

EFFECTIVENESS OF BILATERAL ERECTOR SPINAE PLANE BLOCK VERSUS TRANSVERSUS ABDOMINIS PLANE AS ANALGESIA AFTER GYNECOLOGIC LAPAROTOMY

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ABSTRAK

Penelitian ini bertujuan untuk membandingkan efektivitas blok ESP dan TAP terhadap durasi efek analgesik pasca operasi, nyeri pasca operasi, total konsumsi opioid pasca operasi, dan perubahan dalam nilai *Neutrophil-Lymphocyte Ratio (NLR)* sebelum dan sesudah operasi laparotomi ginekologi. Jenis penelitian ini adalah eksperimental murni (eksperimental sejati). Desain penelitian yang digunakan adalah uji acak tunggal tersamar. Subjek penelitian adalah pasien berusia 18-65 tahun yang menjalani operasi laparotomi ginekologi di ruang operasi Instalasi Bedah Pusat. Analisis data dilakukan dengan bantuan SPSS versi 26 termasuk analisis deskriptif dan uji perbandingan rata-rata menggunakan uji *t* independen. Blok ESP memiliki durasi analgesik yang lebih lama dengan rata-rata 6.13 ± 3.30 jam sedangkan TAP memiliki durasi analgesia sebesar 3.93 ± 1.98 jam, dengan perbedaan rata-rata sebesar 2.18 jam (IK 95% 0.22-4.15 jam; $p = 0.030$). Terdapat perbedaan pada skala VAS pada 6, 12, 24, dan 48 jam dengan hasil ESP lebih rendah dari TAP. Rata-rata kebutuhan morfin pada blok ESP adalah 1.62 ± 0.71 mg dan kelompok TAP dengan total kebutuhan rata-rata $\pm SB$ 3.31 ± 1.74 mg, perbedaan yang diperoleh adalah 1.68 mg (IK95% 0.72-2.64 mg; $p = 0.001$). Hasil perbedaan nilai perubahan NLR antara sebelum dan sesudah operasi antara blok ESP bilateral dan TAP ditemukan memiliki perbedaan yang signifikan dengan perbedaan rata-rata sebesar 0.36 (IK 95% 0.04-0.69; $P=0.029$). Kesimpulan dari penelitian ini adalah blok ESP memiliki efektivitas yang lebih baik dibandingkan dengan blok TAP sebagai analgesia setelah operasi laparotomi ginekologi.

Kata kunci : analgesia, blok Erector Spinae Plane bilateral, blok regional, blok Transversus Abdominis Plane bilateral, laparotomi ginekologi

ABSTRACT

Anesthetic measures that can be performed in gynecological laparotomy surgery are the administration of Erector Spinae Plane (ESP) and Transversus Abdominis Plane (TAP) blocks which are components of multimodal analgesia can reduce postoperative pain and the amount of opioid consumption. The research design used was single blind randomized trial. The subjects were patients aged 18-65 years who underwent gynecological laparotomy surgery in the operating room of the Central Surgical Installation. Data analysis was performed with the help of SPSS version 26 including descriptive analysis and mean comparison test using independent t test. ESP block has a longer analgesic duration with a mean of 6.13 ± 3.30 hours while TAP has an analgesia duration of 3.93 ± 1.98 hours, with a mean difference of 2.18 hours (IK 95% 0.22-4.15 hours; $p = 0.030$). There were differences in VAS at 6, 12, 24 and 48 hours with ESP results lower than TAP. ESP morphine requirement mean $\pm SB$ 1.62 ± 0.71 mg and TAP group with mean $\pm SB$ total requirement 3.31 ± 1.74 mg, the difference obtained was 1.68 mg (IK95% 0.72-2.64 mg; $p = 0.001$). The results of the difference in the value of NLR changes between before and after surgery between bilateral ESP and TAP blocks were found to have a significant difference with a mean difference of 0.36 (IK 95% 0.04-0.69; $P=0.029$). The conclusion of this study is that ESP block has better effectiveness compared to TAP block as analgesia after gynecological laparotomy.

Keywords : regional block, bilateral erector spinae plane block, bilateral transversus abdominis plane block, analgesia, gynecologic laparotomy

INTRODUCTION

A complication of gynecological laparotomy surgery is postoperative pain which can impact mobilization and rehabilitation time, length of hospital stay, patient satisfaction and can lead to chronic pain. The use of conventional analgesics with the use of opioids is known to cause unavoidable opioid-related side effects. These side effects include nausea, vomiting, pruritis, urinary retention and dizziness. Meanwhile, the use of epidural catheters for pain management often results in complications such as infection and hematoma, as well as risks in more severe insertions such as entry into the *subarachnoid* space to spinal cord injury. *Erector Spinae Plane* (ESP) block and *Transversus Abdominis Plane* (TAP) block can be considered actions that have a very low risk of complications, because based on sonoanatomy it is easy to recognize. Both blocks are performed with the help of ultrasonography (USG) so that the incidence of nerve injury, hematoma, local infection, intraperitoneal injection, viscera trauma, and trauma to other abdominal organs can be minimized.

More than 137 million obstetric and gynecologic surgeries are performed worldwide comprising 26.5% of surgical procedures for adult women (Mattson et al., 2021). Sixty-four percent of obstetric surgeries and 29% of gynecologic surgeries. Surgical procedures in gynecological cases vary widely, one of which is laparotomy. The laparotomy procedure requires a wider incision than laparoscopy for adequate visualization and surgery (Leitao et al., 2021). Laparotomy is a major surgery that involves incision of the abdominal layer to obtain problematic abdominal organs (bleeding, perforation, cancer, and obstruction) (Frassini et al., 2023). Thus, anesthesia techniques that are capable of including sedation, painlessness, and strong muscle relaxation are needed in handling gynecological laparotomy cases (Mattson et al., 2021).

The principle of the triad of anesthesia plays a very important role in anesthesia, in order to obtain the ideal dose, and reinforce each other and reduce unwanted side effects of drugs (Sani et al., 2022). In regional anesthesia, nerve transmission is blocked, and the patient may remain awake or sedated during procedures that fulfill the triad of anesthesia, namely, painlessness, sedation, and muscle relaxation (Coe et al., 2023). Regional anesthesia techniques in gynecological laparotomy can provide adequate analgesic effects and rapid postoperative mobilization, facilitate patient transfer between units, reduce opioid side effects and reduce the number of inhalation agents and muscle relaxants required under general anesthesia (Hutton et al., 2018).

Gynecological oncology surgeries such as *total abdominal hysterectomy* (TAH), *salpingo-oophorectomy*, and tumor *debulking* cause postoperative pain with a VAS score of 7-8 so adequate pain management is needed. Surgical procedures cause acute pain due to nociceptive stimuli in the operated tissue (Lim et al., 2016). The stimulus is received by pain receptors and then the process of transduction, transmission, modulation and perception occurs, so that to prevent or overcome it requires adequate analgesics (Haddad et al., 2021).

Anesthesia measures that can be performed in gynecological laparotomy surgery are the administration of ESP and TAP blocks, which are components of multimodal analgesia that can reduce postoperative pain and the amount of opioid consumption (Frassanito et al., 2020). ESP block is said to be an effective and safe procedure for total laparoscopic hysterectomy (Frassanito et al., 2020). It has a very low risk of complications, as the sonoanatomy is easily recognizable and there are no nearby structures at risk of injury. Bilateral ESP block results in good sensory and motor block in hysterectomy surgery. Extensive craniocaudal and mediolateral spread at multiple segment levels of the *m. erector spinae* was obtained (Altinpulluk et al., 2019). ESP block is said to be a good analgesia method for postoperative abdominal hysterectomy compared to the group without additional postoperative block with the initial 24-hour results showing lower total opioid consumption in the ESP block group and

lower pain rates within 12 hours (Warner et al., 2022). Another anesthesia measure, TAP block, is also performed using an ultrasound device, where local anesthetic drugs are injected between the layers of *m. internal obliq* and *m. transversus abdominis*. (Bacal et al., 2019). This results in a block of the *thoracoabdominal*, *ilioinguinal* and *iliohypogastric nodes*. The incidence of complications with this block is very rare. What may occur is nerve injury, hematoma, local infection, intraperitoneal injection, trauma to the viscera, and trauma to other abdominal organs. TAP block is said to be significantly better postoperative analgesia than placebo in hysterectomy surgery (Moon et al., 2023).

These two block measures were compared in a study conducted by Shukla, which found that the NRS value in the ESP group was lower than the TAP group at baseline up to 6 hours postoperatively. The mean duration of analgesia was longer in the ESP group than the TAP group. The amount of tramadol consumption in the postoperative 24 hours was more in the TAP group than ESP. Patient satisfaction was higher 12 hours postoperatively in the ESP group. The use of ESP block is considered better in postoperative pain control and the duration of analgesia and the amount of postoperative opioid consumption is lower than TAP block in postoperative hysterectomy patients (Shukla et al., 2022). Similar results were also obtained in a study by Kamel et al (2020) where pain scores were statistically lower in the 24 hours postoperatively in the ESP group compared to the TAP group. The amount of opioid consumption was lower in the ESP group compared to TAP (Kamel et al., 2020). ESP block proved to be more potent and longer analgesia effect compared to TAP block. In addition, postoperative side effect complaints in ESP group patients were said to be lower and satisfaction higher.

Whereas the results of (Warner et al., 2022) found no significant difference in the use of ESP and TAP blocks in this type of surgery. There was no difference in opioid consumption, pain scale and patient satisfaction between these two groups. Similar results were obtained by (Rosato et al., 2023) who found no significant difference in pain scale between ESP and TAP groups. Opioid requirements during surgery were higher in the TAP group compared to ESP. The number of opioid requirements 36 hours postoperatively did not show significant results.

Postoperative *Neutrophil-Lymphocyte Ratio* (NLR) assessment is known to be an indicator for inflammation caused by postoperative pain. According to (Turgut et al., 2017) it is said that postoperative pain interferes with surgical complications. Then inflammation has an important role in the development of postoperative pain. The predictive role of NLR as an inflammatory marker in several diseases suggests that NLR can be a predictive tool for postoperative pain resulting from inflammatory pathways secondary to surgical trauma and/or directly associated with nerve trauma due to surgery. Administration of block as an anesthetic is expected to reduce the inflammatory response so that changes in NLR values are much reduced.

Several studies with different results made researchers want to compare the effectiveness of ESP and TAP blocks on the duration of postoperative analgesic effects, postoperative pain, total postoperative opioid consumption, and changes in NLR values before and after gynecological laparotomy surgery so that later it can contribute input / suggestions to be considered for use in relation to the clinical benefits of patients undergoing gynecological laparotomy surgery at Prof. Dr. I.G.N.G. Ngoerah Denpasar Hospital.

METHOD

This study has obtained a research ethics permit from Udayana University / Prof. IGNG Ngoerah Denpasar Hospital in 2024 with number 0346 / UN14.2.2.VII.14 / LT / 2024. This type of research is pure experimental (*true experimental*). The research design used was *single blind randomized trial*. This study divided the eligible subjects into two groups, namely group P1 [bilateral *Erector Spinae Plane* (ESP) Block] and group P2 [bilateral *Transversus*

Abdominis Plane (TAP) Block]. The allocation of subjects to each group was randomized. The study was conducted in the operating room of the Central Surgical Installation of the Central General Hospital (RSUP) Prof. Dr. I.G.N.G Ngoerah Denpasar from December 2023 to March 2024. Inclusion Criteria: Patients aged 18-65 years who underwent gynecological laparotomy surgery in the operating room of the Central Surgical Installation of Prof. Dr. I.G.N.G Ngoerah Denpasar Hospital in the period February to March 2024. Exclusion Criteria: 1) BMI <17.5 and >25 kg/m²; 2) ASA physical status > II; 3) Drug allergy; Infection in the area to be blocked; 4) Severe cardiovascular disorders; 5) History of chronic analgesia use; 6) Use of blood thinning drugs that have not been discontinued according to guidelines and coagulopathy; 7) Patient or guardian refused to sign the informed consent form. *Drop Out* Criteria: 1) Patients experienced complications after the procedure such as severe bleeding, heart rhythm disturbances, and shock; 2) The patient had an allergic reaction to bupivacaine and opioids; 3) Patients using ventilator; 3) The patient died during the study. Data analysis was carried out using the help of SPSS version 26 including descriptive analysis and mean comparison test with *independent t test* for numerical data scale and Chi Square test for categorical scale.

RESULTS

In this study, 32 research subjects were obtained which were divided into 2 groups, namely 16 subjects in the ESP group and 16 subjects in the TAP group totaling 16 subjects with data characteristics presented in Table 1.

Table 1. Research Data Characteristics

Variables	Group (mean±SB)		P-value
	ESP	TAP	
Age (years)	48,87±6,88	48,31±8,64	0,840 ^a
Body Weight (kg)	58,75±6,71	61,75±6,14	0,198 ^a
Height (m)	1,61±0,05	1,59±0,06	0,361 ^a
BMI (kg/m) ²	22,78±3,12	23,12±2,46	0,106 ^a
ASA			
I	4 (25%)	3 (18,8%)	0,669 ^b
II	12 (75%)	13 (81,3%)	

The difference in analgesia duration presented in Table 5.2 and Figure 1 shows that the group with ESP blocking has a longer analgesic duration with a mean ± SB of 6.13 ± 3.30 hours while the group with TAP has an analgesia duration of 3.93 ± 1.98 hours, with a mean difference in the two groups of 2.18 hours (IK 95% 0.22-4.15 hours) which is statistically significant 0.030.

Table 2. Differences in Duration of Analgesia

Variables	Group	Average difference	95% IK	P-value	
					ESP
Duration of analgesia (Hour)	of 6,13±3,30	3,93±1,98	2,18	0,22-4,15	0,030 ^{a*}

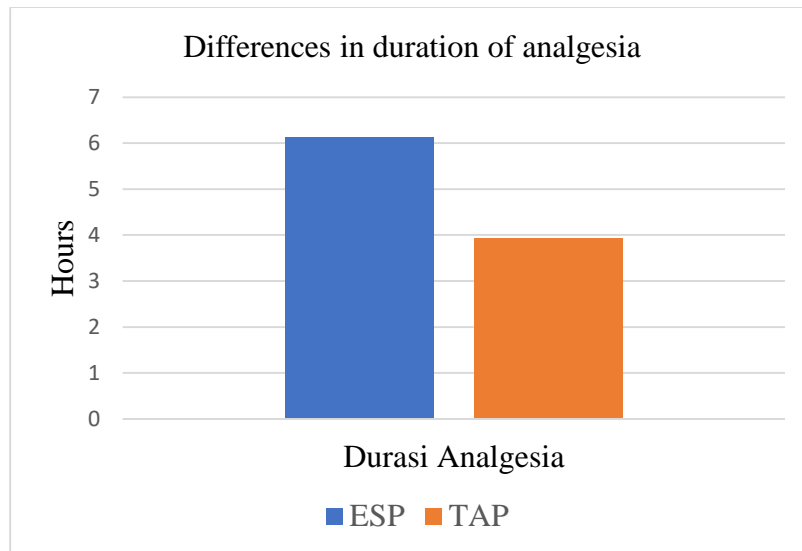


Figure 1. Difference in Duration of Analgesia

The results of pain intensity presented in Table 3 and Figure 2 showed that in the first 1 hour after blocking, there was no significant difference in VAS values between the two groups. Whereas at the 6th, 12th, 24th and 48th hours, there were significant differences between the two groups. The ESP group had a lower mean VAS compared to the TAP group.

Table 3. Pain intensity

Variables	Group		Average difference	95% IK	P-value
	ESP	TAP			
VAS 1 hour	0,37±0,88	0,56±1,03	0,18	0,51-0,88	0,585
VAS 6 hours	0,75±1,39	3,18±1,10	2,43	1,52-3,34	<0,001
VAS 12 hours	2,31±1,25	3,81±1,27	1,50	0,58-2,41	0,002
24-hour VAS	2,43±0,63	3,06±0,68	0,62	0,15-1,09	0,011
VAS 48 hours	1,68±0,70	2,75±0,85	1,06	0,49-1,63	0,001

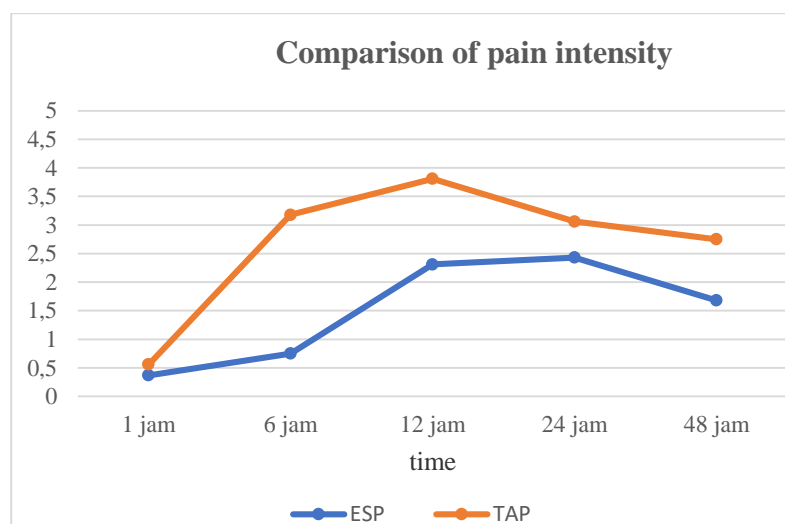


Figure 2. Comparison Chart of Pain Intensity

The number of differences in 48-hour total opioid requirements are presented in Table 3 and Figure 2. with the results obtained significant differences in the level of morphine requirements in the two groups. The ESP group had a lower morphine requirement with a total

mean ± SB of 1.62 ± 0.71 mg and the TAP group with a mean ± SB total requirement of 3.31 ± 1.74 mg, the mean difference obtained was 1.68 mg (IK95% 0.72-2.64 mg; p = 0.001).

Table 4. Difference In 48-Hour Total Opioid Requirement

Variables	Group		Average difference	95% IK	P-value
	ESP	TAP			
Morphine (mg)	1,62±0,71	3,31±1,74	1,68	0,72-2,64	0,001

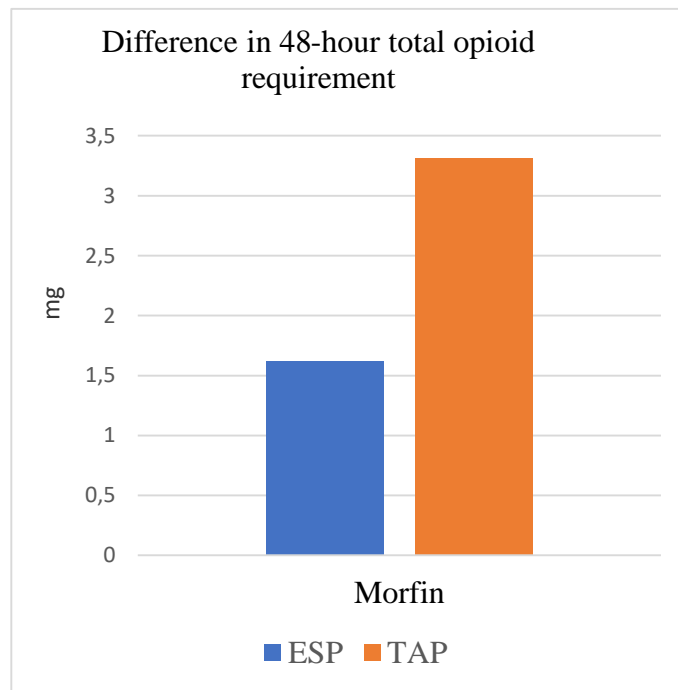


Figure 3. Difference in 48-Hour Total Opioid Requirement

The number of NLR before and after the study in both groups was not found to be significantly different, but delta NLR obtained differences in the value of NLR changes presented in Table 5.5. The result of NLR in the ESP group before was 2.35±1.59 and after 2.76±1.37 while in the TAP group before was 2.05±0.97 and after was 2.82±1.02. The results of the difference in the value of NLR changes between before and after surgery between ESP and TAP bilateral blocks were found to have a significant difference with a mean difference of 0.36 (IK 95% 0.04-0.69; P=0.029).

Table 5. Differences in NLR Change Values Between Before and After Surgery Between Bilateral ESP and TAP Blocks

Variables	Group		Average difference	95% IK	P-value
	ESP	TAP			
NLR before	2.35±1.59	2.05±0.97	0.30	0.66-1.26	0.522
NLR after	2.76±1.37	2.82±1.02	0.65	0.81-0.94	0.881
Delta (Δ) NLR	0.40±0.35	0.77±0.53	0.36	0.04-0.69	0.029

DISCUSSION

In this study, both groups were found to have no significant differences in terms of age, weight, height, BMI and ASA. Age was found to be at the age of 48 years, this is in accordance with demographic data in Indonesia where the age of action of most gynecological operations occurs at the age of 45-50 years (Kementerian Kesehatan, 2018). Data from WHO in 2023 found that the most age undergoing is also in the age range of 45-55 years, although the

majority in the UK tend to perform hysterectomy at the age of 60 years (Moss et al., 2020). The results of age under 60 years have no significant difference in terms of the effectiveness of the blocks used in terms of both ESP and TAP (Forero et al., 2016; Khan & Khan, 2018; Kot et al., 2019; Mallan et al., 2019; Petersen et al., 2013).

The BMI results in both groups are still in the normal range so this shows there is no significant difference in effectiveness between the use of ESP and TAP, the results of this study are in accordance with BMI data in research conducted by (Warner et al., 2022). Body mass index $>25 \text{ kg / m}^2$ will require the number of doses of drug use for more blocks in achieving the same effectiveness, the results of the study of (Petersen et al., 2013) stated that the block dose was increased 1.5-2 times in patients with BMI 25 kg / m^2 who will perform TAP actions.

The results of this study found that the most ASA group was ASA group 2, this is in accordance with the research of Han & Khan, 2018; Lin et al., 2022; Oh et al., 2022 (Khan & Khan, 2018; Lin et al., 2022; Oh et al., 2022). That the use of ESP and TAP carried out ASA I-II. ASA III-IV status will affect the effectiveness of the block due to complications in the patient.

The results in this study found that ESP has a longer duration in the impact of analgesia effects than TAP, this can be caused because the diffusion of local anesthesia has an effect on the posterior spinal nerve and produces a partial paraspinal block effect (El-Boghdadly et al., 2018). This ESP block is a paraspinal fascial plane block in which needle placement is between the *m. erector spinae* and the thoracic *transverse processus*, and local anesthesia is administered, blocking the dorsal and ventral branches of the thoracic and abdominal spinal nerves (Kot et al., 2019). Blockage of the dorsal and ventral branches of these spinal nerves helps achieve multi-dermatomal sensory block of the anterior, posterior, and lateral thoracic and abdominal walls. The multi-dermatomal sensory block is due to the spread of local anesthetic injected cranially and caudally. This spread is aided by the thoracolumbar fascia, which extends across the posterior thoracic and abdominal walls (Chin & El-Boghdadly, 2021). The results of the study by (Gürkan et al., 2015) also state that ESP block is more favorable than other thoracic interfascial plane blocks due to this spread and the resulting abdominal viscera analgesia effect. In this study, the analgesia impact of the ESP procedure was an average of 6 hours, a result similar to the research conducted by (Kamel et al., 2020; Shukla et al., 2022) which stated that the analgesia impact of the ESP procedure had an average of 6 hours.

The TAP technique blocks the thoracolumbar nerves T10 to L1 and provides adequate somatic analgesia with little or no visceral blockade whereas the ESP technique blocks the nerves of the ventral and dorsal branches of the spine along with the communicating branches which adds to the sympathetic chain catering for sympathetic block and visceral analgesia. Results in the study (Malawat et al., 2020), it was found that the duration of analgesia with ESP technique was longer, reaching 43.53 hours while the duration of TAP was only 12.07 hours, while in the research obtained by (Mankikar et al., 2016) who got the duration of analgesia 9.35 hours.

ESP block makes a prolonged craniocaudal block, achieving paravertebral spread of as much as three and four vertebral levels, cranially and caudally respectively, facilitating extensive somatic and visceral analgesia thus having an effect profile comparable to retrolaminar and paravertebral blocks. Another advantage of ESP block makes it a simpler, safer, and reliable substitute for other pain relief modalities as it includes an ultrasonic target represented by a transverse process that can be easily seen, the point of injection is the musculofascial plane. and because the erector spinae muscle is composed of muscles and tendons that extend through the cervical, thoracic, and lumbar areas, a single injection of 20-30 mL in an adult will cause anesthesia to multiple dermatomes and facilitate the approach being at a point that is somewhat distant from the surgical zone (Malawat et al., 2020).

In this study, it was found that at 1 hour there was no difference in pain values in the two groups but after 6, 12, 24, and 48 hours there were significant differences. This is because at 1 hour both groups still have an adequate post-block analgesia effect but after 6 hours there is an increase in the pain threshold which results in an increase in the number of pain needed to administer opioids. Similar results were obtained in a study conducted by Warner et al in 2022 which stated an ESP block guided by an ultrasound device, where local anesthetic drugs were injected under the *m. erector spinae* group (*m. spinalis*, *m. longissime*). *erector spinae* (*m. spinalis*, *m. longissimus thoracis* and *m. Ileocostalis*) causes sensory blockade in the anterior and dorsolateral parts by blocking the dorsal and ventral branches of the spinal cord so that the analgesia effect will spread and make the duration longer than the TAP technique. Extensive craniocaudal and mediolateral spread at several segment levels of the *m. erector spinae* resulting in good sensory and motor block in hysterectomy surgery (Altinpulluk et al., 2019).

In the group given TAP, which has begun to increase the pain threshold at hour 3, the addition of continuous TAP blocks to single injection TAP blocks can improve analgesia after laparotomy for gynecological cancer (Maeda et al., 2015; Yoshida et al., 2016). Whereas in the ESP group because the duration of analgesia effectiveness has an average of 6 hours, this procedure is superior, similar results to the study of Shukla et al, 2022. The level of satisfaction rate was also found to be higher in the ESP group compared to the TAP group (Kamel et al., 2020).

A case report of ESP block at T5 level using continuous catheter technique in a patient with multiple unilateral rib fractures reported a significant reduction in pain scores within 2 minutes of regional block performance documented with a numerical rating scale of 0/10 at rest and 1/10 when coughing (Hamilton & Manickam, 2017). ESP block was used for post caesarean section pain relief, patients reported a significant reduction in pain; assessed by visual analog scale scores (VAS<40) both at rest and movement at all time intervals for 43.53 hours compared to TAP block where VAS<40 was maintained both at rest and movement for up to 12.07 hours (Malawat et al., 2020).

A series of 11 cases of ESP block for abdominal surgery, including laparoscopic surgery was performed. Two of the 11 patients who received ESP block did not require general anesthesia while most patients maintained general anesthesia numerical rating scale (NRS) for pain 0-2/10 postoperatively (Luis-Navarro et al., 2018).

The results in this study found that ESP has the advantage of lower opioid use, this is in line with research conducted by Oh et al.who found that with more adequate analgesia, opioid requirements can also be reduced with the use of ESP blocks (Oh et al., 2022). From the results of 7 studies conducted by (Goel et al., 2021; Jin et al., 2021; Lin et al., 2022; Oh et al., 2022; Qiu et al., 2020; van den Broek et al., 2021; Vergari et al., 2021) that opioid consumption within 24 hours of the onset of ESP block.It was found that opioid consumption in the first 24 hours postoperatively was reported to be lower in the ESP group compared to TAP. Opioid use is associated with side effects such as respiratory depression, urinary retention, pruritus, constipation, and ileus (Vincenzi et al., 2022). With less opioid use, side effects such as incidence of postoperative nausea and vomiting were also found to be lower in patients given ESP block (Massoth et al., 2021). In the reported randomized clinical studies and systematic reviews, there were also no severe complications of ESP block such as *local systemic anesthetic toxicity* (LAST), pneumothorax, or nerve injury (van den Broek et al., 2021). This may be due to the large injection area of the *m. erector spinae* and the ultrasound-assisted block procedure.

A study using TAP block with ropivacaine 0.5% in post-caesarean section reported a reduction in total morphine use over a 24-hour period (median 18 mg) compared to the control group (median 31.5 mg) (Belavy et al., 2009).There was a drastic reduction in total analgesic use over a 48-hour period with an average of 4 analgesic doses (diclofenac) required with TAP block (mean time to first analgesia administration: 12.07 hours) compared to an average

analgesic requirement of 1 dose with ESP block (mean time to analgesia administration: 43.53 hours) and significantly reduced VAS scores at rest and on movement (Malawat et al., 2020).

On the other hand, early publications on ESP block mainly centered on thoracic analgesia and reported decreased pain scores and perioperative opioid consumption (oral morphine equivalent 218 mg vs. 548 mg) (Adhikary et al., 2018). Some other publications on ESP block reported extensive multidermatomal analgesia in thoracic neuropathic pain, breast cancer surgery where total opioid consumption was found to decrease by 65% in 24 hours compared to the control group (Forero et al., 2016).

The results showed that the NLR difference value was lower in the ESP group compared to the TAP group. No previous studies have examined NLR in distinguishing the effectiveness of the two blocks. The lower results in ESP block administration compared to TAP may be due to the technique of block anesthesia performed, the spread of drugs in ESP is more than TAP so that the effectiveness of the block is better which has an impact on lower inflammation.

The neutrophil-lymphocyte ratio (NLR) is a simple marker of inflammatory response. Peripheral blood NLR values are used as a parameter that provides information on the relationship between the inflammatory environment and physiological stress. The results of past studies have shown significant differences in NLR values during the postoperative period. NLR was independently correlated with *surgical site infection* (SSI). SSI is the third most common complication after spinal surgery. The incidence of wound infection in spinal surgery reaches 16% and still causes significant morbidity and mortality after spinal surgery. Many studies have shown that SSI after posterior lumbar surgery is associated with higher NLR values. In this study, the NLR value of ESP block was found to be lower than that of TAP, which is consistent with research (Domagalska et al., 2023). ESP was associated with lower NLR values at 12 and 24 hours after surgery. After 24 hours, the NLR was <3.0. This study suggests that ESP is associated with less stress response and is associated with a lower risk of surgical site infection, which is important in spinal surgery. Until now, there have been no studies explaining the effect of ESPB on NLR and PLR. however (Tantri et al., 2023) showed that ESP in posterior lumbar decompression and stabilization procedures was associated with lower levels of interleukin-6 (Il-6) and interleukin (Il-10), two proinflammatory cytokines. Also, Bravi et al, 2021) showed that Il-6, Il-10, and tumor necrosis factor-alpha (TNF- α) were significantly lower in the ESB group in patients after video-assisted thoracoscopic surgery (Bravi et al., 2021).

ESP blocks afferent nociceptive stimulation at the injury site and enhances the effects of intravenous analgesia. This may be the reason why ESP decreases the stress response expressed through lower NLR, PLR, and cytosine. ESP provides adequate pain management with fewer side effects by blocking the dorsal and central branches of spinal nerves. ESPB also has a wide range of cranial and caudal spread through the paraspinal muscles via a single injection, facilitating ESP coverage at multiple spinal levels. Based on a cadaveric study by (Forero et al., 2016) local anesthetic was injected between the deep fascia of the ESP muscle and the transverse process to cover the ventral and dorsal ramus of multiple spinal nerves above and below the injection site (Forero et al., 2016). The distribution of local anesthetic to the target area is affected due to disruption of postoperative tissue integrity resulting in a lower inflammatory response and an impact on low NLR values. While the TAP technique is known to have no significant difference with the control on the NLR value with the median NLR results (minimum and maximum) without TAP 7.14 (3.92- 14.12) and with TAP treatment with median results (minimum and maximum) 7.90 (3.25- 13.95) (Espadas-González et al., 2024).

Based on the results obtained in the ESP block group in terms of longer analgesia duration, lower pain levels after 6 hours, lower opioid consumption, and lower changes in postoperative NLR values are interrelated. ESP block is known to spread anteriorly towards the paravertebrae and epidural, thus causing a blockade effect on spinal innervation in the ventral and dorsal

branches. In addition, local anesthetic drugs that spread dorsally will be distributed craniocaudally so that the spread of drugs depends on the volume administered. The process of spreading further laterally results in anesthetic block in the *lateral cutaneous nerve* branch that innervates deeper into the *musculus serratus anterior* and *musculus intercostalis*. This is attributed to the effectiveness of the block on the upper and lower abdominal regions as well as the lateral side of the abdomen. This block is also said to have the properties of a *quadratus lumborum-like* block acting at the lower thoracic and lumbar levels (Hassanin et al., 2022; Saadawi et al., 2021).

TAP block, although not better than ESP block, can still be used as an analgesic in laparotomy surgery but with the right technique. The use of the *subcostal oblique* technique can reach a wider area than other types of TAP blocks, so it can be used for laparotomy such as myomectomy, cystectomy, and hysterectomy (Saadawi et al., 2021).

The statistical superiority of the ESP block over TAP is consistent with previous studies, but the effectiveness of both blocks as post-laparotomy analgesics is well established. Although the ESP block has an advantage in its analgesic effect, it is required to be performed in a tilted position. This is not feasible in all conditions of the subject for whom the block is to be performed. A longer time can also occur when we perform an ESP block because in addition to having to reposition after surgery and block, sometimes inappropriate positioning can complicate the block action process when compared to a TAP block.

CONCLUSION

The duration of analgesia was lower, pain intensity decreased by *visual analogue scale* (VAS) assessment at 6, 12, 24 and 48 hours, total opioid requirement was lower, and the change in *Neutrophil-Lymphocyte Ratio* (NLR) between pre- and postoperatively with bilateral *Erector Spinae Plane* (ESP) block was lower compared to *Transversus Abdominis Plane* (TAP) in gynecological laparotomy.

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