia while minimizing the need for airway instrumentation and avoiding the hemodynamic implications associated with general anesthesia. These techniques have gained popularity due to increased patient satisfaction, growing demand for economical anesthesia solutions, and favorable postoperative recovery profiles [15]. A widely accepted approach for performing peripheral nerve blocks involves the use of ultrasound guidance to accurately position local anesthetics (LA) adjacent to anatomical structures with known proximity to peripheral nerves, such as fascia and vasculature [16,17].

When a nerve is challenging to visualize using ultrasound, nerve stimulation techniques can be employed to direct the needle tip towards the nerve. This method is particularly useful for nerves that are both difficult to image and stimulate, such as the obturator nerve (ON) [18]. During transurethral resection of bladder tumor (TURBT), electrical stimulation of the obturator nerve can provoke an obturator reflex, resulting in an involuntary contraction of the adductor muscles. This sudden jerk can lead to complications such as bladder perforation, significant bleeding from deep cuts, incomplete tumor resection, or even tumor dissemination [19,20]. Various strategies have been proposed to mitigate these risks, including the use of general anesthesia with muscle relaxants, obturator nerve blocks (ONB), superficial tumor resection using low electrical currents, and bipolar resectoscopes [21,22]. Advancements in ONB techniques over the past decade have introduced ultrasound-guided (US-guided) interfascial injections as an alternative to traditional methods. These injections are performed either before or after the division of the obturator nerve, offering improved precision and efficacy [23,24]. The present study evaluated the efficacy of US-guided ONB in preventing obturator jerk during TURBT. The study cohort had a mean age of 55.58 years, with a predominance of male patients, consistent with findings by Tabassum *et al.,* (2023) [25]. Motor block was assessed at intervals of 5, 10, and 15 minutes following LA injection. Previous research by Manassero *et al.,* (2012) compared interfascial injections with neurostimulation-assisted ONB under ultrasound guidance, reporting a motor block onset time of 7.2 ± 3.6 minutes in the US-guided group [18]. Similarly, Taha (2012) evaluated a proximal US-guided ONB technique, noting a median motor block onset time of 4 minutes (95% confidence interval: 3–5 minutes) [26]. In this study, the mean block performance time was 3.26 ± 0.36 minutes, aligning with Manassero *et al.,* (2012), who reported a performance time of 1.6 minutes, and Sinha *et al.,* (2009), who documented a similar time of 2 minutes using US-guided ONB without nerve stimulation [18,24]. Intraoperative outcomes revealed that 63.08% of patients experienced bleeding, and 29.23% required blood transfusions, consistent with findings by Tabassum *et al.,* (2023), where 60% of patients reported bleeding, and 20.9% required transfusions [25]. Patient satisfaction in the current study was 87.69%, while surgeon satisfaction reached 93.85%. These results corroborate observations by Thallaj and Rabah (2011), who reported high levels of both patient and surgeon satisfaction when employing US-guided ONB in transurethral surgeries [21]. The study's single-center design confines its applicability to similar institutional settings, potentially overlooking variations in equipment, expertise, or patient demographics. The use of a purposive sampling method may introduce selection bias, as the cohort was restricted to patients with specific tumor locations and characteristics.

CONCLUSION AND RECOMMENDATIONS

The study demonstrates that ultrasound-guided obturator nerve block (USG-ONB) is a highly effective and safe method for preventing obturator jerk during TURBT operations. With a motor block success rate of 78.46%, minimal block performance time, and high patient and surgeon satisfaction rates (87.69% and 93.85%, respectively), the technique offers significant advantages over traditional approaches. The real-time visualization provided by ultrasound ensures precise anesthetic delivery, reducing complications such as bleeding and the need for blood transfusions while enhancing surgical safety and efficiency. These findings underscore the clinical utility of USG-ONB as a preferred anesthetic strategy in transurethral bladder tumor resections, particularly in patients at risk of obturator nerve stimulation.

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