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Role of erector spinae plane block in transjugular intrahepatic portosystemic shunt procedure: A randomized controlled trial

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ABSTRACT

Background: Anesthesia for transjugular intrahepatic portosystemic shunt (TIPS) for lowering raised portal pressure is clinically challenging. As patients, candidates for TIPS are medically complex due to chronic liver disease, adding to remote area anesthesia's complexities. Multimodal analgesia, including erector spinae plane block (ESPB), can improve anesthesia quality with patient satisfaction.

Methods: Fifty-six patients scheduled for TIPS, aged 18–60 years and with Child classification A or B, were randomly allocated into two groups. The ESPB group experienced ESPB ($n = 24$), while the control group was introduced with sedation spontaneously breathing ($n = 24$). Primarily, we investigated the records of the hemodynamic profile and analgesia nociceptive index (ANI). As a secondary aim, we recorded the opioid consumption, complication incidence, and patient and interventional radiologist satisfaction scores.

Results: Heart rate was significantly lower in the ESPB group at the beginning of the procedure, liver puncture, and balloon dilatation events, while there were no significant differences in mean blood pressure. Analgesia assessment by ANI was significantly higher in the ESPB group indicating adequate analgesia. Opioid consumption was significantly lower in the ESPB group than in the control group. Statistical analysis for patient satisfaction showed better results in the ESPB group, while the surgeon satisfaction score showed no significant statistical differences.

Conclusion: ESPB could be recommended as an alternative to analgesia in TIPS and its vulnerable patients to improve safety by reducing sedation-related morbidity and complications with improving the patient's degree of satisfaction.

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1. Introduction

Transjugular intrahepatic portosystemic shunt (TIPS) insertion is a minimally invasive procedure for lowering raised portal pressure, which can provide symptomatic management for portal hypertension (PH) complications [1].

The first TIPS procedure was carried out in the 1980s, and the success rate increased as radiological technologies developed. TIPS insertion is indicated in refractory ascites, variceal bleeding, portal hypertensive gastropathy, hepatopulmonary syndrome, hepatorenal syndrome, Budd–Chiari syndrome and Hepatic veno-occlusive disease [2].

In this procedure, hepatic venography and communication between a branch of hepatic and portal venous circulation is created under fluoroscopic control. A stent is deployed to maintain patency after balloon dilatation of this communicating track [3].

Patients undergoing TIPS are medically complex and clinically challenging as a result of chronic liver disease causing multisystem physiological disruption. They should receive multidisciplinary preoperative assessment and optimization before undergoing the procedure [4]. Complexities of remote area anesthesia should be considered, including the delivery of care in an unfamiliar environment and the inherent safety due to staff and equipment availability, which may present a significant challenge with a patient positioned on the imaging table [5].

Anesthesia for elective TIPS procedures varies between sedation or general anesthesia according to the patient's condition and local hospital protocol. The best sedation should provide patient comfort and safety simultaneously, while sedation techniques may be associated with the risk of cardiopulmonary complications, such as respiratory depression, hypotension, bradycardia [6], and discomfort during balloon

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dilatation of the intrahepatic tracts, which may be severe. These adverse effects may lead to prolonged hospitalization. General anesthesia is mainly recommended as the preferred technique on the basis of safety, particularly when complications occur [7].

Multimodal analgesia associating analgesic drugs and regional anesthesia technique in the form of erector spinae plane block (ESPB) can allow a better quality of anesthesia [8]. ESPB is a regional anesthetic technique that was described by Forero et al. [9], where local anesthetic is injected into this erector spinae fascial plane; it then can spread craniocaudally to cover several levels and to the thoracic paravertebral space. As it reaches the spinal nerve's dorsal and ventral rami, it can achieve both somatic and visceral sensory blockade. It is simple and safe technique, with ultrasound guidance, makes it an ideal regional anesthetic technique for abdominal surgery [10] and is not prohibited by the risk of coagulation abnormalities usually suffered by the cirrhotic patient [11].

We aimed primarily to investigate the efficacy of ESPB in patients scheduled for TIPS on analgesia regarding the hemodynamic profile and analgesia nociceptive index (ANI). Secondarily, we aimed to record opioid consumption, complication incidence, and patient and interventional radiologist satisfaction scores.

2. Materials and methods

2.1. Study design

A designed randomized controlled trial enrolled hepatic patients who were electively scheduled for TIPS procedure. Approval was obtained from the Institutional Review Board and ethical committee of the National Liver Institute, Menoufia University, Egypt (NLI IRB 00260/2021). This trial was prospectively registered with the Pan African Clinical Trial Registry (PACTR202110642018302) on 29 October 2021, starting on 1 November 2021 and ending on 15 October 2022. The current study was conducted in accordance with the ethical principles of the Declaration of Helsinki (2013).

2.2. Recruitment

After written informed consent, the study enrolled 48 patients who were candidates for TIPS procedure, aged 18–60 years old from both sexes, with Child Turcotte-Pugh Score classification A or B.

Exclusion criteria were applied to patients with pre-existing significant heart failure, severe tricuspid regurgitation, pulmonary, and psychological compromise, patients with severe pulmonary hypertension, coagulopathy and thrombocytopenia $< 75 \times 10^3$, and infection at injection site, and also patients suffering from major intraoperative events (e.g., severe hemodynamic instability), allergic patients to any of the study drugs, opioid addiction, body mass index higher than 40 kg/m^2 and unwilling to participate in the study.

2.3. Randomization and blinding

Patients were randomly allocated into two groups, using the random number generator in sealed opaque envelopes in a 1:1 ratio: ESPB group ($n = 24$). Patients received bilateral ESPB with 20 ml bupivacaine 0.25% then conscious sedation with fentanyl plus propofol. In the control group ($n = 24$), patients received conscious sedation with fentanyl plus propofol. ESPBs were performed by an experienced anesthetist in locoregional nerve blocks.

An experienced anesthesiologist prepared the study drugs and performed the ESPB. The group allocations were concealed from the patients, surgeons, and research personnel who recruited participants and gathered trial data.

2.4. Anesthetic management

2.4.1. Study procedures

All patients underwent a full assessment of co-existing conditions, ESPB procedure was explained to all patients, and all measures for general anesthesia were revised.

Patients were admitted to the radiology suite, a wide pore peripheral IV line was secured, and then the standard anesthetic monitoring (electrocardiograph, non-invasive blood pressure and pulse oximetry) was applied. Electrical Cardiometry (EC) monitor (Osypka Medical GmbH, Berlin, Germany) for cardiac output (L/min) monitoring and corrected flow time (FTc)-guided the perioperative fluid therapy. The Bispectral Index (BIS) monitor (Aspect Medical Systems Inc., Newton, MA, USA) for anesthesia depth monitoring. Analgesia Nociception Index (ANI MDoloris Medical Systems SAS Biocentre Fleming Bâtiment C Epi de Soil 270, rue Salvador Allende 59,120 LOOS – France) where two sensors are connected to patient skin by specific electrodes, one at the right second intercostal space, and the second one at the apex of the heart.

2.5. Interventions

2.5.1. Technique of bilateral ESPB

In the ESPB study group, bilateral ESPB with ultrasound guidance was done at the thoracic vertebrae (T 6–7). The patient was placed in the sitting position. The skin was disinfected with 2% Chlorhexidine in 70% alcohol, and a 6–11-MHz linear-array ultrasound transducer (SonoSite Edge, Bothell, Washington) was placed at the longitudinal parasagittal lateral tip of the T7

transverse process corresponding to the inferior angle of the scapula. The erector spinae muscle was identified as superficial to the acoustic shadow of the transverse processes. A local anesthetic drug (Lidocaine Hydrochloride 1%) was used to provide local anesthesia to the skin for the port of entry of the needle. A 22-gauge, 80-mm block needle (Pajunk, Geisingen, Germany) was inserted in a cephalad-to-caudal direction until the tip lay on the tip of the transverse process. Then, a local anesthetic dose of (20 ml of Bupivacaine 0.25%) was injected (Figure 1).

In both groups, spontaneous breathing was supported by oxygen nasal cannula to keep SaO2 >95%, and Fentanyl 0.5 µg/kg was injected. In both groups, patients were sedated with an initial propofol loading dose of 40–60 mg (depending on patient age, body weight, and comorbidities) followed by bodyweight adapted continuous infusion of propofol (1.5–4.5 mg/kg/hour) guided by the bispectral index (BIS) to be kept between 60 and 70.

Fentanyl boluses were given according to Analgesia Nociception Index (ANI). It is based on heart rate variability HRV, which represents the autonomic nervous system tone on a scale of 0–100. A high ANI value represents a predominant parasympathetic tone, and a low ANI value represents low HRV and diminished parasympathetic tone. ANI measure was suggested to be between (50–70) during the procedure, so at ANI lower than 50, rescue analgesia of Fentanyl (50 µg) bolus was given. Intraoperative episodes of hypotension and bradycardia were managed carefully.

At the end of the procedure, propofol infusion was stopped to allow the recovery of the BIS to more than 80 and the return of consciousness. All patients were admitted to the post-anesthesia recovery unit (PACU) for hemodynamics monitoring and reporting postoperative complications. Patients were evaluated after the procedure according to the "Post Anesthesia Recovery Score" for complete recovery, which was defined as a maximum score of 10 points, to be discharged from the recovery unit after being fully recovered. Furthermore, after regaining full consciousness, all patients were asked about patient satisfaction index criteria of a 5-point scale regarding patient satisfaction (1: not satisfied, 2: less satisfied, 3: quite satisfied, 4: satisfied, 5: very satisfied). Interventional radiologist satisfaction was also recorded using a 5-point scale (1: very bad, 2: bad, 3: moderate, 4: good, 5: very good).

2.5.2. Outcome measures

Analgesia assessment by ANI was the primary outcome, whereas total intraoperative fentanyl consumption, the recorded complications after the procedure as abdominal distension, delayed recovery, and PONV were the secondary outcomes.

2.5.3. Measurements

Hemodynamic parameters: MBP (mmHg); heart rate (beat/min)); CO (L/min); and ANI score were reported at the base time (T0), 20-min post-ESPB (T1), time of start of TIPS (T2), time of liver capsule puncture (T3), time of portosystemic shunt dilatation (T4), time of stent insertion (T5), time at the end of procedure and anesthesia (T6), and at recovery time 2 h after the procedure (T7). Postoperative complications such as nausea, vomiting, delayed recovery, distension, and arrhythmia were recorded.

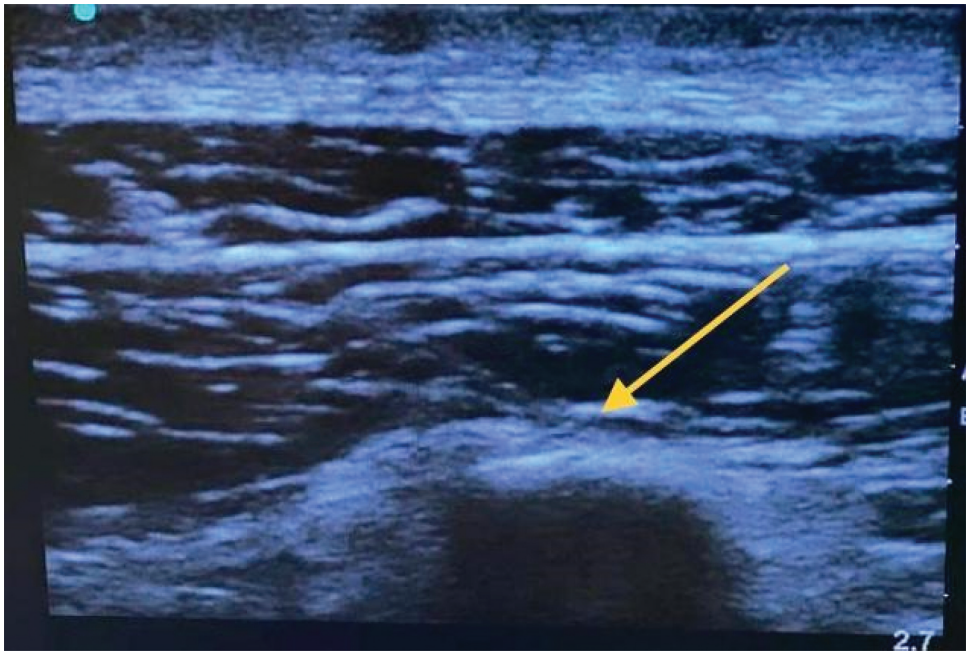

Figure 1. Ultrasound picture of ESPB. Ultrasound guided ESPB, the yellow arrow pointed to the needle tip touching the origin of erector spinae muscle from the T7 transverse process.

2.6. Sample size calculation

2.6.1. Post-hoc power analysis

The power achieved by a sample size of 24 patients per group (number of groups = 2) for t test (Means: Differences between two independent means (two groups)) based on Analgesia/Nociception Index (ANI) starting from time (Begin, Liver puncture, Balloon dilatation, Stent, End) resulted in power >99%. In conclusion, the sample size per group of 24 patients is enough to achieve a power more than 80%. The sample size was calculated using GPower version 3.1.9.2.

2.7. Statistical methodology

The allocation sequence was generated using a permuted block randomization technique, and the block size was variable. The single-blinded approach was adopted. Blinding was employed for the statistical analysis team, who were blinded to the group allocation of patients.

Data were collected and analyzed using Statistical Package for Social Science (SPSS) program (ver 25). Data were described using minimum, maximum, mean, standard deviation, standard error of the mean, median, and 95% CI of the median. Comparisons were carried out between two studied independent, non-normally distributed subgroups using the Mann–Whitney U test. Kolmogorov–Smirnov test of normality revealed significance in most variables' distribution, so the nonparametric statistics were adopted. The chi-square test was used to test the association between qualitative variables. Monte Carlo corrections were carried out when indicated. An alpha level was set to 5% with a significance level of 95%, and during the sample size calculation phase, a beta error was accepted up to 20% with a power of study of 80%. Statistical significance was tested at p-value <.05

3. Results

Fifty sex patients were assessed for eligibility to be included in the study, and only 48 patients were included in the CONSORT diagram (Figure 2). Eight patients were not enrolled due to the following: Three patients refused to participate, two did not meet the inclusion criteria, two were rolled out from the analysis due to uncontrolled arrhythmia, and the procedure was aborted, while the last case showed repeated apnea attacks and general anesthesia with intubation was introduced. The first group experienced

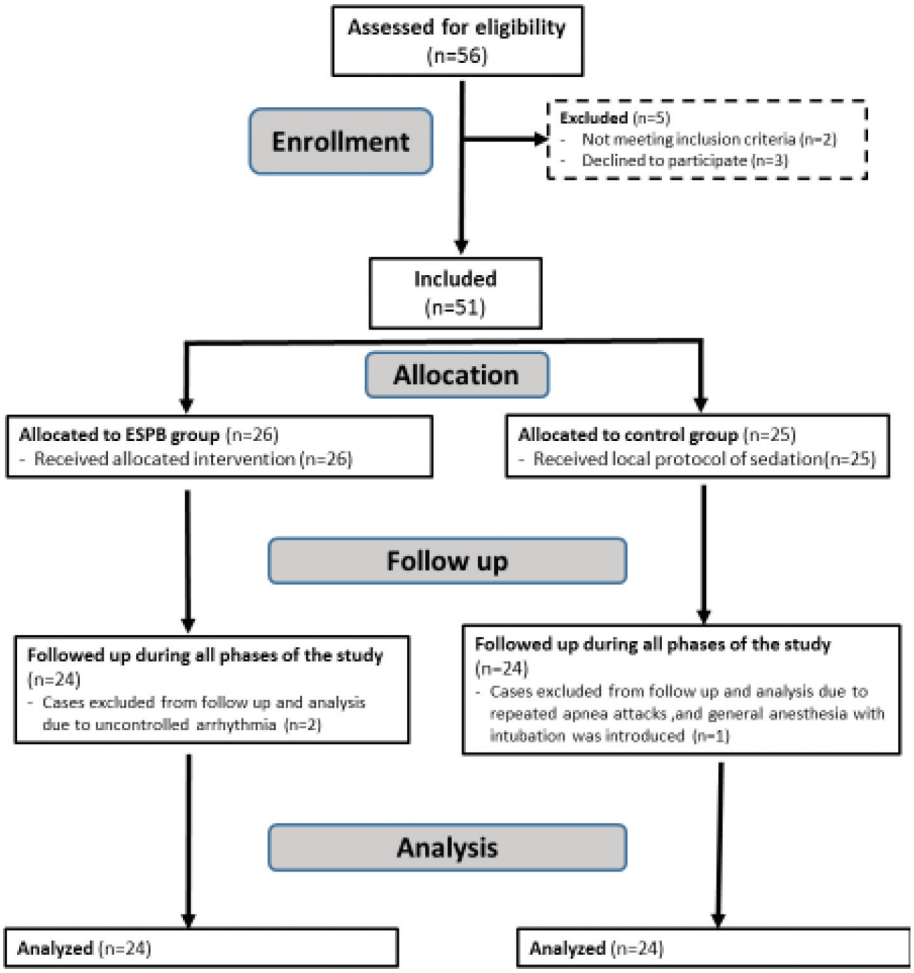

Figure 2. CONSORT flow diagram.

erector spinae plane block (ESPB group; $n = 24$), where the second group was introduced with sedation spontaneously breathing (control group; $n = 24$).

As shown in (Table 1), both groups were similar with respect to age and sex. Also, BMI, Child-Pugh classification, and operative time were statistically insignificant.

Regarding hemodynamic profile, heart rate was significantly lower in the ESPB group at the beginning of the procedure, liver puncture, during the balloon dilatation events, and 2 h after the procedure ($p < 0.05$) (Figure 3). There were no significant differences between both groups in terms of mean blood pressure unless at 2 h after the procedure, where it was significantly lower in the ESPB group compared to the control.

In our primary outcome, analgesia assessment by ANI was significantly higher in the ESPB group at all times starting from the beginning of the procedure, indicating adequate analgesia ($p < 0.05$) as shown in (Figure 4).

For our secondary outcome, opioid consumption (Fentanyl) was significantly lower in the ESPB group than in the control group (58.33 ± 19.03 µg versus 189.58 ± 48.85 µg), respectively, with ($p < .001$). The recorded complication after the procedure, abdominal distension, was observed to be significantly higher in the ESPB group (16.67%), while the control group showed a higher incidence of delayed recovery and PONV (20.83%) and (20.83%), respectively (Table 2).

Statistical analysis for the patient satisfaction in the ESPB group versus the control group showed Very Satisfied 50% (12 patients) versus 37.5% (9 patients), Satisfied 50% (12 patients) versus 45.83% (11 patients), respectively, while the quietly satisfied category showed 16.67% in the control group. The interventional radiologist satisfaction score in the ESPB versus the control group showed very good in 29.16% (7 patients) versus 29.16% (7 patients), good in 70.83% (17 patients) versus 70.83% (17 patients, respectively, with non-significant statistical differences between groups.

4. Discussion

Sedation with short-acting propofol infusion and opioid analgesia had been considered the followed regimen in our institute for TIPS procedure anesthesia but with limitations. This is the first randomized,

Table 1. Demographic data, Child classification, and procedure duration.

	ESPB (n=24)	Controls (n=24)	Test of significance p value
Age(years)			$Z_{(MW)}$=0.682
• Min-Max	19.00–50.00	16.00–55.00	p=.495 NS
• Mean ± Std. Deviation	32.67±8.68	34.17±10.00	
• Median	32.00	34.00	
• 95% CI for median	28.00–37.00	32.00–38.00	
Sex			$X^2_{(df=1)}$=0.751
Male (n=23) (47.92%)			p=.386 NS
o n	13	10	
o %	54.17	41.67	
Female (n=25) (52.08%)			
o n	11	14	
o %	45.83	58.33	
WHO BMI Classification			$X^2_{(df=2)}$=1.58
25.0–29.9: Pre-obesity (n=11) (22.92%)			p=.924 NS
o n	5	6	
o %	(20.83%)	(25.00%)	
30.0–34.9: Obesity class I (n=22) (45.83%)			
o n	11	11 (	
o %	(45.83%)	45.83%)	
30.0–34.9: Obesity class II (n=15) (31.25%)			
o n	8	7	
o %	(33.33%)	(29.17%)	
Child A (n=11) (22.92%)			$X^2_{(df=2)}$=0.118
o n	5	6	p=.731 NS
o (%)	(20.83%)	(25.00%)	
Child B (n=37) (77.08%)			
o n	19	18	
o (%)	(79.17%)	(75.00%)	
Procedure Time (minutes)			$Z_{(MW)}$=1.129
• Min-Max	45.00–70.00	49.00–66.00	p=.259 NS
• Mean ± Std. Deviation	54.83±6.34	56.67±5.81	
• Median	54.00	56.00	
• 95% CI for median	53.00–58.00	54.00–60.00	

Data presented as Mean ± SD or n (%) as indicated. ESPB: Erector spinae plane block, N: Number of patients.
Min-Max: Minimum – Maximum CI: Confidence interval S.D.: standard deviation.
MW: Mann–Whitney U test p: Probability of error (chance).
2= Pearson Chi-Square * : Statistically significant (p<0.05).
NS: Statistically not significant (p>0.05).

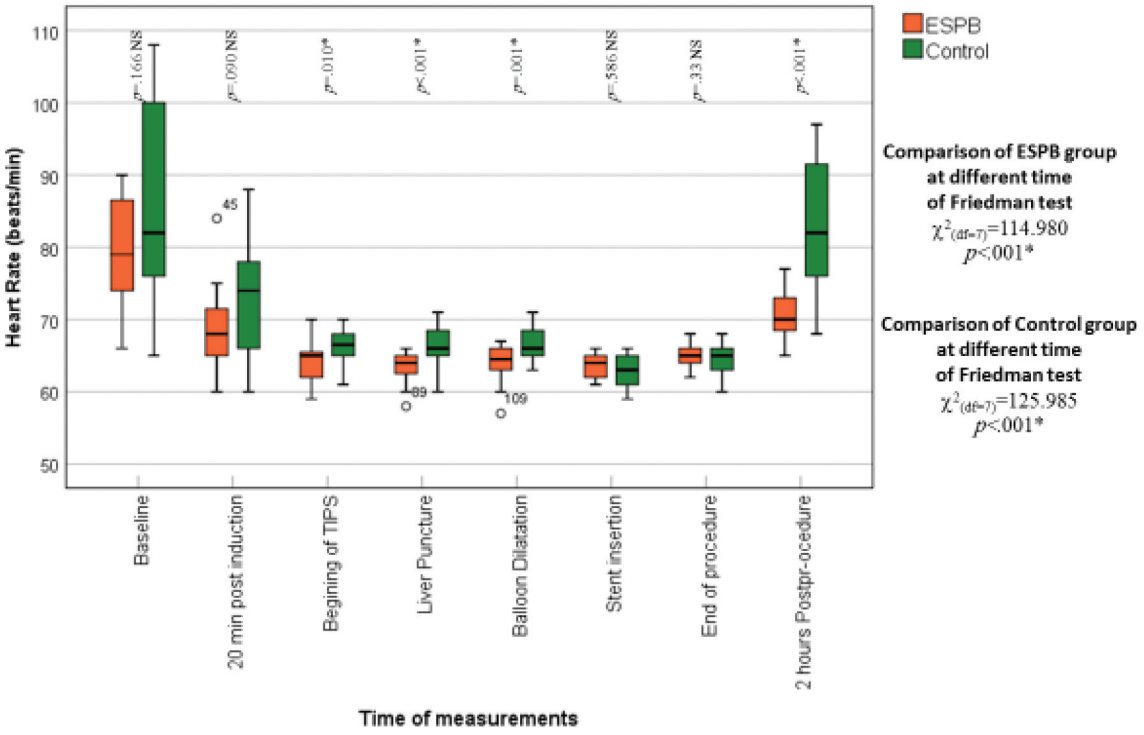

Figure 3. Heart rate changes among the studied cases. Box and whisker graph of heart rate (beats/min) in the two studied groups, the thick line in the middle of the box represents the median, the box represents the inter-quartile range (from 25th to 75th percentiles), the whiskers represent the minimum and maximum after excluding extremes (asterisks). *Number(s) attached indicate(s) patient serial number in the original master table.*

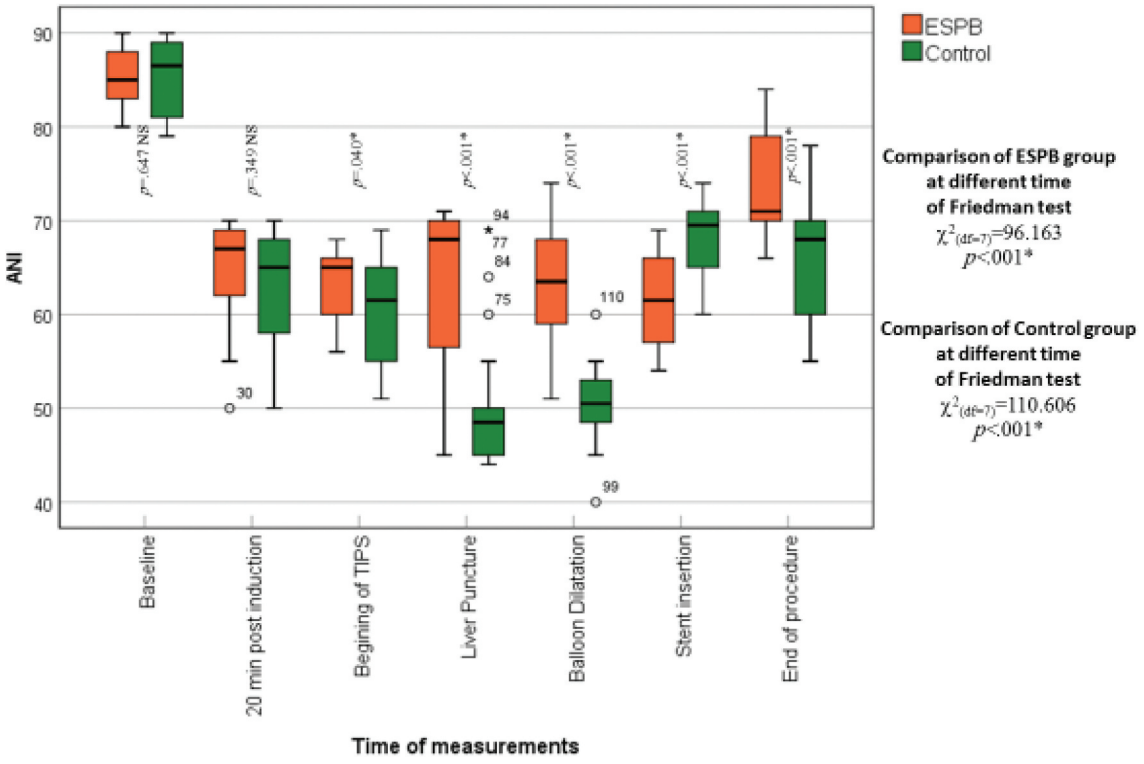

Figure 4. ANI index the among studied cases. Box and whisker graph of ANI in the two studied groups, the thick line in the middle of the box represents the median, the box represents the inter-quartile range (from 25th to 75th percentiles), the whiskers represents the minimum and maximum after excluding extremes (asterisks). *Number(s) attached indicate(s) patient serial number in the original master table*

Table 2. Total Fentanyl consumption (μg), and postoperative complications.

	ESPB (n=24)	Controls (n=24)	Test of significance p value
Total Fentanyl Consumption (μg)			$Z_{(MW)}$=6.133
• Min-Max	50.00–100.00	100.00–300.00	p<.001*
• Mean ± Std. Deviation	58.33±19.03	189.58±48.85	
• Median	50.00	200.00	
• 95% CI for median		200.00–300.00	
Postoperative complications			
• No (n=33) (68.75%)	19 (79.17%)	14 (14.00%)	$\chi^2_{(df=4)}$=15.758
• Distension (n=4) (8.33%)	4 (16.67%)	0 (0.00%)	$p_{(MC)}$<.001*
• Arrhythmias (n=1) (2.08%)	1 (4.17%)	0 (0.00%)	
• Delayed Recovery (n=5) (10.42%)	0 (0.00%)	5 (20.83%)	
• PONV (n=5) (10.42%)	0 (0.00%)	5 (20.83%)	

Values are presented as mean ± SD or median, PONV: postoperative nausea and vomiting N : Number of patients.
Min-Max: Minimum – Maximum S.D.: standard deviation CI: Confidence interval.
MW: Mann–Whitney-Chi Square test.
MC: Monte Carlo correction for p value of Pearson Chi square test df: degree of freedom.
* : Statistically significant (p<0.05).

double-blind controlled trial comparing ESP block with routine systemic analgesia and sedation for TIPS procedure, aiming to achieve effective visceral analgesia.

Our results demonstrated a clinical analgesic efficacy of ESBP in the TIPS procedure. It had a significantly superior pain control, assessed by the ANI results throughout the procedure, with non-significant differences in the hemodynamic parameters compared to the control group.

Matching with our results, Fu J and his colleagues searched for quality of analgesia as assessed by VAS scores, the duration of analgesia of ESP block, opioid consumption, and postoperative recovery in patients undergoing hepatectomy, and they concluded that it provided adequate analgesia according to VAS score results with hemodynamic stability, and recorded reduced opioid requirements and its side-effects [12].

Also, Abu Elyazed M [13] and his colleagues studied the analgesic efficacy of bilateral ultrasound-guided ESBP in 60 patients undergoing open midline epigastric hernia repair; they proved that it provided lower postoperative visual analog scale pain scores and decreased fentanyl consumption.

At the same time, Jin Y et al. studied ESBP in lumbar laminectomy for pain management. They proved it was effective in reducing postoperative pain scores and lowering perioperative opioid utilization, resulting in improved patient satisfaction [14].

Our results showed that ESPB was more beneficial in decreasing opioid requirements and its side effects. The ESPB group did not show serious adverse effects, such as delayed recovery, postoperative nausea, and vomiting.

Similarly, Zhang Y et al. conducted a meta-analysis involving 679 patient candidates for breast cancer surgery, and they proved that Ultrasound-guided ESPB was an effective approach for reducing morphine consumption and incidence of postoperative nausea and vomiting within the first 24 h after surgery, compared with GA alone [15]. In a study conducted by Mostafa SF et al. [16] On Ultrasound-guided ESPB in laparoscopic bariatric surgery, they proved that ESPB provided satisfactory postoperative analgesia, with decreased analgesic consumption without significant difference in postoperative pulmonary functions compared with the control group. However, ESP blocks resulted in higher resting pain scores 24 h postoperatively compared with intrathecal morphine in laparoscopic donor hepatectomy.

However, Kang R et al. [17] examined bilateral ESP blocks versus intrathecal morphine in 54 donors for a liver transplant. They found that ESP blocks resulted in higher resting pain scores 24 h postoperatively compared with ITM. However, they introduced the ESPB with 20 mL 0.5% ropivacaine against 400 μg morphine injected intrathecally to be assessed after 24 h.

Our study patients were spontaneously breathing supported by an oxygen nasal cannula to keep SaO2 >95%, which was sufficient and safe except for one case in the control group with propofol sedation, who showed repeated apnea attacks, and general anesthesia with intubation was introduced.

On the other hand, Razavi and Malekianzadeh [18] evaluated the efficacy and safety of deep sedation with propofol infusion in 250 pediatric patients scheduled for dental procedures. They concluded that deep sedation was a suitable technique with a high success rate in the presence of a skilled anesthetist and close monitoring, which were essential unless this procedure could be risky.

Enhanced recovery protocols frequently included regional anesthesia techniques to minimize opioid analgesics whenever possible. As the reduction in pain scores itself does not mean an improvement in patient experience, but other factors than only analgesia, such as general well-being and subsided complications, matter in patient satisfaction and contribute to earlier hospital discharge.

Our trial yielded positive results that the ESPB provided improved analgesia with significantly higher satisfaction levels among patients, with non-significant differences in the level of surgeon satisfaction.

At the same time, Moorthy A et al. [19] and van den Broek RJC et al. [20] evaluated outcomes in ESP block through the Quality of Recovery-15 score and proved that continuous ESBP incorporated into multimodal analgesia regimen is non-inferior to a continuous thoracic epidural in terms of the quality of postoperative recovery in patients undergoing elective unilateral video-assisted thoracoscopic surgery. Also, Kamel and his colleagues assessed the efficacy of ultrasound ESPB on hemodynamics and patient satisfaction in abdominal hysterectomy under general anesthesia. They declared a better impact on patient satisfaction with hemodynamic stability [21].

Limitations of this study included that it had a limited number of patients in a single-center study which made it not possible to generalize our findings. There may be a risk of bias from lack of patient blinding, and the serum concentrations of the local anesthetic administered in the ESP were not estimated.

In conclusion, our study yields positive results that ESPB could be recommended as an alternative to analgesia in minimally invasive TIPS procedures and its vulnerable patients to improve safety by reducing sedation-related morbidity and complications with improving the degree of comfort and satisfaction.

List of abbreviations

ANI	Analgesia nociceptive index
BIS	Bispectral Index
BMI	Body mass index
CO	Cardiac output
EC	Electrical cardiometry
ECG	Electrocardiography
ESPB	Erector Spinae Plane Block
PH	Portal hypertension
PACU	Post-anesthesia recovery unit
PONV	Post-operative nausea and vomiting
MBP	Mean blood pressure
NIBP	Non-invasive blood pressure
SpO2	Oxygen saturation
TIPS	Transjugular intrahepatic portosystemic shunt.

Disclosure statement

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Authors' contributions

MAE designed the work and reviewed the manuscript. AMA revised the literature, performed the analysis, revised the statistical analysis, and wrote the manuscript. NIM design of the work revised the literature and collected the data. MLE followed the patients and collected the data. All authors approved the final version of the manuscript. All authors have contributed intellectually to the manuscript, and the manuscript has been read and approved by all the authors. The manuscript has not been published, simultaneously submitted, or accepted for publication elsewhere.

Availability of data and material

The datasets generated and/or analyzed during the current study are not publicly available due publishing the clinical data about any study conducted in our institute and approved by the institutional ethical committee is against the policy of the National Liver Institute, Menoufia University unless there is a reasonable request but are available from the corresponding author on reasonable request.

Trial registration

Ethical committee approval: IRB number: 00260/2021

The pan African clinical trial registry number

(PACTR202110642018302)

References

[1] Rajesh S, George T, Philips CA, et al. Transjugular intrahepatic portosystemic shunt in cirrhosis: an exhaustive critical update. World J Gastroenterol. 2020;26(37):5561–5596. doi: 10.3748/wjg.v26.i37.5561

[2] Strunk H, Marinova M. Transjugular intrahepatic portosystemic shunt (TIPS): pathophysiologic basics, actual indications and results with review of the literature. Fortschr Röntgenstr. 2018;190(08):701–711. doi: 10.1055/a-0628-7347

[3] Chana A, James M, Veale P. Anesthesia for Transjugular intrahepatic portosystemic shunt insertion. BJA Edu. 2016;16(12):405–409. doi: 10.1093/bjaed/mkw022

[4] Abbas N, Makker J, Abbas H, et al. Perioperative Care of patients with liver cirrhosis: a review. Health Serv Insights. 2017;10:1178632917691270. doi: 10.1177/1178632917691270

[5] DeGasperi A, Corti A, Corso R, et al. Transjugular intrahepatic portosystemic shunt (TIPS): the anesthesiological point of view after 150 procedures managed under total intravenous anesthesia. J Clin Monit Comput. 2009;23(6):341–346. doi: 10.1007/s10877-009-9167-y

[6] Zhang CC, Ganion N, Knebel P, et al. Sedation-related complications during anesthesiologist-administered sedation for endoscopic retrograde cholangiopancreatography: a prospective study. BMC Anesthesiol. 2020;20(1):131. doi: 10.1186/s12871-020-01048-0

[7] Ripamonti R, Ferral H, Alonzo M, et al. Transjugular intrahepatic portosystemic shunt-related complications and practical solutions. Semin Intervent Radiol. 2006;23(2):165–176. doi: 10.1055/s-2006-941447

[8] Wick EC, Grant MC, Wu CL. Postoperative multimodal analgesia pain management with nonopioid analgesics and techniques: a review. JAMA Surg. 2017;152 (7):691–697. doi: 10.1001/jamasurg.2017.0898

[9] Forero M, Adhikary SD, Lopez H, et al. The Erector spinae plane block: a novel analgesic technique in thoracic neuropathic pain. Reg Anesth Pain Med. 2016;41:621–627. doi: 10.1097/AAP.0000000000000451

[10] Elshafie MA, Khalil MK, ElSheikh ML, et al. Erector spinae block with opioid free anesthesia in cirrhotic patients undergoing hepatic resection: a randomized controlled trial. Local Reg Anesth. 2022;15:1–10. doi: 10.2147/LRA.S343347

[11] Cui Y, Wang Y, Yang J, et al. The effect of single-shot Erector spinae plane block (ESPB) on opioid consumption for various surgeries: a meta-analysis of randomized controlled trials. J Pain Res. 2022;15:683–699. doi: 10.2147/JPR.S346809

[12] Fu J, Zhang G, Qiu Y. Erector spinae plane block for postoperative pain and recovery in hepatectomy: a randomized controlled trial. Medicine. 2020;99(41): e22251. doi: 10.1097/MD.0000000000022251

[13] Abu Elyazed MM, Mostafa SF, Abdelghany MS, et al. Ultrasound-guided Erector spinae plane block in patients undergoing open epigastric hernia repair: a prospective randomized controlled study. Anesthesia & Analgesia. 2019;129(1):235–240. doi: 10.1213/ANE.0000000000004071

[14] Jin Y, Zhao S, Cai J, et al. Erector spinae plane block for perioperative pain control and short-term outcomes in Lumbar Laminoplasty: a randomized clinical trial. J Pain Res. 2021;14:2717–2727. doi: 10.2147/JPR.S321514

[15] Zhang Y, Liu T, Zhou Y, et al. Analgesic efficacy and safety of erector spinae plane block in breast cancer surgery: a systematic review and meta-analysis. BMC Anesthesiol. 2021;21(1):59. doi: 10.1186/s12871-021-01277-x

[16] Mostafa SF, Abdelghany MS, Abu Elyazed MM. Ultrasound-guided Erector spinae plane block in patients undergoing laparoscopic bariatric surgery: a prospective randomized controlled trial. Pain Pract. 2021;21(4):445–453. doi: 10.1111/papr.12975

[17] Kang R, Chin KJ, Gwak MS, et al. Bilateral single-injection erector spinae plane block versus intrathecal morphine for postoperative analgesia in living donor laparoscopic hepatectomy: a randomized non-inferiority trial. Reg Anesth Pain Med. 2019;100902. doi: 10.1136/rapm-2019-100902

[18] Razavi SS, Malekianzadeh B. The efficacy and complications of deep sedation in pediatric dental patients: a retrospective cohort study. Anesthesiol Res Pract. 2022;2022:5259283. doi: 10.1155/2022/5259283

[19] Moorthy A, Eochagain AN, Dempsey E, et al. Ultrasound-guided erector spinae plane catheter versus video-assisted paravertebral catheter placement in minimally invasive thoracic surgery: comparing continuous infusion analgesic techniques on early quality of recovery, respiratory function and chronic persistent surgical pain: study protocol for a double-blinded randomised controlled trial. Trials. 2021;22(1):965. doi: 10.1186/s13063-021-05863-9

[20] Van den Broek RJC, Koopman J, Postema JMC, et al. Continuous erector spinae plane block versus thoracic epidural analgesia in video-assisted. thoracic surgery: a study protocol for a prospective randomized open-label non-inferiority trial. Trial. 2021;22(1):321. doi: 10.1186/s13063-021-05275-9

[21] Kamel AAF, Amin OAI, Ibrahem MAM. Bilateral Ultrasound-guided Erector spinae plane block versus transversus abdominis plane block on postoperative analgesia after total abdominal hysterectomy. Pain Physician. 2020;4;23(7;4):375–382. doi: 10.36076/ppj.2020/23/375