# Efficacy of Dexmedetomidine as an Adjuvant in Obturator Nerve Block for Postoperative Pain in Patients Undergoing Transurethral Surgeries Under Spinal Anesthesia

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## ABSTRACT

**Background:** Bladder cancer is the second most common genitourinary cancer. The standard treatment for superficial bladder tumors is intravesical transurethral resection. Obturator nerve block (ONB) enhances analgesia quality in bladder surgeries. Dexmedetomidine (DEX) can extend the duration of sensory and motor nerve blocks.

**Aim:** To evaluate the effect of adding DEX to a local anesthetic on the efficacy of ONB in reducing postoperative pain compared to ONB with a local anesthetic alone.

**Patients and Methods:** This randomized study was carried out on 56 cases scheduled for transurethral surgery. They were randomly divided into two groups: Group A (n=28) received regional anesthesia and bilateral ONB with DEX (2 µg/kg), while Group B (n=28) received regional anesthesia and bilateral ONB only. Pain was assessed using a visual analogue scale (VAS) at various intervals up to 24 hours postoperatively. Additionally, time to first analgesic request, total analgesic consumption in 24 hours, sensory and motor block duration, adverse effects, and incidence of the adductor reflex were recorded.

**Results:** Group A had significantly lower VAS scores at 6, 8, and 12 hours postoperatively (P-values =0.045, 0.041, 0.030, respectively). Sensory and motor block duration was longer in Group A (P-value =0.01), with a delayed time to first analgesic request (P-value <0.001) and reduced nalbuphine use in 24 hours (P-value <0.001).

**Conclusion:** Adding DEX to a local anesthetic in ONB improves postoperative pain management, resulting in lower pain scores, reduced analgesic requirements, and extended analgesic duration.

**Keywords:** Dexmedetomidine, Obturator nerve block, Transurethral Surgeries.

## INTRODUCTION

Bladder cancer ranks as the 2nd most prevalent malignancy within the genitourinary system, comprising 7% of newly diagnosed cancers in men and 2% in women [1]. The primary approach for treating superficial bladder tumors is transurethral resection, often supplemented with intravesical therapy. For bladder tumors, whether superficial or muscle-invasive, urethrocystoscopy combined with transurethral resection serves a dual role in both diagnosis and treatment [2].

One significant challenge encountered during the procedure is the occurrence of an obturator jerk, a sudden, involuntary contraction of the adductor muscle group triggered by electrical stimulation of the obturator nerve. This reflex can hinder the complete resection of tumors located on the inferolateral bladder wall. Implementing an obturator nerve block (ONB) can enhance analgesic efficacy during bladder surgeries [3].

Dexmedetomidine (DEX), a potent α2-agonist, exhibits superior pharmacokinetic and pharmacodynamic profiles compared to clonidine [4,5]. Its intravenous administration has been shown to reduce the need for opioids and alleviate postoperative pain when compared to a placebo [6,7]. Recent meta-analyses have confirmed the enhanced safety and effectiveness of perineural DEX combined with local anesthetics in brachial plexus blocks, compared to using local anesthetics alone [8-10].

Hence, the goal of this trail is evaluating the effect of adding DEX to a combination of bupivacaine and lidocaine on the efficacy of ONB in managing postoperative pain following transurethral procedures, in comparison to ONB using only bupivacaine and lidocaine.

## PATIENTS AND METHODS

This randomized clinical study included 56 cases, aged 18 to 60 years, categorized as ASA I-III, who were scheduled for transurethral surgery under regional anesthesia at Cairo University Hospitals from February 2024 till August 2024.

Exclusion criteria included patients classified as ASA IV, those with significant cardiac conditions (such as impaired contractility with an ejection fraction (EF) below 50%, significant arrhythmias, heart block, or severe valvular disease), or those with known allergies to the study medications.

Prior to surgery, a comprehensive medical history was obtained for all participants, including details on past medical conditions, anesthesia history, current medications, and dental status. Preoperative laboratory tests were conducted, encompassing a CBC, coagulation profile, renal function tests, liver enzyme levels, and fasting blood glucose. Additional investigations were performed as needed. An airway assessment was also completed.

Participants were instructed to fast for at least six hours before the procedure. Following history-taking and review of laboratory results, a 20-gauge intravenous



Received: 01/09/2024
Accepted: 03/11/2024

catheter was inserted into the dorsum of the non-dominant hand. A lactated Ringer's solution infusion was initiated at a rate of 5 mL/kg/h. Baseline measurements, including electrocardiogram, peripheral oxygen saturation, heart rate, non-invasive arterial blood pressure, and respiratory rate, were measured prior to administering the block.

Under aseptic conditions, all patients received a subarachnoid block at the L3–4 or L4–5 interspace while seated. A total of 3 mL (15 mg) of heavy 0.5% bupivacaine was injected into the subarachnoid space. Afterward, patients were positioned supine, and a 5-minute interval was allowed the anesthetic to take effect, during which sensory levels were evaluated using a pinprick or cold stimulus, and motor block assessment employed a modified Bromage scale, aiming for a sensory level of T10.

**Patients were then randomly assigned into two groups:**

**Group A**: Received regional anesthesia combined with bilateral ONB using 10 mL of 2% preservative-free lignocaine, 5 mL of 0.5% preservative-free bupivacaine, and DEX (2 µg/kg). **Group B**: Received regional anesthesia with bilateral ONB using 10 mL of 2% preservative-free lignocaine and 5 mL of 0.5% preservative-free bupivacaine without DEX.

The bilateral ONB was executed with a conventional technique, aiming for a location 1.5 cm laterally and 1.5 cm caudally from the pubic tubercle. After reaching the pubic ramus, the needle was repositioned laterally and progressed 2-3 cm deeper than the pubic ramus [11]. A 20-minute interval was monitored to confirm complete block effectiveness.

For transurethral procedures that could not be completed due to adductor spasm or ineffective blockade, general anesthesia with muscle relaxation was administered. The block was deemed unsuccessful if more than two doses of rescue analgesia were required in the first postoperative hour or if intraoperative adductor spasm resulted in uncontrolled adduction and external rotation of the thigh at the hip joint.

**Postoperative Pain Assessment and Management**

VAS score was used to evaluate the postoperative pain intensity. Each patient received the VAS upon arrival in the recovery room, marked as hour 0, and recorded their pain levels at postoperative hours 0, 2, 4, 8, 12, 16, 20, and 24. A score of 10 indicated the worst pain imaginable, while a score of 0 represented no pain. If a patient's VAS score reached or exceeded 4/10, a rescue nalbuphine dose of 0.1 mg/kg was administered. If VAS score remained above 4 after 30 minutes, an additional nalbuphine dose was provided, with a maximum daily dose limit of 160 mg.

The standard postoperative analgesic regimen included intravenous paracetamol at a dose of one gram every 8 hours. As a second-line rescue analgesic, ketorolac (0.5 mg/kg) was administered every six hours if VAS score exceeded 4/10, with reassessment 30 minutes after the initial rescue dose.

**Assessment of Adverse Effects**

Adverse events were monitored, including hypotension (defined as a 20% reduction in baseline mean arterial blood pressure), which was managed with intravenous fluids; bradycardia (a 20% decrease in baseline heart rate), treated with intravenous atropine 0.02 mg/kg; respiratory depression (SpO2 below 95% necessitating oxygen supplementation); PONV, treated with intravenous ondansetron 0.1 mg/kg; and complications related to the block, such as hematoma formation, nerve injury, bleeding, intravascular injection, bladder perforation, and local anesthetic toxicity.

**Block Efficacy Assessment [12]**

**Leg Lift Scale**: This scale rated patients as follows: 0 = effortless leg lift and adduction; 1 = slight effort needed for leg lift and adduction; 2 = marked effort with evident abduction during leg lift; 3 = significant effort with inability to adduct the leg.

**Leg Movement During Surgery**: Evaluated as follows: 0 = severe leg abduction making the surgery challenging; 1 = slight leg abduction allowing the surgery to proceed with caution; 2 = no leg movement observed during tumor resection.

**Study Outcomes**

The 1ry outcome was the VAS score during the first 24 hours postoperatively. 2ry outcomes included perioperative opioid consumption, measured as the total amount administered postoperatively; incidence of adverse effects like bladder perforation; bleeding; frequency of adductor reflex during transurethral surgeries; and sensory and motor block duration provided by the spinal anesthesia.

**Sample Size Determination**

Pain assessment can be highly subjective, with considerable variability between individuals. To refine our sample size estimation, a pilot study was performed using the same surgical team and study medications. Following **Abdulatif *et al.'s*** [13] recommendation, this pilot study is regarded as the optimal approach for sample size calculation. In this preliminary study of 8 patients (excluded from the final analysis), undergoing transurethral surgeries with ONB, the mean VAS score within the first 24 hours postoperatively was found to be 1.22 ± 0.23. Using MedCalc software version 14.10.2 (MedCalc Software bvba, Ostend, Belgium), the required sample size was calculated to detect a 15% difference between groups, ensuring an 80% study power with an

alpha error of 0.05. This resulted in a minimum of 50 patients (25 per group), which was adjusted to 56 patients (28 per group) to account for potential dropouts.

**Ethical considerations:**

**The research was conducted with approval from the Research Ethics Committee at Cairo University (Approval code: MS-537-2023). All patients submitted signed informed consent prior to enrolment. The permission form clearly delineated their acceptance to participate in the research and the dissemination of data, guaranteeing the safeguarding of their anonymity and privacy. This research has been conducted in compliance with the World Medical Association's Code of Ethics (Declaration of Helsinki) for studies involving human subjects.**

**Statistical analysis:**

Data analysis was performed using SPSS version 26 (IBM Inc., Chicago, IL, USA). The Shapiro-Wilk test and histograms assessed the normality of data distribution. Parametric quantitative data were presented as mean and standard deviation (SD) and examined using the unpaired Student's t-test. Non-parametric quantitative data were expressed as median and interquartile range (IQR) and analyzed using the Mann-Whitney test. Categorical data were expressed as frequency and percentage (%) and analyzed using the Chi-square test or Fisher's exact test as applicable. A two-tailed P-value less than 0.05 was considered statistically significant.

**RESULTS**

The study began with the assessment of 73 patients for eligibility, out of them 17 were excluded. This resulted in the randomization of 56 patients into two groups, each comprising 28 patients. The 2 groups were manged as mentioned before in the methods. All patients in both groups completed the study without any dropouts, and the data from all 28 participants in each group were included in the follow-up and statistical analysis phases **(Figure 1)**.

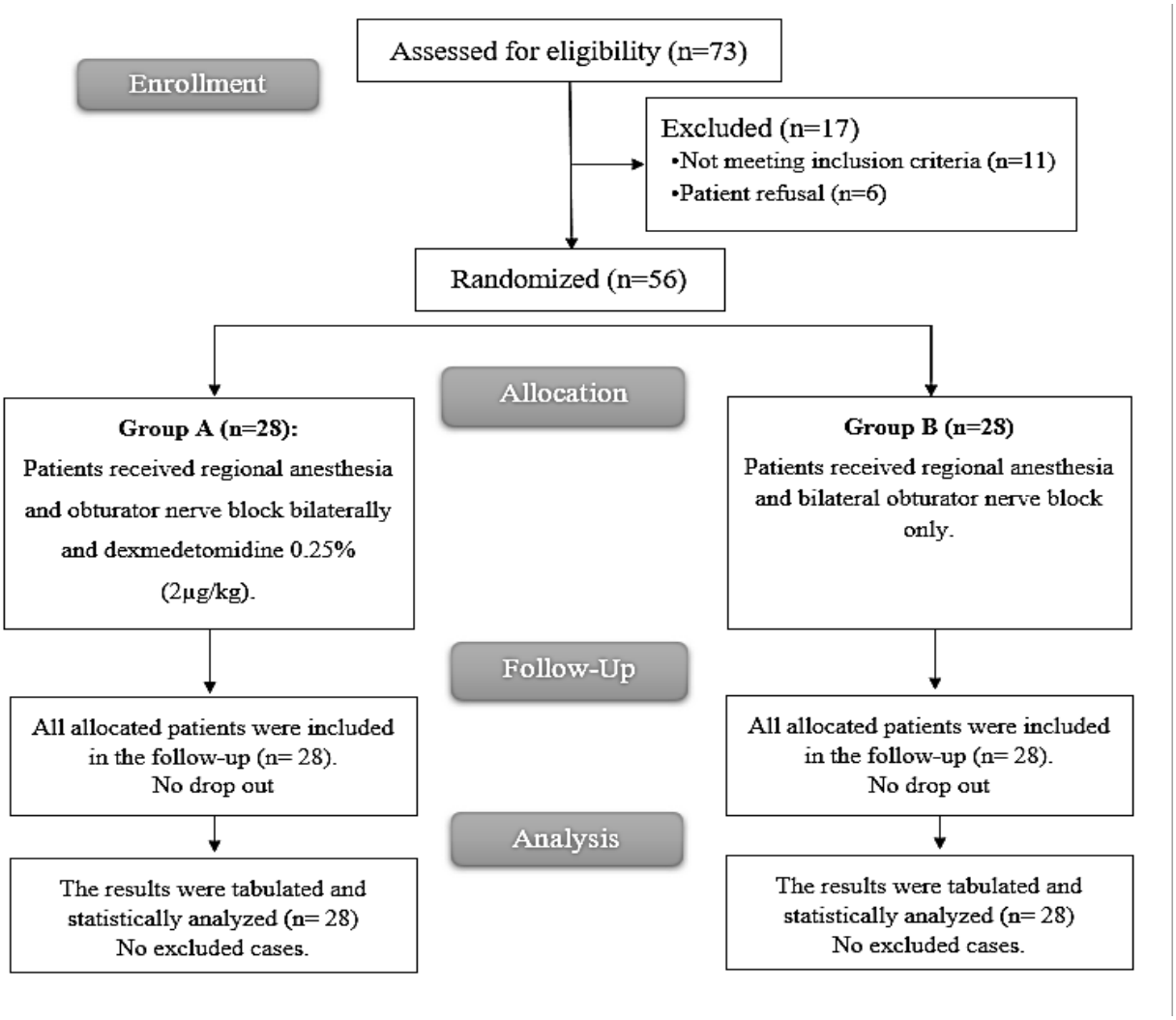


**Figure 1: CONSORT flowchart of the enrolled patients.**

No significant differences were observed between Group A and Group B regarding age, sex distribution, weight, height, BMI, ASA physical status, and duration of surgery **(Table 1)**.

**Table 1: Demographic data and duration of surgery of the studied groups**

| | | Group A (n=28) | Group B (n=28) | P value |
|---|---|---|---|---|
| **Age (years)** | **Mean ± SD** | 45.21 ± 13.79 | 42.46 ± 15.36 | 0.453 |
| | **Range** | 23 - 69 | 19 - 74 | |
| **Sex** | **Male** | 19 (67.86%) | 17 (60.71%) | 0.577 |
| | **Female** | 9 (32.14%) | 11 (39.29%) | |
| **Weight (kg)** | **Mean ± SD** | 78.68 ± 11.33 | 77.61 ± 12.13 | 0.734 |
| | **Range** | 61 - 103 | 58 - 95 | |
| **Height (cm)** | **Mean ± SD** | 167.64 ± 6.91 | 168.39 ± 6.94 | 0.687 |
| | **Range** | 157 - 179 | 153 - 180 | |
| **BMI (kg/m$^2$)** | **Mean ± SD** | 28.1 ± 4.38 | 27.37 ± 3.96 | 0.517 |
| | **Range** | 20.6 - 36.1 | 19.8 - 35.8 | |
| **ASA physical status** | **I** | 10 (35.71%) | 12 (42.86%) | 0.812 |
| | **II** | 15 (53.57%) | 14 (50%) | |
| | **III** | 3 (10.71%) | 2 (7.14%) | |
| **Duration of surgery (min)** | **Mean ± SD** | 135.18±23.19 | 131.96 ±24.13 | 0.613 |
| | **Range** | 105 - 175 | 95 - 170 | |

SD: standard deviation, BMI: Body mass index, ASA: American Society of Anaesthesiologists.

Group A had a significantly longer duration of sensory block and motor block than Group B **(Table 2)**.

**Table 2: Duration of sensory block and of motor block of the studied groups**

| | | Group A (n=28) | Group B (n=28) | P value |
|---|---|---|---|---|
| **Duration of sensory block (min)** | **Mean ± SD** | 116.39±11.75 | 107.79 ±12.44 | **0.01*** |
| | **Range** | 99 - 139 | 91 - 128 | |
| **Duration of motor block (min)** | **Mean ± SD** | 116.39±11.75 | 107.79 ±12.44 | **0.01*** |
| | **Range** | 99 - 139 | 91 - 128 | |

SD: standard deviation, *: Significantly different

Intraoperative mean arterial blood pressure was insignificantly different at baseline, 5 and 10 min and end of surgery between two groups and was significantly lower at 15, 20, 25, 30, 35, 40, 45, 50, 55, 60, 75, 90, and 120 min in Group A than Group B (P<0.001) **(Figure 2)**.

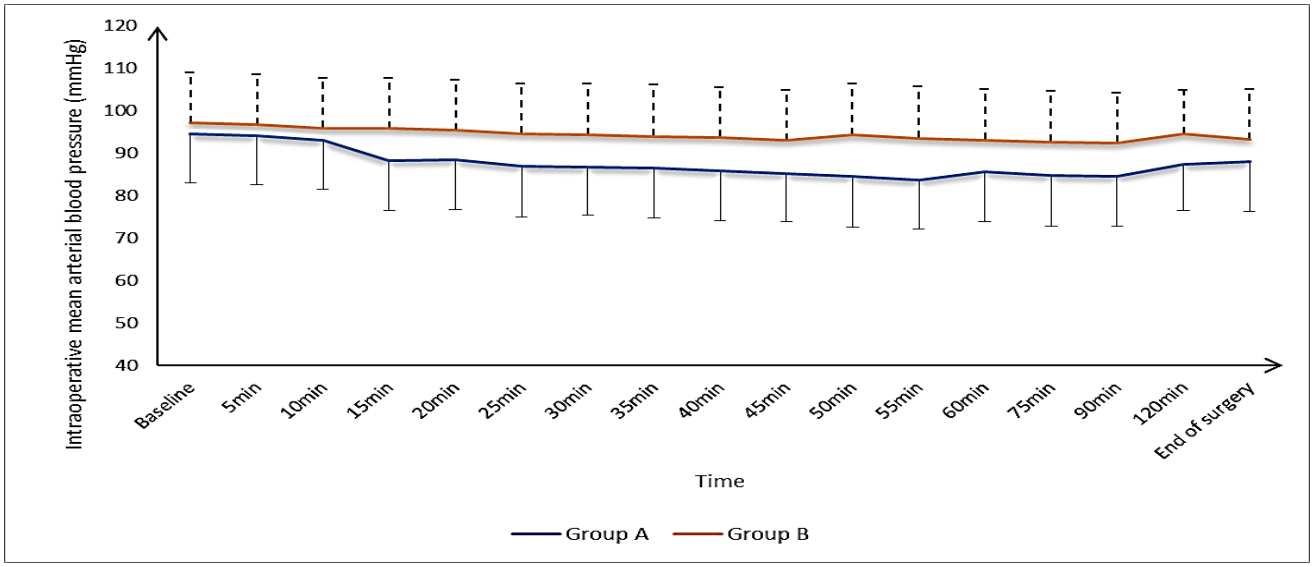


**Figure 2: Intraoperative mean arterial blood pressure of the studied groups**

Group A had a significantly longer time to the first request of rescue analgesia compared to Group B. Additionally, the total dose of nalbuphine consumption in the first 24 hours was significantly lower in Group A compared to Group B **(Table 3)**.

**Table 3: Time to first request of rescue analgesia and total dose of nalbuphine consumption in the first 24 hours of the studied groups**

| | | Group A (n=28) | Group B (n=28) | P value |
|---|---|---|---|---|
| **Time to first request of rescue analgesia (h)** | **Mean ± SD** | 10.07 ± 1.65 | 7.18 ± 0.94 | **<0.001*** |
| | **Range** | 8 - 12 | 6 - 8 | |
| **Total dose of nalbuphine consumption in the first 24 hours (mg)** | **Mean ± SD** | 26.43 ± 4.88 | 34.64 ± 5.08 | **<0.001*** |

SD: standard deviation, *Significantly different.

Group A had significantly lower VAS scores compared to Group B at 6, 8, and 12 hours. No significant differences were observed at 2, 4, 16, 20, and 24 hours **(Table 4)**.

**Table 4: VAS of the studied groups**

| | Group A (n=28) | Group B (n=28) | P value |
|---|---|---|---|
| **0 h** | 0(0 - 0) | 0(0 - 0) | --- |
| **2 h** | 1(0 - 2) | 1(0.75- 2) | 0.388 |
| **4 h** | 2(1 - 2) | 2(1 - 2) | 0.592 |
| **6 h** | 2(1 - 2) | 2.5(1 - 5) | **0.045*** |
| **8 h** | 2(1.75 - 4) | 4(2 - 5) | **0.041*** |
| **12 h** | 2.5(2 - 4) | 4(2 - 5) | **0.030*** |
| **16 h** | 3.5(3 - 4.25) | 4(3 - 4) | 0.761 |
| **20 h** | 3(2 - 4) | 3.5(2 - 4) | 0.828 |
| **24 h** | 4(2 - 4) | 4(2.75 - 5) | 0.715 |

Data are presented as median (IQR). VAS: Visual analog scale. *Significantly different.

HR was insignificantly different at 0h and 2h between both group and was considerably lower at 6h in group A than group B (P=0.005) **(Figure 2)**.

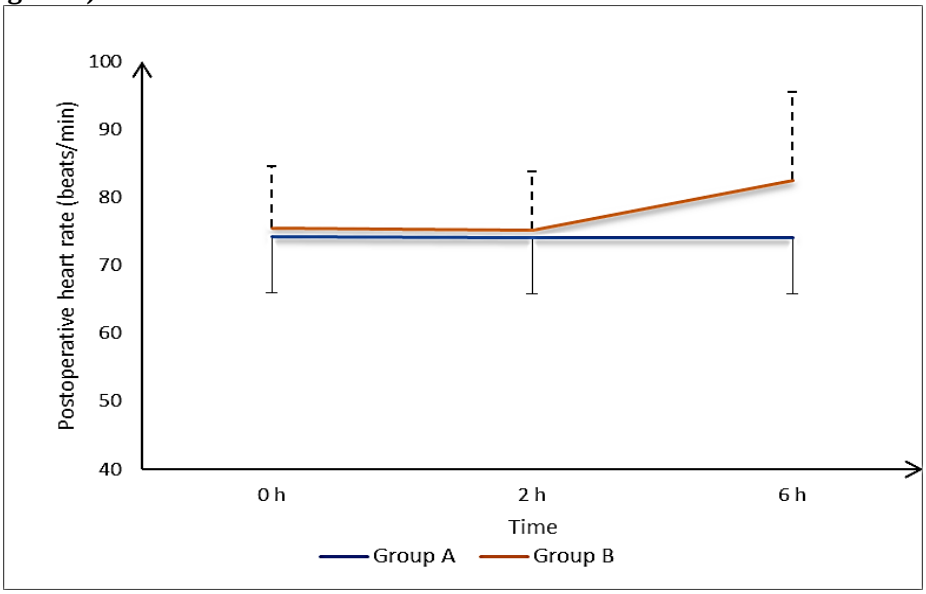


**Figure 3: Postoperative HR of the studied groups.**

MAP was insignificantly different at 0h and 2h between both groups and was notably lower at 6h in Group A than Group B (P = 0.002) **(Figure 4)**.

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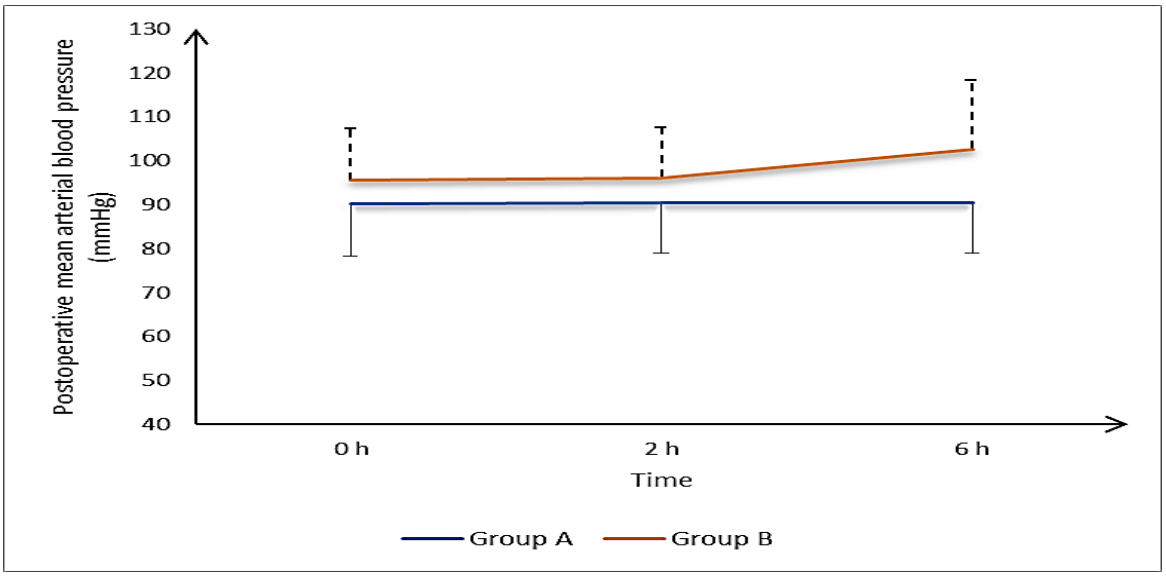


**Figure 1: Postoperative MAP of the studied groups.**

No significant differences were observed between Group A and Group B regarding the incidence of the adductor reflex, bladder perforation, and bleeding **(Table 5)**.

**Table 1: Incidence of the adductor reflex and complication of surgery of the studied groups**

| | | Group A (n=28) | Group B (n=28) | P value |
|---|---|---|---|---|
| **Incidence of the adductor reflex** | **Yes** | 3 (10.71%) | 5 (17.86%) | 0.705 |
| | **No** | 25 (89.29%) | 23 (82.14%) | |
| **Bladder perforation** | **Yes** | 2 (7.14%) | 3 (10.71%) | 1 |
| | **No** | 26 (92.86%) | 25 (89.29%) | |
| **Bleeding** | **Yes** | 0 (0%) | 1 (3.57%) | 1 |

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## DISCUSSION

Bladder cancer, the second most prevalent malignancy of the genitourinary system, is commonly managed with intravesical transurethral resection for cases involving superficial tumors [14]. Utilizing an ONB can enhance the quality of analgesia during these procedures, and incorporating DEX has been shown to prolong the sensory and motor block duration. [12] This study aimed to evaluate the effect of adding DEX to a local anesthetic on the efficacy of ONB in minimizing postoperative pain, compared to using a local anesthetic alone. A total of 56 patients scheduled for transurethral surgery were randomly divided into two groups: Group A received regional anesthesia with bilateral ONB and DEX (2 µg/kg), while Group B received regional anesthesia with bilateral ONB without DEX.

The study revealed that Group A experienced a notably longer duration of both sensory and motor blocks compared to Group B. These results are consistent with those of **Abdulatif *et al.***, [13] who conducted an RCT exploring how different doses of perineural DEX affect the pharmacodynamics of bupivacaine-induced femoral nerve blocks. The study utilized ultrasound guidance to administer femoral nerve blocks using 0.5% bupivacaine combined with varying DEX doses (25 µg, 50 µg, or 75 µg), comparing the outcomes to a control group that received only bupivacaine. Their findings showed that the 50 µg and 75 µg DEX doses significantly prolonged the duration of both sensory and motor blocks compared to the control group. Similarly, **Hu *et al.*** [15] examined the effects of adding DEX to a lidocaine-ropivacaine mixture for popliteal sciatic nerve block (PSNB) in patients undergoing varicose vein surgery. In their study, 60 participants were randomly assigned to receive either 50 µg of dexamethasone (DL group) or saline (SL group), alongside 2% lidocaine and 0.75% ropivacaine. The results showed that the DL group had notably longer sensory and motor block durations than the SL group. **Ahmad *et al.*** [16] also studied the analgesic effectiveness and quality of blocks when DEX was combined with bupivacaine for spinal anesthesia in abdominal

hysterectomy patients. This study involved 100 women, divided into two groups: Group B received 12.5 mg of 0.5% hyperbaric bupivacaine mixed with saline, while Group B+D received the same bupivacaine dose plus 10 µg of DEX. The addition of DEX in Group B+D led to a significantly longer duration of sensory and motor blocks compared to the bupivacaine-only group.

In this study, the intraoperative HR showed no notable changes between the two groups at baseline, 5, 10, and 120 minutes, as well as at the end of surgery. However, Group A demonstrated considerably lower HR readings compared to Group B at intervals of 15, 20, 25, 30, 35, 40, 45, 50, 55, 60, 75, and 90 minutes. Postoperatively, HR differences between the groups were not significant at 0 and 2 hours but were significantly lower in Group A at 6 hours. **Weheba *et al.*** [17] also studied the addition of DEX to bupivacaine in a fascia iliaca block for proximal femur surgeries and found no significant difference in HR between the groups up to 24 hours postoperatively. The discrepancy at the 6-hour mark between our findings and theirs could be due to differences in patient characteristics and the type of surgery performed.

In contrast, **Chattopadhyay *et al.*** [18] studied the heart rate response in 135 patients following total knee replacement with an adductor canal block using varying doses of DEX. Conducted at a tertiary care center in India, this study found no significant differences in HR among the groups, potentially due to variations in surgical techniques and patient demographics. Similarly, **Goel and Desai** [19] examined the effects of adding DEX to bupivacaine in ultrasound-guided femoral nerve blocks for hip surgeries, using intramuscular DEX. Their randomized, double-blind study of 75 patients also reported no significant heart rate changes across the groups, suggesting that variations in patient and procedural characteristics might explain the differing outcomes observed in our study.

Regarding intraoperative MAP, our study found no significant differences between the two groups at baseline, 5 minutes, 10 minutes, and upon surgery completion. However, Group A exhibited significantly lower MAP readings from 15 to 120 minutes post-intervention. Postoperatively, MAP levels were comparable between the groups at 0 and 2 hours but showed a significant decrease in Group A at the 6-hour mark. These findings align with those of **Weheba *et al.*** [17] who found no significant changes in postoperative MAP across groups, attributing the variations at 6 hours to differences in patient demographics and surgical types. Conversely, **Chattopadhyay *et al.*** [18] and **Goel and Desai** [19] did not report any significant changes in MAP among their study groups.

This study found that Group A experienced a significantly longer time before needing the first dose of rescue analgesia, along with a notably lower total consumption of nalbuphine over a 24-hour period. **Abdulatif *et al.*** [13] similarly reported a longer duration before rescue analgesia was required and a reduction in morphine usage in groups receiving 50 and 75 µg of DEX, as opposed to the control group. **Chattopadhyay *et al.*** [18] also observed a delayed time to rescue analgesia and reduced total opioid consumption in the DEX-treated group. Consistent with these results, **Weheba *et al.*** [17] found a longer time to initial analgesia and decreased opioid use in the DEX group. **Ahmad *et al.*** [16] reported a significantly extended duration of analgesia (263.8 ± 13.7 minutes) and lower analgesic consumption (1.42 ± 0.51 mg) in the DEX group compared to the control group.

Moreover, **Packiasabapathy *et al.*** [20] studied the effects of two different doses of DEX in femoral nerve block for postoperative pain management after total knee arthroplasty. Their findings showed that both doses resulted in longer-lasting analgesia and reduced opioid consumption when compared to the control group. In contrast to our findings, **Goel and Desai** [19] found no significant difference in the duration of analgesia between groups receiving perineural or intramuscular DEX. This lack of difference could be attributed to variations in patient characteristics, block techniques, and surgical methods.

This study found that VAS scores were comparable between the two groups at 0, 2, 4, 16, 20, and 24 hours post-surgery. However, Group A exhibited significantly lower VAS scores at 6, 8, and 12 hours. Aligning with these observations, **Ahmad *et al.*** [16] reported lower mean VAS ratings at various time points in the DEX group compared to the control group. **Weheba *et al.*** [17] also found significantly reduced VAS scores in the DEX group at 8 and 12 hours, while **Chattopadhyay *et al.*** [18] noted that Numeric Rating Scale (NRS) scores were considerably lower in the DEX group than in the control group.

This study also indicated no significant differences between the groups in terms of the incidence of adductor reflex, bladder perforation, or bleeding. **Abdulatif *et al.*** [13] similarly observed no notable differences in the risk of complications across their study groups, supporting these findings. **Hu *et al.*** [15] reported an absence of adverse effects associated with DEX, noting no cases of severe drowsiness, vomiting, nausea, hypotension, respiratory depression, or bradycardia. Furthermore, postoperative evaluations showed no impairments in sensory or motor functions and no evidence of nerve damage. Additionally, **Packiasabapathy *et al.*** [20] found that the frequency of intraoperative and postoperative hypotension and bradycardia did not differ significantly between groups, and there were no reports of significant vomiting, sedation, nausea, neuropathy, or itching among the patients.

The study's limitations include a relatively small sample size, which may affect the generalizability of the results. Additionally, the single-center design limits the broader applicability of the findings across different populations and settings. The study also did not evaluate long-term outcomes beyond the 24-hour postoperative period, potentially overlooking delayed effects of DEX. Furthermore, the assessment of pain relied on subjective measures like the VAS score, which may introduce variability in reporting. Lastly, potential confounding factors such as variations in surgical technique and patient pain thresholds were not fully controlled.

## CONCLUSION

The addition of DEX as an adjuvant to local anesthetic in ONB for postoperative pain management in patients undergoing transurethral surgeries has been linked to enhanced pain control, including lower VAS scores, reduced morphine use, and an extended time before the need for rescue analgesia, compared to the control group.

**Financial support and sponsorship: Nil.**
**Conflict of Interest: Nil.**

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