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Efficacy of ultrasound-guided transversus abdominis plane block versus erector spinae plane block for postoperative analgesia in patients undergoing emergency laparotomies: A randomized, double-blinded, controlled study

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ABSTRACT

Ninety-three adult ASA I–III E patients undergoing emergency laparotomies were investigated in this research. Subjects were randomly divided into three groups. Following general anesthesia, bilateral peripheral nerve blocks guided by ultrasound Transversus abdominis plane block (TAPB) or erector spinae plane block (ESPB) were administered. Pain scores at rest and movement, time to first analgesic request, and total fentanyl consumption were recorded postoperatively and compared. Pain scores at rest were significantly reduced in the research groups for 12 and 18 h in TAPB and ESPB, respectively, also there was a significant decrease at 2, 4, 6, and 8 h in the ESPB group compared to the TAPB group. While pain scores at movement were significantly reduced in the ESPB group for the first 8 h than in the TAPB group both study groups demonstrated significantly reduced pain scores than the control group for the first 8 h for the ESPB group and the first 4 h for TAPB group. The time to first analgesic demand was longer in the ESPB group than in the TAPB group and both study groups were longer than the control group. Fentanyl consumed in the ESPB group was reduced than in the TAPB group and both study groups were reduced than the control group in the first 24 h. For patients having emergency laparotomies, bilateral ultrasound-guided ESPB with 40 ml of 0.25% bupivacaine reduces pain scores both at rest and motion, fentanyl use, and extends the duration of analgesia postoperatively compared to bilateral ultrasound-guided TAPB.

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1. Introduction

Postoperative pain is one of the most significant problems in the postoperative period. Postoperative pain with its inflammatory, neuropathic, and nociceptive components is triggered by surgical damage and lessens as the tissue recovers. Children and adults who are not treated for postoperative pain have extremely significant physiopathological alterations [1].

One of the modalities to control postoperative pain is the regional anesthetic techniques, which are now applied as a core component of multimodal analgesia for postoperative pain. There are multiple regional anesthetic techniques, but in this research, we compare the analgesic efficacy of ESPB versus TAPB after emergency laparotomies.

Ultrasound-guided ESPB is a new approach first introduced by **Forero et al., 2016** for neuropathic pain control. It is an interfacial plane block that targets the spinal neurons' dorsal rami, ventral rami, and rami communicating spinal nerves. It was demonstrated that after local anesthetic administration, it was extended caudally and cranially across many dermatomal layers [2].

Rafi originally developed the TAP block **in 2001** as a landmark-based method using the Petit triangle to produce a field block [3]. It was done by injecting local anesthesia into the space between the internal oblique and transversus abdominis muscles. While **Borglum et al. 2011** were the first to introduce the bilateral dual TAP block as the four-point approach [4]. Bilateral subcostal and posterior TAP blocks are performed in each of the four TAP block quadrants. This procedure is relevant for patients having both open and laparoscopic operations since its analgesia involves the whole front abdominal wall, including the parietal peritoneum [5].

This research aimed to compare the analgesic effectiveness of using the US-ESPB and the US-four quadrant TAPB for emergency laparotomies.

2. Materials and methods

After gaining clearance from the Ethics Committee of Minia University's Faculty of Medicine (No: 73–7/2018), this research was carried out. As part of the study's registration with Clinical Trials.gov (**Trial ID: NCT03989570**), we employed the CONSORT checklist to select and assign patients (Figure 1). Each patient signed an informed consent form to participate in block therapy and research.

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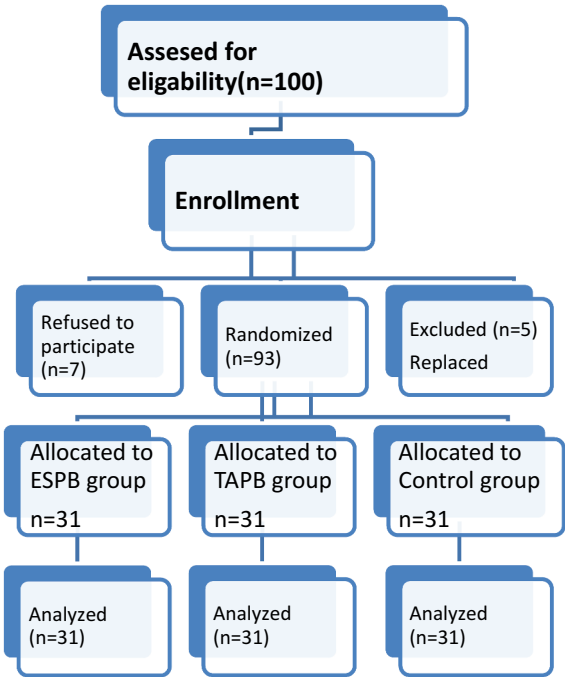

Figure 1. Flowchart of the study.

Depending on a digitalized allocation table produced by a physician who was not engaged in the research, subjects were split into three groups at random: ESPB group, TAPB group, and control group.

One hundred adults ASA I–III E patients, of both genders, their ages ranging from 20 to 50 years, undergoing emergency laparotomy under general anesthesia in the period from July 2018 to June 2019 were recruited in this randomized, double-blinded, controlled trial that was prospective. Seven patients refused to participate, and five patients (the TAPB group had two patients, whereas the ESPB group had three patients) were left out of the research due to admission to ICU intubated and replaced by other patients. The exclusion reasons from this research were the existence of Coagulation disorders, known local anesthesia allergies, infections at the site of injection for the block, severe organ failure, chronic opiate use, and body mass index ≥40kgm^{-2}.

3. Anesthetic technique

IV cannula was inserted for all patients, noninvasive ASA standard monitors (pulse oximeter, noninvasive blood pressure, electrocardiogram, and capnography) were used, and IV fluids were administered.

The same anesthetic method was used on all subjects; they were premeditated with IV midazolam 0.05 mg/kg and fentanyl 1 µg/kg. To assist tracheal intubation with an adequate size cuffed endotracheal tube, 2 mg/kg propofol and atracurium 0.5 mg/kg was given to induce anesthesia.

Then, based on the group, bilateral ultrasound-guided TAP or ESP block was applied. After 15 minutes from the block, surgery started.

Patients with ESPB were positioned in the lateral position. The ultrasonic probe (linear multi- frequency 6–13 MHz transducer) (SONOSITE M-TURBO, USA) was positioned by the anesthesiologist at the position of the T8 spinous process in a longitudinal position, and it was then moved 3 cm lateral from the midline. The T8 transverse process and the nearby erector spinae muscle were the ultrasound landmarks. To touch the T8 transverse process, a 90-mm 22-gauge spinal needle (GMS, Egypt) was placed in-plane at an angle of 30° to 40° from cranial to caudal. Before injecting 20 mL of 0.25% bupivacaine deep in the erector spinae muscle, anesthesiologists employed hydro dissection by 2–3 mL of isotonic saline to ensure the precise needle tip location. On the other side, the identical process was carried out again using 20 mL of a 0.25% bupivacaine solution.

Patients with TAPB were positioned in supine posture. To properly identify the transversus abdominis fascial plane and conduct posterior TAP, the anesthesiologist cautiously moved the ultrasound probe (linear multi-frequency 6–13 MHz transducer) (SONOSITE M-TURBO, USA) posterolaterally after placing it between the iliac crest and the costal border on the mid-axillary line of the abdominal wall. A 90-mm 22-gauge spinal needle (GMS, Egypt) was placed in-plane at a 30°–40° angle from medial to lateral under aseptic circumstances. The exact needle tip location was checked by hydro-dissection with 2–3 mL of isotonic saline before the anesthetist administered 10 mL of 0.25% bupivacaine in the fascial plane. The subcostal TAP block was accomplished similarly with the ultrasonic probe in position beneath the costal margin, and the TAP on the other side was carried out using the same method.

Atracurium bolus 0.1 mg/kg and inhalational isoflurane (MAC 1.5 to 2 in O2) were used to maintain anesthesia. To control ventilation, tidal volumes of 6–8 ml/kg and breathing rates of 12–14 breathing per minute were utilized. End-tidal CO2 was maintained at 30–35 mmHg with PEEP of 3–5 cmH2O and O2 flow of 5 L/min by adjusting the ventilation settings.

Neostigmine 0.05 mg/kg and atropine 0.01 mg/kg injections were administered before the surgery's conclusion to reverse any remaining neuromuscular blockage.

After they had fully recovered, the patients were shifted to the postoperative care facility and got postoperative care and monitoring of hemodynamics. Paracetamol 15 mg/kg/6 h IV (paracetamol 100 ml 1%, Pharco B International, Egypt) was given. When the VAS pain scores were ≥4 while resting, patients received intravenous fentanyl (0.5 µg/kg) as rescue

analgesia. If the analgesia was not adequate (VAS ≥4 for 20 min after fentanyl injection) another dose of fentanyl at 0.5 μg/kg was given, and the overall amount of fentanyl needed for analgesia was reported.

The study group's postoperative pain levels were evaluated using the VAS pain score. The VAS pain score is a 10-point scale with integers ranging from 0 to 10, where 0 implies "no pain" and 10 implies "worst suffering possible." Patients chose a whole number to express the degree of their pain both at rest and when moving (sitting). To score VAS, we used a ruler, the score is determined by measuring the distance (mm) on the 10-cm line between the "no pain" and the patient's mark. The VAS scores were recorded by an anesthetist who was unaware of the group assignments at the postoperative 1, 2, 4, 6, 8, 10,12, 18, and 24 h intervals.

Also mean arterial blood pressure and heart rate was recorded postoperative at 1, 2, 4, 6, 8, 10, 12, 18, and 24h.

4. Outcome measures

Our primary outcome was to measure pain score (VAPS) at resting and when moving (sitting position) during 24 h postoperative. Comparisons of the first analgesic requests, total fentanyl use at the 24th hour postoperatively, hemodynamics, and the prevalence of complications (pneumothorax, local anesthetic toxicity, and abdominal wall hematoma) in the first twenty-four postoperative hours were our secondary outcomes.

5. Calculating the sample size

Before this research, the number of patients required in each group was determined after a power calculation according to data obtained from a Pilot study (six patients within each group). The median VAS at 24 in that pilot study was 3.16 in group A, 2.5 in group B, and 2.16 in group C (with SD = 1 in every group). Utilizing the G Power 3.1 9.2 program, a sample size of 31 patients per group was shown to have a 95% power for a one-way ANOVA test at the level of 0.05 significance.

6. Statistical analysis

The IBM SPSS 20.0 statistical package software was utilized to analyze the data. Data were expressed as means ± SD the minimum and maximum range for quantitative parametric measures or median and interquartile range (IQR) in quantitative nonparametric measures in addition to both number and percentage for categorized data.

For non-parametric quantitative records, the Kruskal Wallis test was utilized, accompanied by the Mann-Whitney test to compare every two groups, and the Chi-square test or Fisher's exact test was utilized to compare categorical factors. ANOVA was used to compare independent groups for parametric data, and the LSD post hoc test was utilized to evaluate intergroup distinctions.

For parametric quantitative data within each group, paired sample t-test was used and for non-parametric quantitative data, Wilcoxon signed-rank test was used.

P-values of 0.05 or below were regarded as significant.

7. Results

100 patients were enrolled in this study. Seven patients refused to participate and five patients TAPB group had two patients, whereas the ESPB group had three patients who were cut off from the research due to admission to ICU intubated and replaced by other patients. The subjects were split into three equal parallel groups at random, with 31 patients in each group: ESPB group, TAPB group, and control group.

According to (table 1), the research groups were similar in age, the proportion of men to women, weight, ASA status, and length of the procedure.

Table 1. Patient's characteristics.

Variables	Control group (C) (n=31)	TAPB group (T) (n=31)	ESPB group (E) (n=31)		P value	
Age (year)					0.547	
Range	(22-69)	(20-65)	(22-69)	**C vs T**	***C vs E***	**T vs E**
Mean ± SD	43.6±13.7	47.4±11.8	45.8±14.9	*0.518*	*0.804*	*0.518*
Sex					0.875	
Male	15(48.4%)	17(54.9%)	16(51.6%)	**C vs T**	***C vs E***	**T vs E**
Female	16(51.6%)	14(45.1%)	15(48.4%)	0.796	0.606	0.796
Weight (KG)					0.274	
Range	(60-90)	(70-90)	(65-90)	**C vs T**	***C vs E***	**T vs E**
Mean ± SD	75.8±6.9	78.5±6.5	76.3±7.3	0.288	0.963	0.425
ASA *ASA I*	22(71%)	20(64.5%)	24(77.4%)		0.776	
ASA II	5(16%)	7(22.5%)	3(9.6%)	**C vs T**	***C vs E***	**T vs E**
ASA III	4(13%)	4(13.1%)	4(13%)	0.925	0.913	0.473
Surgical time (mins)					0.896	
Range	(80-140)	(60-120)	(60-150)	**C vs T**	***C vs E***	**T vs E**
Mean ± SD	102±19.2	100±18.2	100±19.8	0.913	0.913	1

Values are expressed as Mean ±SD or number and percentage or range.

Table 2. Visual analogue pain score at rest.

VAS at rest	Control group (C)	TAPB group (T)	ESPB group (E)	P value		
After 1 hour				*<0.001**		
Median	3	1	1	*C vs T*	*C vs E*	*T vs E*
IQR	(2–3)	(1–1)	(1–1)	*<0.001**	*<0.001**	*0.088*
After 2 hours				*<0.001**		
Median	3	1	1	*C vs T*	*C vs E*	*T vs E*
IQR	(2–5)	(1–1.3)	(1–1)	*<0.001**	*<0.001**	*0.023**
After 4 hours				*<0.001**		
Median	3	2	1	*C vs T*	*C vs E*	*T vs E*
IQR	(3–5.3)	(2–3)	(1–1)	*<0.001**	*<0.001**	*<0.001**
After 6 hours				*<0.001**		
Median	4	3.5	1	*C vs T*	*C vs E*	*T vs E*
IQR	(3–4)	(2–4)	(1–2)	*0.138*	*<0.001**	*<0.001**
After 8 hours				*<0.001**		
Median	3	3	2	*C vs T*	*C vs E*	*T vs E*
IQR	(3–4)	(3–4)	(1–2)	*0.498*	*<0.001**	*<0.001**
After 10 hours				*0.010**		
Median	3	2	3	*C vs T*	*C vs E*	*T vs E*
IQR	(3–4)	(2–3.3)	(2–4)	*0.004**	*0.026**	*0.600*
After 12 hours				*<0.001**		
Median	4	3	3	*C vs T*	*C vs E*	*T vs E*
IQR	(3–5)	(2–4)	(2–4)	*<0.001**	*<0.001**	*0.912*
After 18 hours				*0.059*		
Median	3	3	2	*C vs T*	*C vs E*	*T vs E*
IQR	(3–4)	(2–4)	(2–4)	*0.539*	*0.019**	*0.106*
After 24 hours				*0.801*		
Median	2	2	2	*C vs T*	*C vs E*	*T vs E*
IQR	(1–3)	(2–2)	(2–2)	*0.835*	*0.723*	*0.435*

Data are expressed as Median, Inter-Quartile Range.
*: Significant difference between groups at P value ≤ 0.05.

As seen in (table 2) the postoperative VAPS score at rest in the ESPB group was statistically and significantly decreased in comparison with the control group till 18 h of the postoperative observation day, while the TAPB group in comparing with the control group clarify significantly less VAPS value at 1, 2, 4, 10 and 12 h of the postoperative study day. However, there is a substantial variation between the ESPB group and TAPB group at 2, 4, 6, and 8 h of the study period.

Dynamic pain reported by study participants throughout the study duration was substantially reduced in the ESPB group at the first 8 h of the observing day than in the TAPB and both demonstrated substantially reduced dynamic pain scores than control groups at the first 8 h for the ESPB group and at the first 4 h for the TAPB group as illustrated in (table 3).

In the control group, all patients received supplemental fentanyl postoperative. The total fentanyl consumption was 175 ± 38.9 µg. The time to 1st request of analgesia was (2.8 ± 1.6) 1 h postoperative in 6 patients, after 2 h in 14 patients, and lastly after 4 h in 11 patients.

In the TAPB group, also all patients received supplemental fentanyl postoperative. The total fentanyl consumption was 111 ± 38.1 µg. The time to 1st request of analgesia was (6.5 ± 2.2) 3 h postoperative in 5 patients, after 6 h in 22 patients, and lastly after 10 h in 4 patients.

In the ESPB group, the time to 1st request of analgesia was (14.9 ± 5.7) 8 h postoperative in 9 patients, after 12 h in 14 patients, and lastly, 8 patients did not receive supplemental fentanyl postoperative. The total fentanyl consumption was 40.3 ± 26.7 µg (table 4).

As regards postoperative HR, a statistical variation was recorded between the control group and the TAPB group at 1, 2, 4, 10, and 12 h with higher readings in the control group. When comparing the control group and the ESPB group, a statistical difference was recorded at 1, 2, 4, 6, 8, 10, and 12 hrs with higher readings in the control group. However, in comparison between the TAPB group and the ESPB group statistical difference was recorded at 6, 8 h with higher readings in the TAPB group (Tables 5).

As regards post-operative mean arterial blood pressure, there is a statistical variation was recorded between the control group and the TAPB group at 6, 8, 10, 12, and 18 h with higher readings in the control group. Also, in comparing the control and the ESPB groups, a statistical variation persisted till 18 hrs with greater readings in the control group. However, in comparison of the TAPB and the ESPB groups, there was a statistical difference recorded till 8 h (Tables 6).

No intraoperative and postoperative complications such as pneumothorax, local anesthetic toxicity, and abdominal wall hematoma were observed among the study groups.

8. Discussion

The ESPB was first identified at the position of the TP of T5, giving efficient analgesia for the ipsilateral thoracic wall due to anesthetic distribution from C7-T1 to T8 [2].

Also, ESPB can provide abdominal analgesia if it is performed at a lower level as it spreads throughout the lumbar region [6].

Table 3. Visual analogue pain score at movement.

Dynamic VAS	Control group (C)	TAPB group (T)	ESPB group (E)	P value		
After 1 hour				***<0.001****		
Median	4	2	1	***C vs T***	***C vs E***	***T vs E***
IQR	(3–4)	(2–3)	(1–1)	***<0.001****	***<0.001****	***<0.001****
After 2 hours				***<0.001****		
Median	4(3.8–6)	3(2–3)	1(1–1)	***C vs T***	***C vs E***	***T vs E***
IQR				***<0.001****	***<0.001****	***<0.001****
After 4 hours				***<0.001****		
Median	5	4	1	***C vs T***	***C vs E***	***T vs E***
IQR	(4–6.3)	(3–4)	(1–2)	***<0.001****	*<0.001**	*<0.001**
After 6 hours				***<0.001****		
Median	5	5	2	***C vs T***	***C vs E vs C***	***T vs E***
IQR	(4–5)	(4–6)	(2–3)	*0.548*	***<0.001****	***<0.001****
After 8 hours				***<0.001****		
Median	4	4	3	***C vs T***	***C vs E***	***T vs E***
IQR	(4–5)	(4–5.3)	(3–3.3)	*0.168*	***<0.001****	***<0.001****
After 10 hours				0.648		
Median	4	4	4	***C vs T***	***C vs E***	***T vs E***
IQR	(4–5)	(3.8–5)	(4–5)	*0.702*	*0.378*	*0.529*
After 12 hours				0.888		
Median	4	4	4	***C vs T***	***C vs E***	***T vs E***
IQR	(3–5)	(4–5)	(3–5)	*0.639*	*0.771*	*0.822*
After 18 hours				0.260		
Median	4	5	4	***C vs T***	***C vs E***	***T vs E***
IQR	(4–5)	(3–5)	(3–5)	*0.607*	*0.196*	*0.143*
After 24 hours				*0.268*		
Median	3	3	3	***C vs T***	***C vs E***	***T vs E***
IQR	(3–4)	(3–4)	(3–4)	*0.105*	*0.550*	*0.318*

Data are expressed as Median, Inter-Quartile Range.
*: Significant difference between groups at P value ≤ 0.05.

Table 4. Time of first analgesic request (hrs.) and total fentanyl requirement.

Variables	Control group (C)	TAPB group (T)	ESPB group (E)	*P value*		
1st analgesic request(h) Mean ± SD				***<0.001****		
	2.8 ± 1.6	6.5 ± 2.2	14.9 ± 5.7	***C vs T***	***C vs E***	***T vs E***
				<0.001*	***<0.001****	***<0.001****
Total fentanyl requirement(mg)				***<0.001****		
Mean ± SD	175 ± 38.9	111 ± 38.1	40.3 ± 26.7	***C vs T***	***C vs E***	***T vs E***
				<0.001*	***<0.001****	***<0.001****

Data are expressed as Mean ±SD.
*: Significant difference between groups at P value ≤ 0.05.

Table 5. Post-operative Heart rate (beat/minute).

Post operative HR	Control group (C)	TAPB group (T)	ESPB group (E)	P value		
After 1 hour				***<0.001****		
Range	(80–105)	(62–92)	(70–94)	***C vs T***	***C vs E***	***T vs E***
Mean ± SD	89.7 ± 6.5	77.7 ± 7.6	80.6 ± 6	***<0.001****	***<0.001****	*0.225*
After 2 hour				***<0.001****		
Range	(77–110)	(71–100)	(66–90)	***C vs T***	***C vs E***	***T vs E***
Mean ± SD	91.3 ± 7.2	79.2 ± 8.1	79.5 ± 6.2	***<0.001****	***<0.001****	*0.982*
After 4 hour				***<0.001****		
Range	(82–110)	(68–100)	(73–92)	***C vs T***	***C vs E***	***T vs E***
Mean ± SD	92 ± 7.3	84 ± 7.5	80.4 ± 4.4	***<0.001****	***<0.001****	*0.094*
After 6 hour				***<0.001****		
Range	(79–105)	(74–105)	(69–92)	***C vs T***	***C vs E***	***T vs E***
Mean ± SD	91.7 ± 6.8	91 ± 7.6	80.1 ± 5.3	*0.913*	***<0.001****	***<0.001****
After 8 hour				***<0.001****		
Range	(82–102)	(75–105)	(71–94)	***C vs T***	***C vs E***	***T vs E***
Mean ± SD	90.4 ± 6.2	89.3 ± 7.7	82.2 ± 6.2	*0.813*	***<0.001****	***<0.001****
After 10 hour				***0.047****		
Range	(79–105)	(71–110)	(70–99)	***C vs T***	***C vs E***	***T vs E***
Mean ± SD	90.2 ± 7.3	86.1 ± 8.5	86.1 ± 5.9	***0.032****	***0.032****	*1*
After 12 hour				***0.007****		
Range	(77–102)	(75–105)	(79–100)	***C vs T***	***C vs E***	***T vs E***
Mean ± SD	90.8 ± 5.9	86.4 ± 6.7	86.3 ± 5.7	***0.018****	***0.014****	*0.996*
After 18 hour				*0.169*		
Range	(80–105)	(72–110)	(75–95)	***C vs T***	***C vs E***	***T vs E***
Mean ± SD	89.1 ± 6.1	87.8 ± 7.1	86.1 ± 4.7	*0.684*	*0.145*	*0.537*
After 24 hour				*0.369*		
Range	(78–100)	(70–94)	(75–93)	***C vs T***	***C vs E***	***T vs E***
Mean ± SD	85.8 ± 6.3	85.9 ± 5.7	84.1 ± 4.5	*0.993*	*0.475*	*0.408*

Data are expressed as Mean ±SD.
*: Significant difference between groups at P value ≤ 0.05.

Table 6. Postoperative Mean blood pressure (mmHg).

Postoperative mean BP	Control group (C)	TAPB group(T)	ESPB (E)	P value		
After 1 hour				*0.006**		
Range	(72–96)	(73–95)	(66–96)	*C vs T*	*C vs E*	*T vs E*
Mean ± SD	84.9 ± 6.1	83.8 ± 5.7	79.3 ± 8.6	*0.822*	*0.007**	*0.038**
After 2 hour				*<0.001**		
Range	(66–100)	(70–93)	(65–93)	*C vs T*	*C vs E*	*T vs E*
Mean ± SD	85 ± 7.5	84.5 ± 6.4	77.3 ± 6.3	*0.956*	*<0.001**	*<0.001**
After 4 hour				*<0.001**		
Range	(75–103)	(75–97)	(67–96)	*C vs T*	*C vs E*	*T vs E*
Mean ± SD	88.1 ± 6.4	85.5 ± 5.4	77.4 ± 6.5	*0.224*	*<0.001**	*<0.001**
After 6 hour				*<0.001**		
Range	(77–110)	(75–96)	(66–96)	*C vs T*	*C vs E*	*T vs E*
Mean ± SD	91.4 ± 8.3	84.9 ± 5	78.4 ± 6.7	*0.001**	*<0.001**	*0.001**
After 8 hour				*<0.001**		
Range	(80–105)	(71–95)	(71–93)	*C vs T*	*C vs E*	*T vs E*
Mean ± SD	89.7 ± 5.4	83.4 ± 5.1	79.1 ± 5.6	*<0.001**	*<0.001**	*0.009**
After 10 hour				*<0.001**		
Range	(81–97)	(74–94)	(66–93)	*C vs T*	*C vs E*	*T vs E*
Mean ± SD	88.2 ± 4.9	83.4 ± 5.1	82.7 ± 6.6	*0.004**	*0.001**	*0.866*
After 12 hour				*<0.001**		
Range	(79–103)	(73–97)	(69–99)	*C vs T*	*C vs E*	*T vs E*
Mean ± SD	90.4 ± 5.9	84.1 ± 5.3	84.3 ± 6.8	*<0.001**	*0.001**	*0.991*
After 18 hour				*<0.001**		
Range	(79–103)	(72–93)	(73–96)	*C vs T*	*C vs E*	*T vs E*
Mean ± SD	91 ± 6.1	82.5 ± 4.4	83.7 ± 5.9	*<0.001**	*<0.001**	*0.664*
After 24 hour				*0.898*		
Range	(71–91)	(74–90)	(70–100)	*C vs T*	*C vs E*	*T vs E*
Mean ± SD	82.4 ± 4.9	81.8 ± 4.6	82 ± 6.5	*0.893*	*0.948*	*0.898*

Data are expressed as Mean ±SD
*: Significant difference between groups at P value ≤ 0.05.

The ESPB is a more secure option than epidural anesthesia due to the easy visualization of the ultrasonic target transverse process, the injection points were away from the neuroaxis, large vascular structures, and the pleura, and the generous anesthetic's craniocaudal diffusion, which enables thorough coverage with just one injection [7]. ESPB was firstly used to treat neuropathic thoracic pain [2]. Other authors have described the safety and effectiveness of ESPB for postoperative pain management in breast operations [8] a procedure for thoracoscopic lobectomy [9], and costal fractures [10], additionally, there was some research documenting its use in abdominoplasty [11], laparoscopic abdominal surgeries [12], lower segment cesarean delivery [13], bariatric surgery [14], and treatment of ventral hernias [6].

For abdominal procedures, ESPB can be done at T7-8 positions. It can be done for breast and thoracic surgeries at T4-5 levels [15]. When 20 ml of fluid were injected at the T7 Transverse Process, a cadaver model demonstrated that it spread to the level of the C7-T 2 vertebra cranially and the L2-3 vertebra caudally. This is why we decided to implement the blockage at level T8.

This research compared the analgesic effectiveness of bilateral ultrasound-guided ESPB and bilateral ultrasound-guided four quadrant TAPB for emergency laparotomy surgery.

In this research, we found that ESPB when compared to TAPB and the control group, ESPB was a successful method for lowering postoperative pain after emergency laparotomy as shown by lowered pain score, delayed analgesic request, and less analgesic use.

Our study clarified that Pain scores on rest and movement in patients who received ESPB were lower than those who received TAPB during the first 8 h postoperative.

Regarding analgesic consumption and time to 1st analgesic request, our study showed that patients who received ESPB had the lowest requirement and longest duration for analgesic request (40.3 ± 26.7 mcg and 14.9 ± 5.7 h) than patients who received TAPB (111 ± 38.1 mcg and 6.5 ± 2.2 h)

Similar to our research **Kamel et al., 2020** in their research compared the effect of ultrasound-guided bilateral ESPB versus ultrasound-guided bilateral TAPB on postoperative pain scores and opioid intake in studied cases who were scheduled for open Abdominal Hysterectomy. 48 studied cases were split into two groups. After the closure of the wound and before reversing the muscle relaxant patients in the ESPB group received 20 mL of bupivacaine 0.375% plus 5 ug/mL adrenaline (1:200,000) on every side at the level of T9. TAPB group received the same volume of bupivacaine and adrenaline. They found that Visual Analog Scale scores at thirty minutes, two, four, six, eight, twelve, sixteen, twenty, and twenty- four hours were significantly lower in the ESPB group compared with the TAPB group. Duration for the requirement of first morphine was significantly prolonged in the ESPB group (14.81 ± 3.52 hours) compared with the TAPB group (10.58 ± 2.35 hours). The total quantity of morphine consumed in twenty- four hours postoperatively

was significantly reduced in the ESPB group. They concluded that ESPB significantly provides more effective and prolonged postoperative analgesia with less morphine usage than TAPB [16].

Similar to our research **Altıparmak *et al., 2019*** evaluated the impact of pre-operative ultrasound-guided ESPB versus ultrasound-guided oblique subcostal TAP block on the postoperative tramadol intake and pain scores in patients who underwent laparoscopic cholecystectomy. 68 subjects were split into two equal groups. Patients in both groups received 40 ml of .0375% bupivacaine divided equally on both sides. They reported that after laparoscopic cholecystectomy surgery, ultrasound-guided ESPB significantly decreased postoperative tramadol intake and pain ratings compared to oblique subcostal TAPB [17].

Our results are consistent with **Abu Elyazed *et al., 2019*** who assessed 60 patients who were randomly split into two equal groups to determine the impact of an ESPB on postoperative pain after open epigastric hernia repair. The ESPB group received 20 ml of bupivacaine 0.25% on every side, whereas the control group received a bilateral sham ESPB using 1 mL of regular saline. They concluded that ultrasound-guided bilateral ESPB led to lower postoperative visual analog scale pain ratings as well as lower use of both intraoperative fentanyl and postoperative rescuing analgesics [18].

Our results are consistent with **Yu et al 2021** who investigated 80 patients who were prepared for posterior lumbar spinal surgery for lumbar spinal fractures, patients were divided into a patient-controlled analgesia group or a combined ESPB plus patient-controlled analgesia group. They found that the numeric rating scale at rest and movement was lower in the combined ESPB plus patient-controlled analgesia group. ESPB also reduced postoperative opioid consumption [19].

Also, **Canıtez et al 2021** studied the effectiveness of ESPB on postoperative pain, and opioid consumption in eighty-two patients who underwent laparoscopic cholecystectomy. Studied cases were separated into two groups: a standard multimodal analgesia group and the ESPB group. Numerical rating scores were significantly lower in the ESPB group than in the control group, both during resting and motion. The total quantity of tramadol used in the first twenty-four hours was lower in the ESPB group than in the control Group. They concluded that ESPB decreased pain scores and cumulative opioid consumption [20].

Similarly, **Mrunalin et al., 2014** reported that TAP block decreased the mean total pain scores and the overall tramadol intake by 36% in patients undergoing emergency laparotomy. 60 adults, ASA I–III, were split into two equal groups at random, the TAPB group, and the control group. Before making a skin incision TAPB is carried out at the umbilicus level in the mid-axillary line. The patients were randomly assigned to receive either bilateral 25 ml of 0.25% bupivacaine or normal saline [21].

In ourstudy, we found that bilateral ESPB provided better postoperative HR and BP stability.

Similarly, **Jin et al., 2020** studied the efficacy of ESPB for pain control in lumber laminoplasty and they found that patients who received ESPB had more stable hemodynamics than those using general anesthesia alone [22].

The benefit of using ESPB as a single-level injection over TAPB may be that there is a spread of local anesthetic more widely throughout the dermatomal surface in the fascial plane. Therefore, it might cover both upper and lower abdominal areas and the lateral abdominal wall, which is supplied by the lateral cutaneous branches of the intercostal nerves. There is also evidence that it may provide both visceral and somatic analgesia. Unlike TAP, the insertion site for ESP block catheters is distant from the anterior abdominal wall, making perioperative insertion easier. For the same reason, ESP blocks are always feasible in the postoperative period regardless of wound dressings or disruption of tissue planes by air and surgery, as long as the patient can be turned into a lateral position to access the back.

9. Limitations of the study

Research's limitations included the inability to evaluate the block's success rate and extent of abdominal wall sensory blockade because the block was performed under general anesthesia. Furthermore, the research examined the effects of a single injection rather than a continuous block.

10. Conclusion

After an emergency laparotomy, bilateral ultrasound-guided ESPB and TAPB are efficient components of a multimodal analgesic regimen for decreasing postoperative pain and fentanyl consumption.

However, ESPB is more effective as it enables significantly better postoperative analgesia, less fentanyl consumption, and delays the onset of rescue analgesia.

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Declaration of conflicting interest

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