Ultrasound guided erector spinae block versus thoracic paravertebral block for postoperative pain control after open nephrectomy : A randomized controlled trial

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Abstract

Background: Open nephrectomy is associated with substantial postoperative pain. Epidural analgesia is a very useful option but with many risks. Systemic analgesics in the form of opioid analgesics may give rise to side effects like nausea , vomiting , constipation , allergy or drowsiness. Erector spinae plane (ESP) block is one of the interfascial plane blocks that target the dorsal and ventral rami of the spinal nerves. Recent studies demonstrated effective postoperative analgesia for ESPB after thoracic and abdominal surgeries. Paravertebral block (PVB) is a technique where a local anesthetic is deposited into a space found on both sides of the spine. Some studies showed that PVB is effective for pain relief in the thoracic and abdominal surgeries.

Aim: to evaluate the analgesic effect of US-guided ESP block and thoracic paravertebral block in patients undergoing elective open nephrectomy surgery.

Methods: forty five patients aged from 30-60 years scheduled for elective open nephrectomy surgeries under general anesthesia and classified to one of three groups (ESPB group , PVB group and Control group).

Postoperative pain was assessed by the visual analogue score at 2, 4, 6, 12, 18, and 24 hours postoperatively and the total 24-hours morphine consumption was recorded.

Results: We reported that both ESP block and PVB significantly reduced total morphine consumption and the VAS score at 24 hours postoperatively compared to the control group. Total morphine consumption 24 h postoperatively was decreased to about 60% (morphine sparing about 40%) with both ESP block and PVB compared to the control group. we also reported that there was no statistical significance between the PVB group and the ESPB group according to total morphine consumption and the VAS scores in 24 hours postoperatively.

Conclusion: Both ESP and PVB block provided better postoperative analgesia compared to IV morphine after open nephrectomy surgeries. Physicians could perform either PVB or ESB according to their clinical experiences and personal choices.

Keywords: Ultrasound guided erector spinae block, paravertebral block, open nephrectomy

Introduction

Open nephrectomy is associated with substantial postoperative pain, pain relief in patients undergoing this procedure is usually provided either by thoracic epidural analgesia (EA) or by systemic analgesics.

EA is a very useful option for the management of postoperative pain in patients undergoing abdominal surgeries, but the risks and contraindications linked to EA like hypotension , headache , nerve damage or infection may limit its use **(1)(2)**.Systemic analgesics in the form of opioid analgesics may give rise to side effects like nausea ,vomiting , constipation , allergy or drowsiness and often provide insufficient analgesia. **(3)** Hence, other methods of postoperative pain management are desired. Sensory level target according to the incision site Flank (T9–T11) , Thoraco-abdominal (T7–T12) and Trans-abdominal (T6–T10). (**4)**

Ultrasound (US) guided erector spinae plane (ESP) block is one of the interfascial plane blocks that target the dorsal and ventral rami of the spinal nerves **(5).**Although there is no sufficient evidence for the spread of local anesthetic to the ventral rami, recent reports demonstrated effective postoperative analgesia after thoracic and lumbar surgeries affecting both the ventral and dorsal rami **(6)(7).** According to a previous study done by Santonastaso D Pietro et al , Erector Spinae Plane block has allowed a reduction in opioid consumption and excellent pain control in partial nephrectomy. **(8)**

Paravertebral block (PVB) is a technique where a local anesthetic is deposited into a space found on both sides of the spine, called the paravertebral space. It is a block with a dermatomal distribution of pain relief depending on the level of the spine at which the block is sited and the quantity and type of deposited local anesthetic. **(9)**

PVB is effective for pain relief in the thoracic, abdominal and limb regions **(10)(11).** It was first described by surgeon Hugo Sellheim (1871–1936) for abdominal analgesia. In a previous study done by Baik JS et al, a preoperative single TPVB improved postoperative analgesia by reducing the postoperative pain score and fentanyl consumption in patients undergoing nephrectomy. **(12)**

The purpose of this randomized, controlled study was to evaluate the analgesic effect of US-guided ESP block and thoracic paravertebral block in patients undergoing elective open nephrectomy surgery. Our primary aim was to compare postoperative opioid consumption rates at 24 h. Secondary end points were to compare pain scores and hemodynamic variables.

SUBJECTS & METHODS

This was randomized, controlled , single-blinded study, conducted in urology operating theatre, Cairo university hospital. Forty five patients aged from 30-60 years scheduled for elective open nephrectomy surgeries under general anesthesia were enrolled in the study.

Sample size

Power analysis was performed using G-power software. We used ANOVA test on the total 24-hour morphine consumption as it the main outcome of the present study. A previous study showed that the total 24-hour morphine consumption was 21.8+-3.7 mg within the control group.We assumed that the blocks have been make a difference of at least 20% in the total morphine consumption.

Considering a study power of a 0.8 and an alpha error of 0.05 , the calculated sample size have been be at least 36 patients (12 in each group). We included 45 patients (15 in each group) to compensate for possible drop-outs.

Inclusion criteria

- Adult patients (30-60 years) with renal cancer.
- Patients with ASA I , II score.

Exclusion criteria

- Patient's refusal
- Patients with ASA III , IV score.
- Coagulopathy to be cancelled if (INR>1.4 , Platelets count $<100x10^9$)
- Infection at the injection site.
- Allergy to local anesthetics.
- Patients receiving opioids for chronic analgesic therapy.

Study Procedures

1. Randomization (in RCT only)

Randomization was achieved using a computer-generated sequence. Concealment was achieved using opaque envelopes.

Study Protocol

Preoperative period:

The patient was asked about his medical and surgical history in details and fasting hours (6-8 hrs) and full examination was performed including airway examination. Lab investigations including cbc , coagulation profile , liver function tests and renal fuction tests to be revised.

The procedure was explained to the patient and informed consent was signed after his agreement then the patient was classified to one of three groups

1-**ESPB Group** : This group received erector spinae plane block.

2-**PVB Group** : This group received thoracic paravertebral block.

3-**Control Group** : This group received pethidine (1 mg/kg iv) before skin incision .

The visual analogue score (VAS) was explained to the patient in details as it was used as a measurement tool for assessment of postoperative pain.

After that , the iv access was secured with 18-gauge cannula and Premedications (midazolam 2mg iv and ondansetron 4 mg iv) was given 30 minutes before operation.

Intraoperative period:

In operation room: firstly the patient was put in the supine position and monitored with ECG, non-invasive arterial blood pressure, capnography and pulse oximetry (SpO2). Preoxygenation using 100% O2 with a face mask then induction of GA by fentanyl (1ug/kg), propofol (2mg/kg), atracurium (0.5 mg/kg) slowly while the effects of the drugs on cardiovascular and respiratory systems were monitored then the airway was secured with cuffed endotracheal tube. GA was maintained by isoflurane (1.15%) and atracurium (0.1 mg/kg).

Ventilation was maintained by relaxant anesthesia and controlled ventilation with (tidal volume 6-8 ml/kg , respiratory rate 12-16 , FIO2 40%, IE ratio 1:2 , peep 5 cmH2o and pmax 40 cmH2o).

The patient was repositioned with careful hands in the lateral position (with the side to be blocked uppermost) for ESPB or PVB block to be performed before skin incision.

Technique of ESPB:

Landmark-guided ESPB can be performed with the patient in lateral position Aim of the study was to deposit local anaesthetic (LA) into the fascial plane deep to erector spinae muscle which blocks the dorsal and ventral rami of the spinal nerve depending on the level of injection and the amount of local anesthetic injected.

The spinous process of the vertebra and a point 3 cm lateral to it were marked at the appropriate level before performing the block. Under aseptic precautions, the needle was inserted and advanced perpendicular to the skin in all planes to contact the transverse process of the vertebra [Figure 1a].

The transverse process of the thoracic vertebra lies at a variable depth of 2–4 cm from the skin depending on the build of the individual . At this point, the needle tip lies between the erector spinae muscle and transverse process.

After negative aspiration, local anesthetic was injected (volume of 20 ml of 0.25% levo bupivacaine) . The drug injected in this plane spreads in the longitudinal axis to both cephalad and caudal direction over several levels as the erector spinae fascia extends from nuchal fascia to the sacrum

Technique of PVB:

In lateral position, Convex ultrasound probe was placed parallel to the vertebral spine at T4 level and shifted 2–3 cm laterally to obtain the appropriate visualization. Following the identification of pleura, transverse process and paravertebral space, the needle was inserted cranial to caudal direction using in-plane approach (fig 2). After confirming the displacement of pleura with 0.5–1 ml of local anesthetic (LA), 20 ml of 0.25% bupivacaine was administered for the block.

The surgery started 20-30 minutes after performation of the block and duration of anesthesia and surgery was recorded . The vital signs were monitored all through for early prediction of any adverse events regarding heart rate , blood pressure , volume status or complications of the blocks like hypotension , vascular puncture , local anesthetic toxicity , pleural puncture or pneumothrax to be properly managed in case of its occurrence.

After the end of operation, residual neuromuscular block was reversed by anticholinesterase (neostigmine 0.04 -0.08 mg/kg iv) with anticholinergic (atropine 0.4 mg per 1 mg neostigmine) till adequate recovery from the muscle relaxant was established and spontaneous ventilation was regained. the patient's phaynx was thoroughly suctioned before extubation .The patient was ventilated with 100 % oxygen just prior to extubation . Extubation was performed when the patient was either deeply anesthetized or awake. A face mask with 100 % O2 was applied till the patient was stable enough for transportation to the recovery room.

Postoperative period:

In the recovery room , the patient was monitored all through by pulse oximeter , ECG and non-invasive arterial blood pressure. Oxygen therapy was applied by oxygen mask in case of O2 saturation <92%. The patient received paracetamol (1gm/8hrs iv) as a regular analgesia. Postoperative pain was assessed by the (VAS) score . If the VAS was 4 or more, a rescue morphine dose (0.02 mg/kg IV) to be repeated every 20 minutes to maintain a resting VAS at <3 .The VAS score was applied by the investigator at 2, 4, 6, 12, 18, and 24 hours postoperatively and the total 24-hours morphine consumption was recorded. The patient was discharged pain free after 1 hour.

Measurement tools

Postoperative pain management:

If the visual analogue scale (VAS) was 4 or more, a morphine increment (0.02 mg/kg IV) was added to maintain a resting VAS at <3 and the total 24-hours morphine consumption was recorded.

Study outcomes

1. **Primary outcome**
   - Total morphine requirements 24 hours postoperatively.
2. **Secondary outcome(s)**

1. Visual analogue score (VAS) at 2, 4, 6, 12, 18, and 24 hours postoperatively.
2. Heart rate.

Statistical Analysis

Data were coded and entered using the statistical package for the Social Sciences (SPSS) version 28 (IBM Corp., Armonk, NY, USA). Data was summarized using mean and standard deviation for normally distributed quantitative variables or median and interquartile range for non-normally distributed quantitative variables and frequencies (number of cases) and relative frequencies (percentages) for categorical variables. Comparisons between groups were done using analysis of variance (ANOVA) with multiple comparisons post hoc test in normally distributed quantitative variables while non-parametric Kruskal-Wallis test and Mann-Whitney test were used for non-normally distributed quantitative variables . For comparing categorical data, Chi square ($\chi 2$) test was performed. Exact test was used instead when the expected frequency is less than 5**.** P-values less than 0.05 were considered as statistically significant**.**

RESULTS

47 patients were evaluated for eligibility for the study. 2 patients were excluded due to failure of the PVB . 45 patients were randomized to receive one of the interventions of the three groups (PVB , ESPB and control) 15 patients for each group were available for the final analysis **.**

Table 1-2: Demographic data, operative data, and baseline characteristics. Data are presented as mean ± standard deviation and frequency (%) .

		ESPB group		PVB group		Control group		P value
		Count	%	Count	%	Count	%	
Gender	**M**	9	60.0%	9	60.0%	11	73.3%	0.678
	F	6	40.0%	6	40.0%	4	26.7%	
Medical history	**HTN**	3	20.0%	4	26.7%	2	13.3%	`0.801
	DM	1	6.7%	2	13.3%	1	6.7%	
	N	11	73.3%	9	60.0%	12	80.0%	

	ESPB group		PVB group		Control group		
	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation	P value
Age	49.20	4.90	47.93	4.20	46.00	4.57	0.167
Hb	12.35	1.89	11.33	1.22	12.05	1.05	0.147
Plts count	270.67	61.73	263.27	95.31	272.40	72.14	0.943
PC	96.73	5.44	95.40	6.01	95.13	4.79	0.691
INR	1.02	0.07	1.05	0.07	1.03	0.05	0.497

Data were comparable between the three groups with no statistical significance.

Table 3-4 : Intraoperative heart rate . Data are presented as mean ± standard deviation.

	ESPB group		PVB group		Control group		
	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation	P value
Intraoperative Baseline HR(beat /min)	76.40	4.69	77.47	6.15	77.40	4.94	0.827
Intraoperative HR 15m	76.27	5.48	78.73	5.71	77.20	4.36	0.433
Intraoperative HR 30	83.80	4.87	77.87	5.24	75.80	1.57	< 0.001
Intraoperative HR 45	82.40	4.00	72.80	6.62	77.60	3.16	< 0.001
Intraoperative HR 60	75.60	3.72	70.87	6.33	78.20	3.82	0.001
Intraoperative HR 75	73.60	3.70	70.80	5.02	79.87	3.58	< 0.001
Intraoperative HR 90	72.80	3.65	70.40	5.22	80.00	3.21	< 0.001
Intraoperative HR 105	70.67	7.59	71.07	5.98	83.07	4.13	< 0.001
Intraoperative HR 120m	72.07	3.47	73.73	4.67	85.27	3.08	< 0.001

Post hoc pair wise comparisons

	ESPB group VS PVB group	**ESPB group VS Control group**	**PVB group VS Control group**
Intraoperative Baseline HR	1.000	1.000	1.000
Intraoperative HR 15m	0.608	1.000	1.000
Intraoperative HR 30m	0.001	0.000	0.563
Intraoperative HR 45m	< 0.001	0.028	0.028
Intraoperative HR 60m	0.029	0.431	< 0.001
Intraoperative HR 75m	0.215	< 0.001	< 0.001
Intraoperative HR 90m	0.354	< 0.001	< 0.001
Intraoperative HR 105m	1.000	< 0.001	< 0.001
Intraoperative HR 120m	0.710	< 0.001	< 0.001

- There is statistical significance between (PVB , control) groups and ESPB group at 30 and 45 minutes readings.
- There is statistical significance between (PVB group , ESPB) groups and control group at 60 ,75 ,90,105 and 120 minutes readings.

	ESPB group		**PVB group**		**Control group**		
	Mean	**Standard Deviation**	**Mean**	**Standard Deviation**	**Mean**	**Standard Deviation**	**P value**
Postoperative HR30m	73.33	4.24	75.47	5.03	89.33	6.84	< 0.001
Postoperative HR 60m	79.13	5.44	80.80	6.20	101.13	7.13	< 0.001
Postoperative HR 90m	87.40	7.33	90.07	7.97	103.27	11.11	< 0.001
Postoperative HR 2h	93.13	6.17	94.60	3.76	96.93	8.76	0.145
Postoperative HR 4h	91.47	6.05	96.00	4.19	99.00	8.11	0.008
Postoperative HR 6h	87.00	7.22	91.53	6.72	92.07	8.44	0.139
Postoperative HR 8h	86.67	7.17	89.53	6.41	98.53	10.45	0.001
Postoperative HR12h	91.40	4.26	95.80	6.01	100.07	7.34	0.001
Postoperative HR18h	91.33	4.55	95.27	5.11	96.00	4.31	0.019
Postoperative HR 24h	87.33	3.15	91.20	3.26	93.67	3.42	< 0.001

Table 5-6 : Postoperative heart rate . Data are presented as mean ± standard deviation

Post hoc pair wise comparisons

	ESPB group VS PVB group	ESPB group VS Control group	PVB group VS Control group
Postoperative HR 30m	0.877	< 0.001	< 0.001
Postoperative HR 60m	1.000	< 0.001	< 0.001
Postoperative HR 90m	1.000	< 0.001	0.001
Postoperative HR 2h	0.207	0.360	1.000
Postoperative HR 4h	0.168	0.007	0.602
Postoperative HR 6h	0.315	0.213	1.000
Postoperative HR 8h	1.000	0.001	0.013
Postoperative HR 12h	0.005	0.001	1.000
Postoperative HR 18h	0.078	0.027	1.000
Postoperative HR 24h	0.007	< 0.001	0.136

- There is statistical significance between ESPB group and control group at almost all readings.
- There is statistical significance between PVB group and control group at 30, 60 , 90 minutes and 8 hours readings.
- There is statistical significance between ESPB group and PVB group at 2 readings only.

Table 7-8: Postoperative VAS score . Data are presented as median and quartiles.

	ESPB group			PVB group			Control group			
	Median	**1st quartile**	**3rd quartile**	**Median**	**1st quartile**	**3rd quartile**	**Median**	**1st quartile**	**3rd quartile**	**P value**
Postoperative VAS score 30m	0.00	0.00	0.00	0.00	0.00	0.00	4.00	2.00	4.00	< 0.001
Postoperative VAS score 60m	2.00	0.00	2.00	1.00	0.00	2.00	5.00	4.00	5.00	< 0.001
Postoperative VAS score 90m	4.00	2.00	4.00	2.00	2.00	4.00	5.00	4.00	6.00	< 0.001
Postoperative VAS score 2h	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	5.00	0.107
Postoperative VAS score 4h	4.00	4.00	4.00	4.00	4.00	4.00	5.00	4.00	6.00	< 0.001
Postoperative VAS score 6h	4.00	2.00	4.00	4.00	2.00	4.00	4.00	3.00	5.00	0.218
Postoperative VAS score 8h	4.00	2.00	4.00	4.00	2.00	4.00	5.00	4.00	6.00	< 0.001
Postoperative VAS score 12h	4.00	4.00	4.00	4.00	4.00	5.00	5.00	4.00	6.00	0.039
Postoperative VAS score 18h	4.00	4.00	5.00	4.00	4.00	4.00	4.00	4.00	5.00	0.372
Postoperative VAS score 24h	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	5.00	0.014

Post hoc pair wise comparisons

	ESPB group VS PVB group	**ESPB group VS Control group**	**PVB group VS Control group**
Postoperative VAS score 30m	1	< 0.001	< 0.001
Postoperative VAS score 60m	1	< 0.001	< 0.001
Postoperative VAS score 90m	0.899	0.004	< 0.001
Postoperative VAS score 4h	1	0.001	0.004
Postoperative VAS score 8h	1	0.004	0.001
Postoperative VAS score 12h	0.582	0.032	0.632
Postoperative VAS score 24h	1	0.033	0.033

-There is statistical significance between (PVB , ESPB) groups and control group at almost all readings.

-No statistical significance between PVB group and ESPB group.

Table 9-10 : Postoperative Morphine . Data are presented as median and quartiles.

	ESPB group			**PVB group**			**Control group**			
	Median	**1st quartile**	**3rd quartile**	**Median**	**1st quartile**	**3rd quartile**	**Median**	**1st quartile**	**3rd quartile**	**P value**
Postoperative morphine 30m	0.00	0.00	0.00	0.00	0.00	0.00	2.00	0.00	2.00	< 0.001
Postoperative morphine 60m	0.00	0.00	0.00	0.00	0.00	0.00	2.00	2.00	4.00	< 0.001
Postoperative morphine 90m	2.00	0.00	2.00	0.00	0.00	2.00	4.00	2.00	4.00	< 0.001
Postoperative morphine 2hrs	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	0.289
Postoperative morphine 4h	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	0.289
Postoperative morphine 6h	2.00	0.00	2.00	2.00	0.00	2.00	2.00	0.00	2.00	0.932
Postoperative morphine 8h	2.00	0.00	2.00	2.00	0.00	2.00	2.00	2.00	4.00	0.002
Postoperative morphine 12h	4.00	4.00	4.00	4.00	2.00	4.00	4.00	4.00	4.00	0.196
Postoperative morphine 18h	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	1.000
Postoperative morphine 24h	4.00	2.00	4.00	4.00	2.00	4.00	4.00	4.00	4.00	0.228

Post hoc pair wise comparisons

	ESPB group VS PVB group	**ESPB group VS Control group**	**PVB group VS Control group**
Postoperative morphine 30m	1	< 0.001	< 0.001
Postoperative morphine 60m	1	< 0.001	< 0.001
Postoperative morphine 90m	1	0.001	< 0.001
Postoperative morphine 8h	1	0.005	0.011

- There is statistical significance between (PVB , ESPB) groups and control group at first 8 hours readings.
- No statistical significance between PVB group and ESPB group.

Table 11-12 : Total Morphine . Data are presented as mean ± standard deviation.

	ESPB group		**PVB group**		**Control group**		
	Mean	**Standard Deviation**	**Mean**	**Standard Deviation**	**Mean**	**Standard Deviation**	**P value**
Total Morphine mg / 24 hrs	18.93	1.49	18.13	1.41	27.33	1.23	< 0.001

	ESPB group VS PVB group	**ESPB group VS Control group**	**PVB group VS Control group**
Total Morphine mg/24 hrs	0.360	< 0.001	< 0.001

- There is statistical significance between (PVB , ESPB) groups and control group .
- No statistical significance between PVB group and ESPB group.

DISCUSSION

Open nephrectomy is associated with substantial postoperative pain. Sensory level target according to the incision site Flank (T9–T11), Thoraco-abdominal (T7–T12) and Trans-abdominal (T6–T10).

Ultrasound (US) guided erector spinae plane (ESP) and Paravertebral block (PVB) are effective for pain relief in the thoracic and abdominal surgeries.

This study involved forty five patients aged from 30-60 years, ASA I and II scheduled for elective open nephrectomy surgeries under general anesthesia classified to one of three groups (ESPB Group, PVB Group and Control Group).

Postoperative pain was assessed by the visual analogue score. If the VAS was 4 or more, a rescue morphine dose (0.02 mg/kg IV) was given. The VAS score was reassessed by the investigator at 2, 4, 6, 12, 18, and 24 hours postoperatively and the total 24-hours morphine consumption was recorded.

We reported that both ESP block and PVB significantly reduced total morphine consumption at postoperative 24 h compared to the control group. The VAS score was significantly reduced in both ESP block and PVB compared to the control group.

Total morphine consumption 24 h postoperatively was decreased to about 60% (morphine sparing about 40%) with both ESP block and PVB compared to the control group.

The efficacy of ESPB has been reported by former recent studies one of them was done by Gürkan et al. The study compared ESP block with the control group for postoperative pain control in breast surgeries and morphine consumptions at postoperative 24 h were reported. The study showed that ESP block significantly

reduced morphine consumption by 60% at 24 h postoperatively compared to the control group at 1, 6, 12 and 24 h .This was 20% more than our study but Gürkan et al included all breast surgeries which included simpler procedures like breast lambectomy .**(13)**

In a systematic review and meta‑analysis, Jun Ma et al compared ESPB with no block in terms of the analgesic effect in adult patients following spine surgery. The primary outcome was Visual Analog Scale at different time intervals in 48 h after surgery and the secondary outcomes included postoperative opioid consumption. The study showed that ESPB was effective in decreasing postoperative pain intensity and postoperative opioid consumption in spine surgery.**(14)**

In another study done by Shaimaa F Mostafa et al. 60 patients aged 18 to 65 years undergoing laparoscopic bariatric surgery with a body mass index (BMI) of $\geq$ 40 kg/m^2 were randomly allocated into two groups. Patients received either bilateral erector spinae plane block using 20 mL bupivacaine 0.25% at the level of the T7 transverse process or bilateral sham block using 20 mL normal saline on each side. The study reported that Ultrasound-guided erector spinae plane block provided satisfactory postoperative analgesia following laparoscopic bariatric surgery with decreased analgesic consumption .**(15)**

In a systematic review and meta-Analysis done by Chang-Hoon Koo et al about the efficacy of erector spinae plane block for analgesia in thoracic surgery. Seventeen studies, including 1,092 patients, were included in the final analysis. Erector spinae plane block reduced 24-hour postoperative opioid consumption and pain score compared to no block. Compared with other regional blocks, various results have been observed. Statistical results reported that ESPB was inferior to thoracic paravertebral block and intercostal nerve block and superior to serratus anterior plan block in postoperative analgesia but clinical differences remain unclear. The incidence of hematoma was lower in the ESPB group than in the other groups so they concluded that ESPB is a safer method, without clinically important differences, for postoperative pain control.**(16)**

Tao Tang et al reported similar findings. They compared the effect of combined thoracic paravertebral block (TPVB) and general anesthesia versus general anesthesia alone on postoperative stress and pain in patients undergoing laparoscopic radical nephrectomy. Patients randomized into a study group given TPVB combined with general anesthesia (n=43) and a reference group (n=43) given general anesthesia. The perioperative clinical indicators were blood pressure, pulse rate and VAS score. **(17)**

Perioperative clinical indicators of the study group were superior to those of the reference group . Systolic blood pressure , diastolic blood pressure and pulse rate at 90 minutes during operation were significantly lower in the study group than in the reference group .The study group had lower VAS scores both during activity and at rest 48 h after the operation than in the reference group . **(17)**

Nnaemeka Ugonna Okoye et al in a study that was carried out on 60 adult female patients scheduled for unilateral mastectomy. A nerve stimulator was used to locate paravertebral space thereafter group received bupivacaine with adrenaline and group received saline injected into the paravertebral space. Intravenous morphine patient controlled analgesia was commenced in the two groups for 24 h after the surgery. **(18)**

The study showed that 24 h morphine consumption was significantly reduced in the bupivacaine group compared to the control group. The Numerical pain rating score was significantly lower in the bupivacaine group than in the control group in the 1st 6 h. The time to first request for analgesia was significantly longer in the bupivacaine group than the control group. **(18)**

Although the morphine sparing effect was 65.7% in the bupivacaine group compared to 40% in our study but explained as Nnaemeka Ugonna Okoye et al added epinephrine with bupivacaine **(18)**The addition of adrenaline to bupivacaine slows its absorption and reduces the peak plasma concentration so it prolongs the duration of the peripheral nerve blocks. **(19)**

We also reported that there was no statistical significance between the PVB group and the ESPB group according to total morphine consumption and the VAS scores in 24 hours postoperatively.

This finding was also reported by Yavuz Gürkan et al in a study about erector spinae plane block and thoracic paravertebral block compared to IV-morphine for breast surgery. Female patients aged between 18 and 65 years scheduled for elective breast cancer surgery were included in the study randomized into 3 groups 25 patients in each group. The study reported that both PVB and ESP block significantly reduced

morphine consumption at 6, 12 and 24 h compared to control group and there were no statistical differences between the two block groups in any time interval. Analyses between groups showed that there was no statistically significant difference between ESP and PVB group for NRS in any time interval. **(20)**

In another study done by Jesse W. Stewart et al comparing erector spinae plane block versus thoracic paravertebral block for pain management after total bilateral mastectomies.25 patients undergoing elective total bilateral mastectomies without reconstruction. All included patients had breast cancer on a unilateral side and contralateral mastectomy was performed for risk reduction. The study reported that there was no significant differences in the resting or movement-evoked pain scores between PVB and ESPB at any time points up to day 7 after surgery.**(21)**

However , Özlem Turhan et al in a study that compared thoracic paravertebral block and erector spinae plane block and intercostal nerve block in thoracoscopic surgery reported that all three blocks ensured adequate pain control but thoracic paravertebral block was associated with significantly lower pain scores for the first 24 hours than ESPB . But the study was done on less invasive surgery and on larger sample size 35 patients in each group.**(22)**

Limitations of the study were the small sample size and the difficult assessment of the sensory level while the patient was under general anesthesia.

We recommend to increase the sample and to use an adjuvant drug like dexmedetomidine or adrenaline to prolong the duration of the block.

CONCLUSION

This study reported that both ESP and PVB block provided better postoperative analgesia compared to IV morphine in patients scheduled for open nephrectomy surgeries under general anesthesia.

Declarations

Consent for publication: I attest that all authors have agreed to submit the work.

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