Journal of
Anesthesia & Intensive Care Medicine
ISSN: 2474-7653

Juniper Publishers
key to the Researchers

Research Article
Volume 14 Issue 1 - March 2025
DOI: 10.19080/JAICM.2025.14.555878

J Anest & Inten Care Med

Systemic Versus Local Dexmedetomidine as An Adjuvant to Ultrasound Guided Erector Spinae Block by Bupivacaine in Kidney Exploration Surgeries, A Randomized Controlled Trial

Ayman Mohamady Eldemrdash[1]* [PhD, MD], Soudy S Hammad[6] [PhD, MD], Zaher Z Zaher[3] [PhD, MD], Mohammed S Ali[4] [PhD, MD], Rehab Ahmed Kassem[5] [PhD], Tarek S Hemaida[2] [PhD, MD],

Anesthesiology and Surgical Intensive Care Department, Aswan University, Egypt

[1]Assistant Professor of Anesthesiology and Surgical Intensive Care and Pain Medicine, Faculty of Medicine, Aswan University, Aswan, Egypt, Email: aymaneldemrdash@yahoo.com

[2]Lecturer of Anesthesiology, Surgical Intensive Care and Pain Medicine, Faculty of Medicine, Aswan University, Aswan, Egypt, Email: Dr.tarek@aswu.edu.eg

[3]Lecturer of Anesthesiology, Surgical Intensive Care and Pain Medicine, Faculty of Medicine, Aswan University, Aswan, Egypt, Email: zaher.zaki@aswu.edu.eg

[4]Lecturer of Anesthesiology, Surgical Intensive Care and Pain Medicine, Faculty of Medicine, Aswan University, Aswan, Egypt, Email: mohammed.ismail@med.aswu.edu.eg

[5]Resident at Anesthesiology, Surgical Intensive Care and Pain Medicine, Faculty of Medicine, Aswan University, Aswan, Egypt, Email: rehabk311@gmail.com

[6]Lecturer of Anesthesiology, Surgical Intensive Care and Pain Medicine, Faculty of Medicine, Aswan University, Aswan, Egypt, Email: soudi.salah@aswu.edu.eg

Submission: February 28, 2025; **Published:** March 12, 2025

***Corresponding author:** Ayman Mohamady Eldemrdash, MD of Anesthesia, Surgical Intensive Care and Pain Management, Faculty of Medicine, Aswan University, Aswan, Egypt

Abstract

Background: Open kidney procedures are linked to a high occurrence of severe acute postoperative discomfort as well as chronic pain for months after the surgical procedure.

Objective: This work aimed to investigate the analgesic effect of local vs systemic dexmedetomidine as a supplement to bupivacaine in erector spinae block (ESB) as regards kidney exploration surgical procedures.

Study Design and Setting: The double-blinded randomized, controlled clinical research included 75 cases, aged 18 to 70 years admitted to exploration surgeries.

Methods: Participants underwent an equal categorization into three equal groups. All patients received ESB using 30 ml bupivacaine 0.25%, group I (control group), group II (local dexmedetomidine) added dexmedetomidine (0.5µg/kg) as local adjuvant and group III (IV dexmedetomidine) dexmedetomidine (0.5µg/kg) was administrated IV.

Results: The duration of analgesia during the 1st 48 hours exhibited significantly greater value within group II 34 hours [95%CI (27.5 to 34.9)] than group III 15 hours [95%CI (10.5 to19)] and group I 7.7 hours [95%CI (5.4 to 8.1)] (p< 0.001). Total nalbuphine administration at 48hours exhibited a significant reduction within group II 15 mg [95%CI (10.5to19)] than group III 28 mg [95%CI (24.9 to30.7)] and group I 31 mg [95%CI (27.5 to 34.9)]. The Numerical rating scale (NRS) during rest at 6, 12, and 24 hrs. exhibited a significant reduction within group II as opposed to group I as well as group III (p<0.001). NRS during coughing at 12 and 24 hrs. exhibited a significant reduction within group II as opposed to group I along with group III (p<0.001). As regards intraoperative HR, no significant variance was documented among groups II as well as III over time, but Postoperative HR was lower at 10 min. after arrival in PACU, at time of discharge from PACU, 1, 3, 6, 12, 24, and 36 hours within group II than group I.

Limitations: This study included that sample size was relatively small including patients undergoing open renal surgery only. We did not use a catheter insertion for intermittent boluses or continuous infusions, didn't assess the incidence of chronic pain also, and didn't assess intraoperative and postoperative complications. The plasma concentration of dexmedetomidine was not evaluated, as it was not measured after its administration with bupivacaine in open renal surgeries.

Conclusions: Using dexmedetomidine as a local adjuvant in ultrasound-guided ESB is more effective for managing postoperative pain in patients undergoing open kidney surgeries compared to systemic dexmedetomidine or bupivacaine alone.

Keywords: Systemic; Adjuvant; Dexmedetomidine; Erector Spinae Block; Kidney Exploration

Abbreviations: ESB: Erector Spinae Block; NRS: Numerical Rating Scale; ESP: Erector Spinae Plane; ASA: Anesthesiologists; BMI: Body Mass Index; SBP: Systolic Blood Pressure; DBP: Diastolic Blood Pressure; MAP: Mean Arterial Blood Pressure; HR: Heart Rate; SpO2: Oxygen Saturation; MAC: Minimum Alveolar Concentration; RSS: Ramsay Sedation Scale; IQR: Interquartile Range; VAS: Visual Analog Scale; ESPB: ESP Block

Introduction

Open kidney procedures, which are linked to a high occurrence of severe acute postoperative discomfort as well as chronic pain for months after surgical procedure, are still one of the methods utilized for patients needing a partial or radical nephrectomy [1]. Successful management of postoperative pain reduces recovery as well as discharge times, delays the chronic pain onset, improves patient satisfaction, along with enhancing long-term quality of life [2]. Currently, local anesthetic infiltration, and administration of oral or parenteral opioids, in addition to certain regional anesthesia and neuraxial methods, such as paravertebral as well as thoracic epidurals blocks, are used to treat discomfort for patients undergoing renal exploration [3].

A more recent method of regional anesthesia, the erector spinae plane (ESP) block, could be utilized to treat acute or chronic pain, as well as to provide analgesia for a range of surgical operations. In the pre-operative holding area, the procedure can be carried out with little to no sedation because it is quite simple to conduct on patients [4]. Anesthesia puncture needles can be guided in the direction and depth by ultrasound, an imaging modality known for its non-invasiveness, helping acquire the target tissues' anatomy and lowering the risk of problems [5]. Due to the short half-lives of local anesthetic medications, adjuvants including opioids, alpha-2 agonists, neostigmine, or magnesium must be added [6]. Strong alpha-2 agonist dexmedetomidine is an effective adjuvant for analgesia and regional anesthesia. It could prolong the nerve block anesthesia duration, which could result in improved block effectiveness as regards duration, decreased use of opioids, along shorter hospitalization, given that no clinically significant side effects such as hypotension, nausea, vomiting, as well as pruritus, are evident [7].

It is common practice to extend the duration of single-injection regional nerve block by mixing adjuvants with local anesthetics [8]. The pain-relieving effects of both perineural and intravenous (IV) dexmedetomidine, when used alongside local anesthetics, have been studied in various settings, such as neuraxial anesthesia and peripheral nerve blocks. Perineural dexmedetomidine extends the duration of both sensory and motor blocks; a meta-analysis on its use as an adjuvant in peripheral nerve blocks has compiled trial results, demonstrating improved effectiveness [4]. IV dexmedetomidine notably decreases postoperative pain and reduces the need for opioids. Recent meta-analysis findings also show that IV dexmedetomidine significantly prolongs sensory block duration and delays the first request for pain relief following spinal anesthesia [9]. This research was aimed at investigating the analgesic effectiveness of local vs systemic dexmedetomidine as a supplement to bupivacaine as regards erector spinae blocks in kidney exploration operations.

Patients and Methods

The prospective, double-blinded, randomized, controlled clinical research included 75 cases, with ages ranging from between 18 to 70 years who belonged to the American Society of Anesthesiologists (ASA) I, II physical status, body mass index (BMI) lower than 35 kg/m2 admitted to kidney exploration operations in Aswan University Hospitals, Egypt. Our research was carried out from February 2023 to June 2024 after receiving approval from the Ethical Committee of Aswan University Hospitals, Aswan, Egypt (approval code: 742/2/23) and being registered on ClinicalTrials.gov (ID: NCT06386770). Written informed consent was obtained from all participants. We excluded patients with block site infection, coagulation disorders, getting opioid analgesics before surgery, ASA III/IV, pregnancy, and prior drug addiction or alcoholics, mental retardation that interferes with the pain score assessment.

Randomization and Blinding

An automated randomization list was utilized to randomly assign consenting research participants in a 1:1:1 ratio to receive ultrasound-guided ESP block (ESPB) along with the trial drug. All participants underwent an equal categorization into three groups:

1) Group I Block only (group BO): ESP received 30 ml bupivacaine 0.25% + infusion by syringe pump 10ml IV saline 0.9% was administered within a ten-minutes period after 10 min from the GA induction (control group).

2) Group II (group DL): ESP received 30 ml bupivacaine 0.25% contained dexmedetomidine (0.5µg/kg) + infusion by syringe pump 10ml IV saline 0.9% was administered within a ten-minutes period after 10 minutes from the GA induction.

3) Group III (group D IV): ESP received 30 ml bupivacaine 0.25% + infusion by syringe pump dexmedetomidine (0.5µg/kg) diluted with 10 ml saline 0.9% within a ten-minutes period after 10 min of the GA induction.

To ensure allocation concealment, sequentially numbered, sealed, opaque envelopes were used and opened by an administrator nurse who was not involved in the study. A dedicated pharmacist, with no other responsibilities in the research, prepared the study drugs. Both outcome assessors and patients remained blinded to the intervention groups..

Preoperative Evaluation

Explaining the numerical rating scale (NRS) where 0 represents the absence of pain while 10 represents the most severe pain. All participants were given no oral medication for a minimum of 6 hours before the operation. Upon arrival at the operating theatre, routine monitoring was initiated by inserting an 18G cannula into the hand to create a peripheral intravenous (I.V.) line and to start a ringer lactate infusion. Systolic blood pressure (SBP), Diastolic blood pressure (DBP), Mean arterial blood pressure (MAP), heart rate (HR), as well as oxygen saturation (SpO2) were assessed pre-block (baseline) and at 1, 3, 6, 12, 24, 36, and 48 hours postoperatively.

How to cite this article: Ayman Mohamady E, Tarek S. H, Zaher Z. Z, Mohammed S. A, Rehab Ahmed K, et al. Systemic Versus Local Dexmedetomidine as An Adjuvant to Ultrasound Guided Erector Spinae Block by Bupivacaine in Kidney Exploration Surgeries, A Randomized Controlled Trial. J Anest & Inten care med. 2025; 14(1): 555878. DOI:10.19080/JAICM.2025.14.555878

Ultrasound-Guided Erector Spinal Plane Block

In preparing the pre-operative room the patients were positioned in the lateral position while adhering to all aseptic precautions after receiving premedication and routine monitoring. ESPB was carried out with the assistance of ultrasonography. Three centimeters to the lateral of the T10 spinous process, the linear ultrasound transducer was positioned in a longitudinal parasagittal orientation. The superficial muscles up to the tip of the T10 transverse process were recognized as the erector spinae. 3 mL of 1% lidocaine was applied subcutaneously to the patient's skin to induce anesthesia. Using the deep (anterior) side of the erector spinae muscle as the fascial plane, the 22-gauge 80-mm block needle (Sonoplex, Pajunk Medical, Geisingen, Germany) was inserted into the muscle. Using transverse process ultrasound imaging, the placement of the needlepoint was verified by a visible fluid spread that lifted the erector spinae muscle off the bone shadow of the transverse process (Figure 1A,1B). By using the in-plane approach, 30 mL of the study drug was injected deeply into the erector spinae muscle after local anesthetics were given when the needle tip reached between the muscle and the transverse process [10,11].

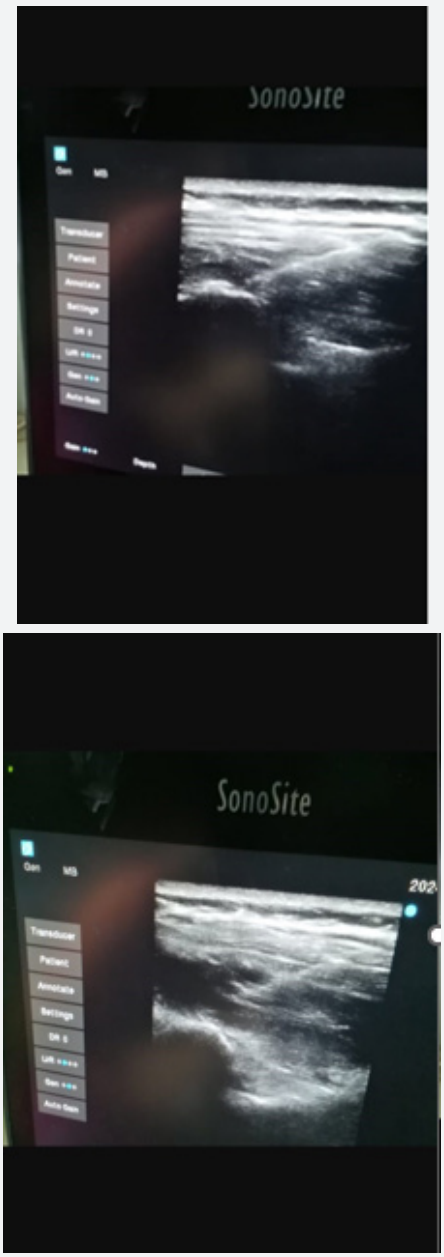


Figure 1A, 1B: Bone shadow of the transverse process.

How to cite this article: Ayman Mohamady E, Tarek S. H, Zaher Z. Z, Mohammed S. A, Rehab Ahmed K, et al. Systemic Versus Local Dexmedetomidine as An Adjuvant to Ultrasound Guided Erector Spinae Block by Bupivacaine in Kidney Exploration Surgeries, A Randomized Controlled Trial. J Anest & Inten care med. 2025; 14(1): 555878. DOI:10.19080/JAICM.2025.14.555878

Intraoperative

Under general anesthesia the following parameters were set tidal volume, 8-10 mL/kg; respiratory rate, 10-12 cycles/min; inspiration and expiration ratio, 1:2; and end-tidal CO2 partial pressure, 35-45 mmHg. Sevoflurane and atracurium were used to maintain general anesthesia. Enrolled patients were randomized to receive either saline 0.9%10 ml I.V infusion over 10 minutes after 10minutes of anesthesia induction (Group I, Group II) or dexmedetomidine (0.5µg/kg) in 10 ml saline 0.9% I.V infusion over 10 minutes after 10minutes of anesthesia induction (Group III). All patients received paracetamol 1gm intraoperatively and 1 gm/8 hours during study time. Intraoperative hemodynamic parameters were measured before anesthesia induction (baseline), at the time of skin incision, at the time of skin closure, upon completion of surgery, and immediately following extubating. These parameters included systolic pressure, diastolic pressure, mean arterial pressure, HR, and minimum alveolar concentration (MAC).

An anesthesiologist who was blind to the patient group evaluated postoperative pain using a numerical rating scale (NRS) (0 = no pain, 10 = the worst possible pain) at rest, during coughing, and at 10-minute intervals after admission to the PACU. It was also recorded at the time of discharge from the PACU. Anesthesiologist blind to group assignment monitored all patients and recorded total nalbuphine consumption 48 hours after surgery and the time from the end of surgery to the onset of post-operative pain, if the NRS score was ≥4, Nalbuphine 0.1 mg/kg was given intravenously as a bolus. Patient postoperative mean arterial pressure (MAP), heart rate (HR), and Ramsay Sedation Scale (RSS) were all recorded by an anesthesiologist who was blinded to the patient group at 10-minute intervals after admission to the PACU, at the time of discharge, and at 1, 3, 6, 12, 24, 36, and 48 hours after surgery.

Sample Size Calculation

The sample size was determined using G*Power software version 3.1.3, based on data from a previously published study [9]. The calculation was performed with a two-sided α error of 0.05 and a β error of 0.2, ensuring a statistical power of 80%, the mean and Standard deviation of primary outcome were compared the duration for postoperative analgesia the sample size is 6 patients per group, but the secondary outcome was postoperative rescue analgesia the sample size is 22 patients per group and based on this value the sample size was taken on the secondary outcome, 66 cases (22 patients in each group) Taking into account a 5% loss to follow-up, we decided to recruit 25 patients per group added 3 patients to each group to avoid drop and difficult cases, so the sample size was 75 patients 25 in each group.

Statistical Analysis

Statistical analysis was conducted by using SPSS version 27 (IBM©, Chicago, IL, USA). The Shapiro-Wilk test and histograms were used to evaluate normality of data. Quantitative data were represented by both mean and standard deviation (SD) and analyzed using the ANOVA (F) test with Tukey's as a post hoc test. Non-parametric of quantitative data were reported by both the median and interquartile range (IQR) and analyzed using the Kruskal-Wallis test, followed by the Mann-Whitney test for as group comparisons. Qualitative variables were described by both frequency and percentage and analyzed using the Chi-square test. A two-tailed and P-value below 0.05 was considered statistically significant.

Results

One-hundred cases were assessed for eligibility to collaborate in the study, and the evaluation process for case inclusion and analysis is depicted in the CONSORT flow diagram (Figure 2). Of these, 25 cases were excluded-15 did not assembly the inclusion criteria, and 10 came down participations. Final sample consisted of 75 cases, which were randomly assigned into equally three studied groups (n=25), no cases lost follow-up. Demographic data characteristics showed no significant differences among the three groups (Table 1).. The duration of analgesia during the first 48 hours was significantly higher in group II than in groups III and I ($p< 0.001$) (Figure 3), (Table 2). There was a significant reduction in opioid consumption over 48 hours in group II compared to groups I and III, while the difference was insignificant between group I and group III (Figure 4), (Table 2).

Table 1: Comparison between studied groups regarding demographic data.

		Group I (n=25)	Group II (n=25)	Group III (n=25)	P
Age (years)		40.64 ± 10.7	44.12 ± 15.49	39.36 ± 9.78	0.369
Sex	Female	9 (36.0%)	8 (32.0%)	10 (40.0%)	0.841
	Male	16 (64.0%)	17 (68.0%)	15 (60.0%)	
Weight (kg)		83.8 ± 8.29	84 ± 8.39	82.76 ± 7.55	0.844
Height (m)		1.7 ± 0.05	1.7 ± 0.07	1.71 ± 0.06	0.796
BMI (kg/m^2)		29.01 ± 2.51	29.09 ± 2.5	28.34 ± 2.29	0.491
ASA	I	18 (72.0%)	15 (60.0%)	22 (88.0%)	0.08
	II	7 (28.0%)	10 (40.0%)	3 (12.0%)	

Data are presented as mean ± SD or frequency (%). ASA: American Society of Anesthesiologists, BMI: body mass index.

How to cite this article: Ayman Mohamady E, Tarek S. H, Zaher Z. Z, Mohammed S. A, Rehab Ahmed K, et al. Systemic Versus Local Dexmedetomidine as An Adjuvant to Ultrasound Guided Erector Spinae Block by Bupivacaine in Kidney Exploration Surgeries, A Randomized Controlled Trial. J Anest & Inten care med. 2025; 14(1): 555878. DOI:10.19080/JAICM.2025.14.555878

Table 2: Comparison between studied groups regarding total nalbuphine consumption at 48 hours and time to events.

	Group I (n=25)	Group II (n=25)	Group III (n=25)	P
Total Nalbuphine Consumption at 48 hours (mg)	31.18±8.95	14.75±10.36	27.78±7.0	< 0.001*
	95%CI (27.5 to34.9)	95%CI (10.5 to19)	95%CI (24.9to 30.7)	
	p1 <0.001*, p2 <0.001*, p3 = 0.142			
The Duration of Analgesia (h)	7.75±6.08	34.22±14.96	14.68±9.98	< 0.001*
	95%CI (5.4 to8.1)	95%CI (27.5 to 34.9)	95%CI (10.5 to19)	
	p1<0.001*, p2<0.001*, p3<0.001*			

Data are presented as mean ± SD. *Significant p value <0.05, p1: Comparison between Group I and Group II, p2: Comparison between Group II and Group III, p3: Comparison between Group I and Group III.

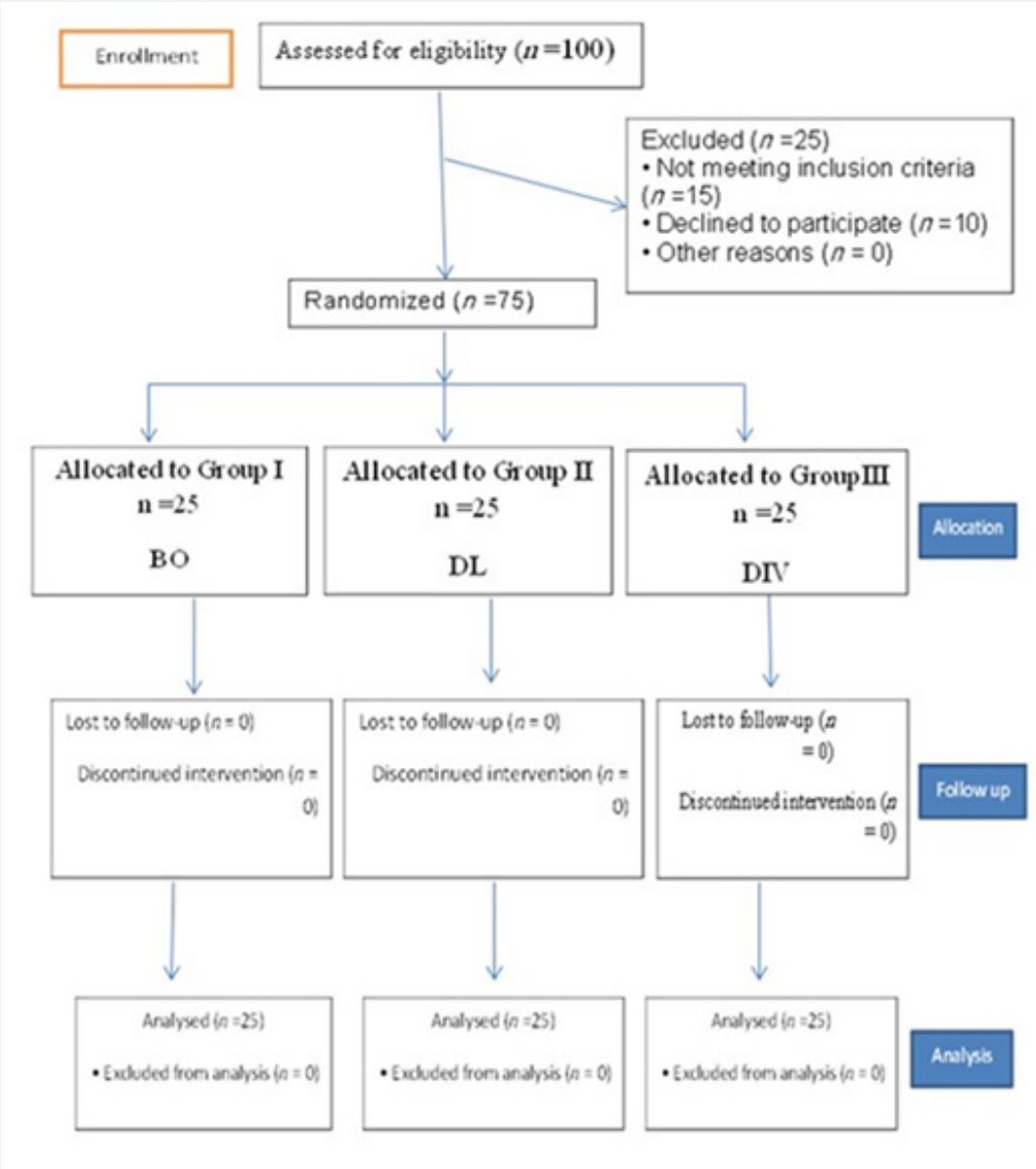


Figure 2: CONSORT flowchart of the studied groups.

How to cite this article: Ayman Mohamady E, Tarek S. H, Zaher Z. Z, Mohammed S. A, Rehab Ahmed K, et al. Systemic Versus Local Dexmedetomidine as An Adjuvant to Ultrasound Guided Erector Spinae Block by Bupivacaine in Kidney Exploration Surgeries, A Randomized Controlled Trial. J Anest & Inten care med. 2025; 14(1): 555878. DOI:10.19080/JAICM.2025.14.555878

At rest and during coughing, NRS at 3 hours was the higher score in group I than in groups II and III (P<0.05). Pairwise comparison was insignificantly different between groups II and III. But, at rest, NRS at 6, 12, and 24 hours was significantly lower in Group II than in Group I and Group III (p<0.001). Pairwise comparison was always non-significant different between groups I and III. While NRS at 36 hours was significantly lower in group II only than in groups I and III (p=0.026). Pairwise comparison was a significant between groups I and II only (p1= 0.012). Moreover, after 48 hours the NRS was the same between the three groups (Figure 5), (Table 3).

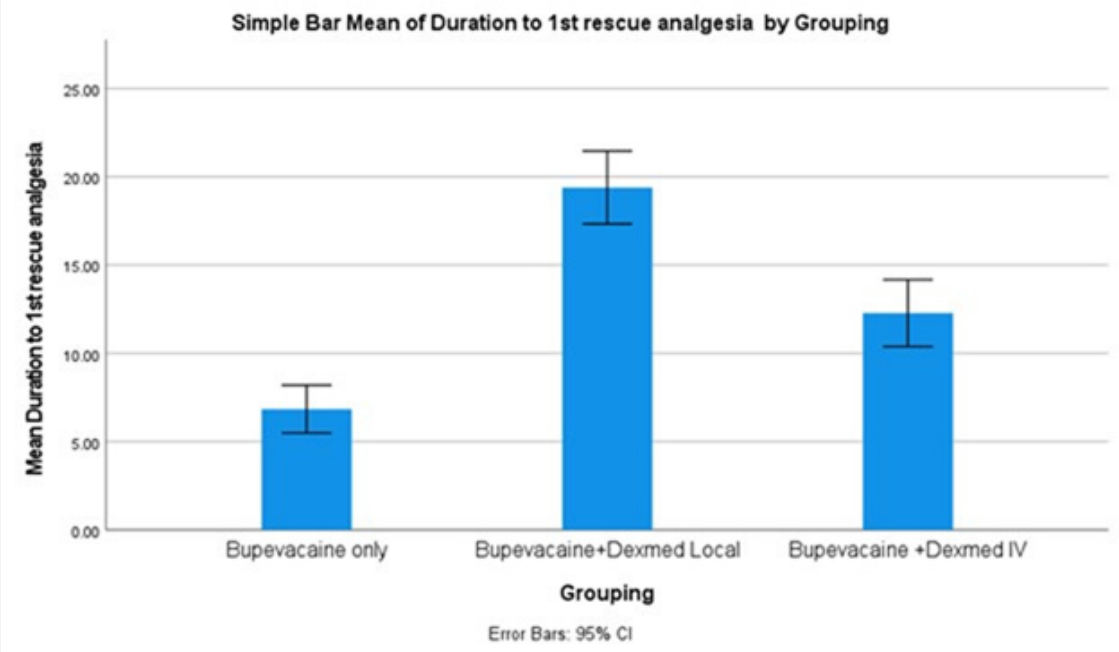


Figure 3: The duration to 1st rescue analgesia(hours) during the first 48 hours between study group.

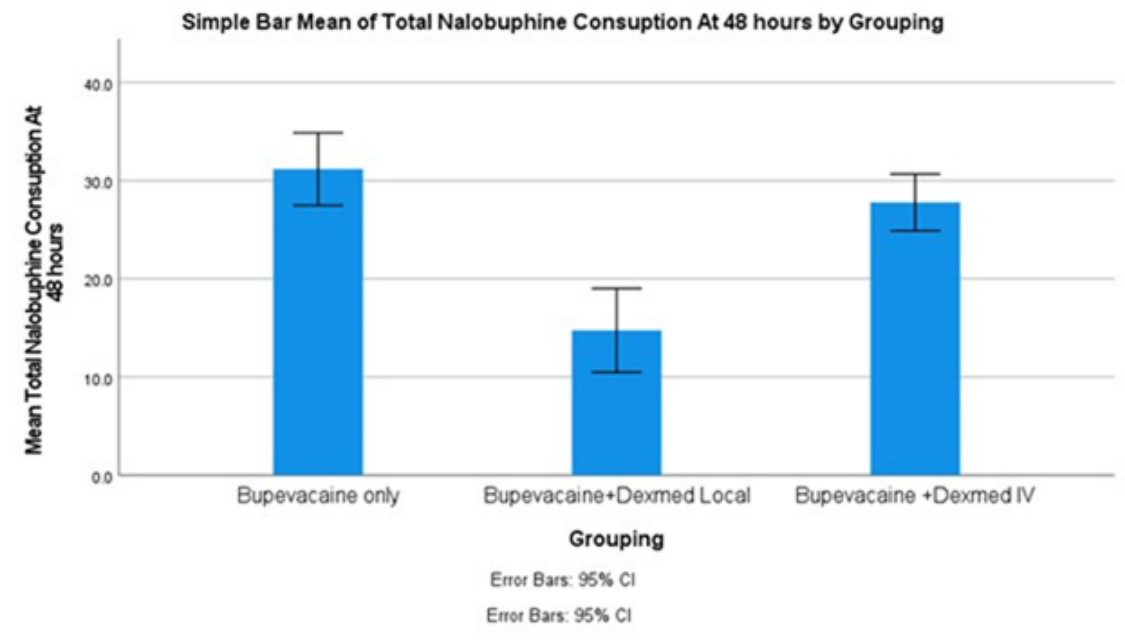


Figure 4: Total Nalbuphine Consumption at 48 hours (mg) between study group.

How to cite this article: Ayman Mohamady E, Tarek S. H, Zaher Z. Z, Mohammed S. A, Rehab Ahmed K, et al. Systemic Versus Local Dexmedetomidine as An Adjuvant to Ultrasound Guided Erector Spinae Block by Bupivacaine in Kidney Exploration Surgeries, A Randomized Controlled Trial. J Anest & Inten care med. 2025; 14(1): 555878. DOI:10.19080/JAICM.2025.14.555878

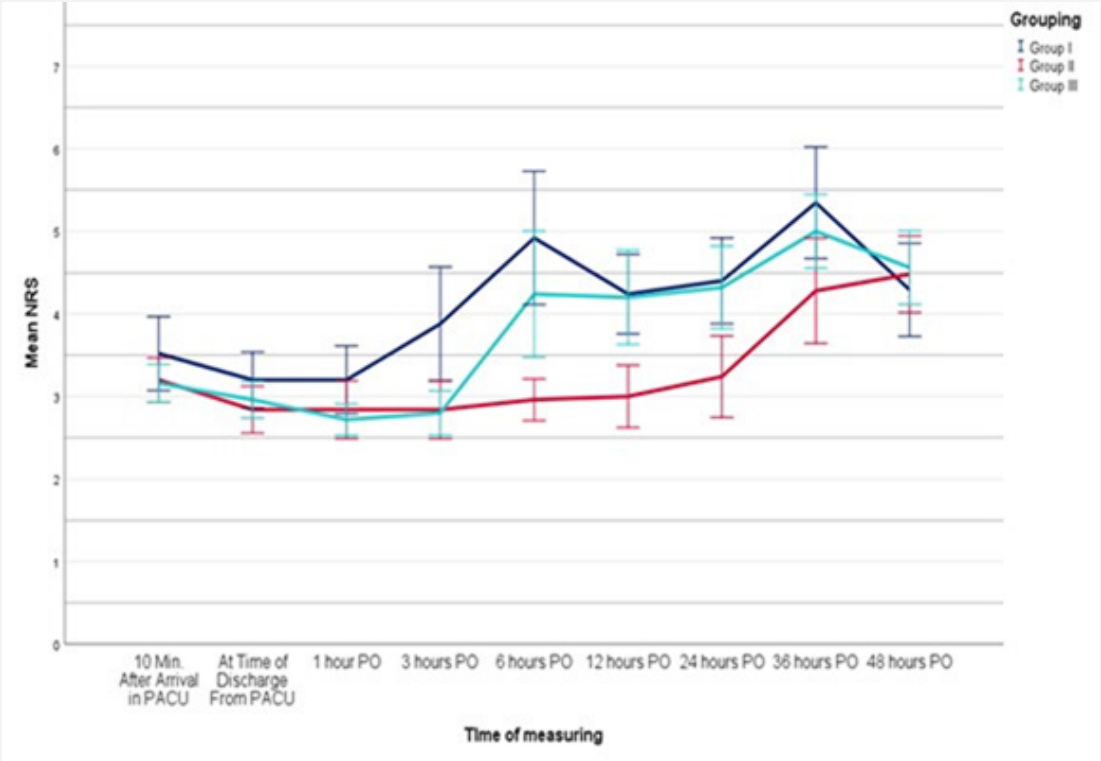


Figure 5: NRS at rest between studied groups.

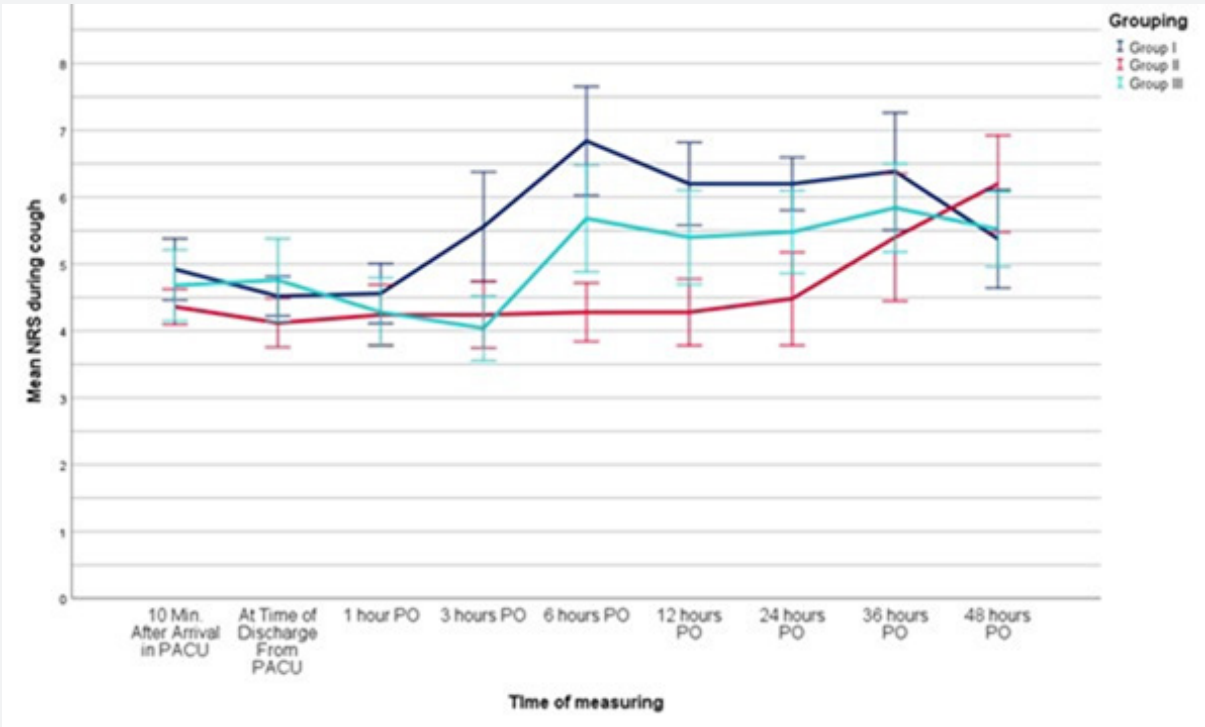


Figure 6: NRS during coughing between studied groups.

How to cite this article: Ayman Mohamady E, Tarek S. H, Zaher Z. Z, Mohammed S. A, Rehab Ahmed K, et al. Systemic Versus Local Dexmedetomidine as An Adjuvant to Ultrasound Guided Erector Spinae Block by Bupivacaine in Kidney Exploration Surgeries, A Randomized Controlled Trial. J Anest & Inten care med. 2025; 14(1): 555878. DOI:10.19080/JAICM.2025.14.555878

Table 3: Comparison between studied groups regarding NRS at rest and during coughing.

	Group I (n=25)	Group II (n=25)	Group III (n=25)	P
At rest				
10 Minutes After Arrival in PACU	3 (3-5)	3 (3-3)	3 (3-3)	0.631
At Time of Discharge from PACU	3 (3-3)	3 (2-3)	3 (3-3)	0.136
1 hour PO	3 (3-3)	3 (2-3)	3 (2-3)	0.133
3 hours PO	5 (3-6)	3 (3-3)	3 (3-5)	0.013*
	p1= 0.014*, p2= 0.954, p3= 0.011*			
6 hours PO	5 (3-6)	3 (3-3)	3 (3-5)	<0.001*
	p1< 0.001*, p2< 0.001*, p3= 0.174			
12 hours PO	4 (3-5)	3 (2-3)	4 (3-5)	<0.001*
	p1< 0.001*, p2< 0.001*, p3= 0.801			
24 hours PO	4 (3-5)	3 (3-3)	4 (3-5)	<0.001*
	p1< 0.001*, p2< 0.001*, p3= 0.841			
36 hours PO	6 (5-6)	3 (3-6)	5 (5-6)	0.026*
	p1=0.012*, p2=0.071, p3= 0.243			
48 hours PO	4 (3-5)	5 (4-5)	4 (4-5)	0.436
During Coughing				
10 Minutes After Arrival in PACU	5 (4-6)	4 (4-5)	5 (4-5)	0.077
At Time of Discharge from PACU	5 (4-5)	4 (4-5)	5 (4-5)	0.112
1 hour PO	5 (4-5)	4 (4-5)	4 (4-5)	0.179
	p1= 0.127, p2= 1.000, p3= 0.100			
3 hours PO	7 (6-8)	4 (4-5)	5 (4-7)	<0.001*
	p1< 0.001*, p2= 0.394, p3< 0.001*			
6 hours PO	7 (6-8)	4 (4-5)	5 (4-7)	<0.001*
	p1< 0.001*, p2= 0.014*, p3= 0.043*			
12 hours PO	6 (5-7)	4 (3-5)	6 (4-7)	<0.001*
	p1< 0.001*, p2=0.021*, p3= 0.123			
24 hours PO	6 (6-7)	4 (4-5)	5 (5-6)	<0.001*
	p1< 0.001*, p2= 0.011*, p3= 0.055			
36 hours PO	7 (6-8)	5 (4-7)	6 (4-7)	0.1
48 hours PO	5 (4-6)	7 (5-7)	6 (4-6)	0.057

Data are presented as median (IQR). *Significant p value <0.05, p1: Comparison between Group I and Group II, p2: Comparison between Group II and Group III, p3: Comparison between Group I and Group III, NRS: Numerical Rating Scale, PACU: Post Anesthesia Care Unit, PO: Postoperative.

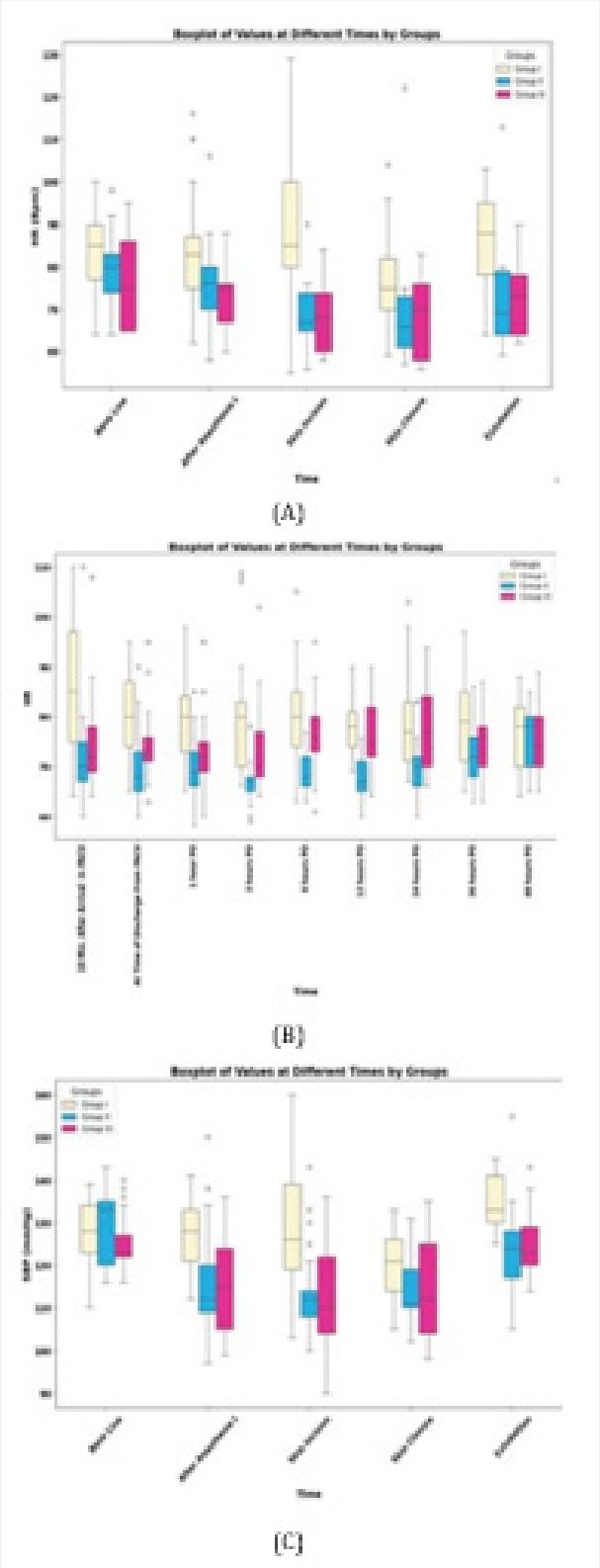
During coughing, NRS at 6 hrs. was the higher score in group I than in group III, and the lowest one was in group II, while NRS at 12 and 24 hrs. was significantly lower in group II than group I and group III (p<0.001). Pairwise comparison was non-significant different between groups I and III. Moreover, after 36 and 48 hours the NRS was the same between the three groups (Figure 6), (Table 3) As regards intraoperative HR there was no significant difference between groups II and III over time, but Postoperative HR was lower at 10 min. after arrival in PACU, at time of discharge from PACU, 1, 3, 6, 12, 24, and 36 hours in group II than group I. while there was no significant difference after 48 hours.

Meanwhile, there was no significant difference between groups II and III over time as to SBP, DBP, and MAP while groups II and III were significantly lower than group I over time. Meanwhile, there was no significant difference between groups II and III over time.

Postoperatively (PO), MAP at baseline, after 6, 24, 36, and 48 hours was insignificantly different between the studied groups, while at time of discharge from PACU, 1-hour PO, 3-hour PO, and 12-hour PO group II was significantly lower than Groups I and III (Figure 7). MAC was similar at baseline, ten minutes after induction, and at extubating. Group II and III need less MAC at skin

How to cite this article: Ayman Mohamady E, Tarek S. H, Zaher Z. Z, Mohammed S. A, Rehab Ahmed K, et al. Systemic Versus Local Dexmedetomidine as An Adjuvant to Ultrasound Guided Erector Spinae Block by Bupivacaine in Kidney Exploration Surgeries, A Randomized Controlled Trial. J Anest & Inten care med. 2025; 14(1): 555878. DOI:10.19080/JAICM.2025.14.555878

incision and closure than Group I. While there was no difference between groups II and III. The analysis of RSS among the three studied groups indicates no significant differences at various postoperative time points.



How to cite this article: Ayman Mohamady E, Tarek S. H, Zaher Z. Z, Mohammed S. A, Rehab Ahmed K, et al. Systemic Versus Local Dexmedetomidine as An Adjuvant to Ultrasound Guided Erector Spinae Block by Bupivacaine in Kidney Exploration Surgeries, A Randomized Controlled Trial. J Anest & Inten care med. 2025; 14(1): 555878. DOI:10.19080/JAICM.2025.14.555878

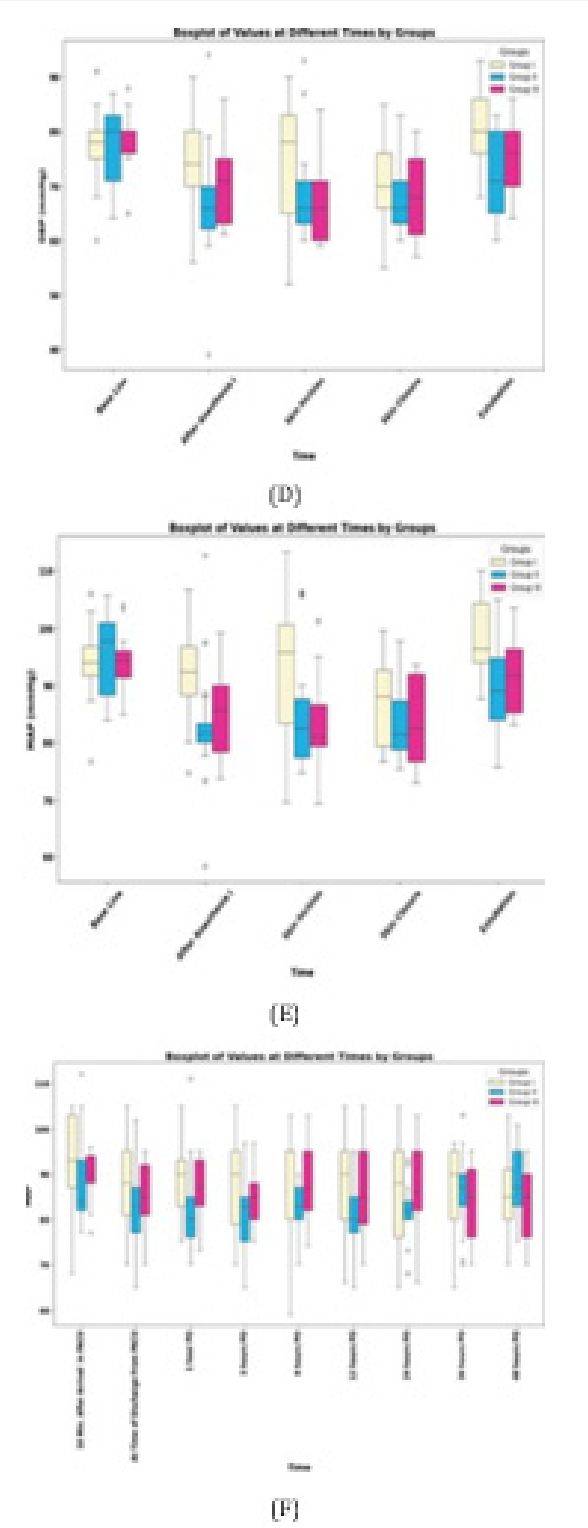


Figure 7: Comparison Between Studied Groups Regarding (A) Preoperative, (B) Postoperative Heart Rate, (C) Systolic Blood Pressure, (D) Diastolic Blood Pressure, (E) Preoperative Mean Arterial Blood Pressure And (F) Postoperative Mean Arterial Blood Pressure.

Discussion

The main findings of our study suggest significant advantages of adding dexmedetomidine (0.5 mcg/kg) to bupivacaine in ultrasound-guided ESB for open renal surgery. Patients receiving this block required less general anesthesia, as shown by a lower minimum alveolar concentration. They also experienced reduced reliance on postoperative opioids due to lower nalbuphine

How to cite this article: Ayman Mohamady E, Tarek S. H, Zaher Z. Z, Mohammed S. A, Rehab Ahmed K, et al. Systemic Versus Local Dexmedetomidine as An Adjuvant to Ultrasound Guided Erector Spinae Block by Bupivacaine in Kidney Exploration Surgeries, A Randomized Controlled Trial. J Anest & Inten care med. 2025; 14(1): 555878. DOI:10.19080/JAICM.2025.14.555878

consumption. Furthermore, the time to the first postoperative opioid dose was extended, indicating a longer-lasting pain relief effect and lower pain scores. Notably, patients displayed improved hemodynamic stability throughout surgery and recovery. Regarding the severity of pain measured by NRS during rest and coughing, in the current study, the three groups provided the same NRS score one-hour post-operative, while after 3 hours post-operative, there was significant superiority of local Dexmedetomidine over I.V Dexmedetomidine and Bupivacaine alone, Also, I.V Dexmedetomidine gave a significantly better result in comparison to Bupivacaine alone.

At rest, NRS at 6, 12, and 24 hours was significantly lower in group II than in group I and group III but, a non-significant difference between groups I and III. While NRS at 36 hours was significantly lower in group II only than in I and III but, was significant between groups I and II only. Moreover, after 48 hours the NRS was the same between the three groups. During coughing, NRS at 6 hours was the higher score in group I than in group III and the last one was group II, while NRS at 12 and 24 hrs. was significantly lower in group II than group I and group III but, non-significant difference between group I and III. Moreover, after 36 and 48 hours the NRS was the same between the three groups.

In our study, we showed that the pain-free time was significantly longer when dexmedetomidine was used locally (34 ± 15 hours) compared to intravenously (15 ± 10 hours), indicating that the prolonged analgesic effect is due to its local action rather than systemic absorption. When dexmedetomidine is injected locally, it acts directly at the site of injection. It works by binding to α2-adrenergic receptors located on peripheral nerve endings and within the spinal cord through transforaminal, leading to a decrease in the release of norepinephrine. This results in prolonged hyperpolarization of the nerve, rather than a synergistic effect with local anesthetics which extends the duration of the block but when administered intravenously, dexmedetomidine exerts its effects primarily through central α2-adrenergic receptors in the brainstem, leading to sedation and modest analgesia. However, the concentration that reaches peripheral nerve endings after I.V. administration is significantly lower compared to when it is directly injected at the site of the nerve block. This explains why the same dose administered I.V. does not provide the same prolonged analgesic effect as local administration.

In line with our findings, Yang et al. [12] discovered that patients undergoing laparoscopic nephrectomy who underwent ultrasound-guided ESPB showed a significant reduction in intraoperative opioid consumption in addition to lower Visual Analog Scale (VAS) scores during rest and during coughing in the postoperative phase. Abu El Hassan et al. [13] showed that using Dexmedetomidine resulted in lower active and passive VAS pain scores. Also, Hussain et al. [14] stated that in the Dexmedetomidine Group pain score decreased significantly in the postoperative period. As regards our research, we observed that dexmedetomidine usage either local or systemic, along with bupivacaine in ESPB, exhibited safety and associated with statistically but not clinically significant fluctuations as regards HR, BP, or MAP.

Similar to our results Abu El Hassan et al. [13] showed that regarding the intraoperative results, such as bradycardia as well as hypotension among all groups, no statistically significant variations were documented. Prasad et al. [15] revealed that hemodynamics was similar among both groups except for the second as well as third hours postoperatively where HR exhibited a significant reduction within the Dexmedetomidine Group, in contrast, several research addressed that dexmedetomidine remains unsafe at all dosages and specific dosages, it could induce systemic complications, as Esmaoglu et al. [16] addressed that incorporating 100 μg of dexmedetomidine with LA decreased the onset time while extending the block duration along with postoperative analgesia, however, it caused significant postoperative bradycardia.

In our study we found that the difference in the post-operative hemodynamic, difference in HR was lower at 10 Min. after arrival in PACU, at time of discharge from PACU, 1, 3, 6, 12, 24 and 36 in group II than group I. while there was no difference after 48 hours. While, the difference in MAP at baseline, after 6, 24, 36, and 48 hours was insignificant between the three groups, while group II was significantly lower than Groups I and II at the time of discharge from PACU, 1, 3, and 12 hours. Meanwhile there were no significant difference between groups II and III over time. Similar to our results, Hussain et al. [14] found that HR was constantly lower in Dexmedetomidine Group patients in the postoperative period and it was significantly lower during the 2nd and 3rd postoperative hours. A previous study by Wang et al. [17] suggests that the variability in hemodynamics between our study and the literature is dose-dependent, so clinicians should select the dose of dexmedetomidine. Moreover, the potential risks of hemodynamic changes such as bradycardia and hypotension should not be disregarded and should be preoperatively and appropriately managed.

Regional Dexmedetomidine is an excellent choice and reasonable adjuvant alternative especially in ultrasound-guided blocks as it provides a more pain-free time postoperatively, less nalbuphine consumption with acceptable advertising effects, Also, extending the duration of blocks with maximal analgesic effects, and non-inferior to opioid in term of motor block. Successful outcomes could lead to improved pain control, fewer opioid-related side effects, and informed clinical guidelines, making ESPB with dexmedetomidine a standard practice in multimodal analgesia for renal surgeries.

Limitations of this study included that the sample size was relatively small including patients undergoing open renal surgery only. We did not use a catheter insertion for intermittent boluses or continuous infusions, didn't assess the incidence of chronic

How to cite this article: Ayman Mohamady E, Tarek S. H, Zaher Z. Z, Mohammed S. A, Rehab Ahmed K, et al. Systemic Versus Local Dexmedetomidine as An Adjuvant to Ultrasound Guided Erector Spinae Block by Bupivacaine in Kidney Exploration Surgeries, A Randomized Controlled Trial. J Anest & Inten care med. 2025; 14(1): 555878. DOI:10.19080/JAICM.2025.14.555878

pain also, and didn't assess intraoperative and postoperative complications, The concentration of dexmedetomidine in the blood was not measured. Owing to the absence of a plasma dexmedetomidine measurement after its administration with bupivacaine in open renal surgeries.

Conclusions

Using dexmedetomidine as a local adjuvant in ultrasound-guided ESB is more effective for managing postoperative pain in patients undergoing open kidney surgeries compared to systemic dexmedetomidine or bupivacaine alone, which mediated primarily by local interfacial action rather than systemic absorption. Local dexmedetomidine significantly prolonged the time to first rescue analgesia, reduced overall nalbuphine consumption, and provided superior pain relief postoperatively. Additionally, the intra-operative hemodynamics were more stable with local dexmedetomidine.

Availability of the Data and Materials

The datasets generated and analyzed during the current study are not publicly available due to institutional restrictions but are available from the corresponding author on reasonable request. Ethical approval and consent to participant This study was approved by ethics committee of Aswan University Hospital (approval code: 742/2/23). All patient signed a written informed consent before inclusion in this study.

Sponsors and funding sources: not to be declared.

Acknowledgment: not to be declared.

Conflict of interests: Not to be declared.

References

1. Gaba DM, Howard SK, Fish KJ, Smith BE, Sowb YA (2001) Simulation-Based Training in Anesthesia Crisis Resource Management (ACRM): A Decade of Experience. Simul Gaming 32(2): 175-193.
2. Rosen KR (2008) The history of medical simulation. J Crit Care 23(2): 157-166.
3. (2013) The Comprehensive Textbook of Healthcare Simulation, pp. 121-131.
4. (2025) About the Simulation Program | Unity Health, Canada.
5. (2025) Simulation Centres | Department of Anesthesiology and Pain Medicine, Canada.
6. Flin R, Fletcher G, McGeorge P, Glavin R, Maran N, et al. (2003) Rating Anaesthetists' Non-Technical Skills -The Ants System. Proc Hum Factors Ergon Soc Annu Meet 47(12): 1498-1501.
7. Motola I, Devine LA, Chung HS, Sullivan JE, Issenberg SB (2013) Simulation in healthcare education: A best evidence practical guide. AMEE Guide No. 82. Méd Teach 35(10): e1511-1530.
8. Radhakrishnan B, Katikar MD, Myatra SN, Gautam PL, Vinayagam S, et al. (2022) Importance of non-technical skills in anaesthesia education. Indian J Anaesth 66(1): 64-69.
9. Rudolph JW, Simon R, Rivard P, Dufresne RL, Raemer DB (2007) Debriefing with Good Judgment: Combining Rigorous Feedback with Genuine Inquiry. Anesthesiol Clin 25(2): 361-376.
10. Eppich W, Cheng A (2015) Promoting Excellence and Reflective Learning in Simulation (PEARLS). Simul Healthc: J Soc Simul Health 10(2): 106-115.
11. Kaufman DM (2003) Applying educational theory in practice. BMJ 326(7382): 213-216.
12. Winfred Arthur Jr, Winston Bennett Jr, Stanush PL, McNelly TL (1998) Factors That Influence Skill Decay and Retention: A Quantitative Review and Analysis. Hum Perform 11(1): 57-101.
13. Chiu M, Tarshis J, Antoniou A, Bosma TL, Burjorjee JE, et al. (2016) Simulation-based assessment of anesthesiology residents' competence: development and implementation of the Canadian National Anesthesiology Simulation Curriculum (CanNASC). Can J AnesthesiaJ Can d'anesthésie 63(12): 1357-1363.

DOI: 10.19080/JAICM.2025.14.555878

How to cite this article: Ayman Mohamady E, Tarek S. H, Zaher Z. Z, Mohammed S. A, Rehab Ahmed K, et al. Systemic Versus Local Dexmedetomidine as An Adjuvant to Ultrasound Guided Erector Spinae Block by Bupivacaine in Kidney Exploration Surgeries, A Randomized Controlled Trial. J Anest & Inten care med. 2025; 14(1): 555878. DOI:10.19080/JAICM.2025.14.555878