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RESEARCH

Comparison of lumbar epidural analgesia, transversus abdominis plane block, and surgical wound infiltration for postoperative pain relief in patients with major gynecologic surgery

Major jinekolojik cerrahi geçiren hastalarda postoperatif analjezide lomber epidural analjezi, transversus abdominis plan bloğu ve cerrahi yara infiltrasyonunun karşılaştırılması

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Abstract

Purpose: This study compared lumbar epidural analgesia (LEA), transversus abdominis plane (TAP) block, and surgical wound infiltration (SWI) for postoperative analgesia, patient satisfaction, and side effects in major gynecologic surgery.

Materials and Methods: Eighty-one patients were randomized into three groups: lumbar epidural block (Group LEA), TAP block (Group TAP), and SWI (Group SWI). Demographic data, surgical characteristics, hemodynamic variables, total morphine consumption, time to first rescue analgesia, pain scores, and side effects were recorded at 1, 2, 6, 12, 24, 36, and 48 hours, along with patient satisfaction scores at 24 and 48 hours postoperatively.

Results: Heart rate was significantly lower in Group LEA than in Group SWI and Group TAP. Postoperative 48-h total morphine consumption was significantly lower in Group LEA (9.63 ± 5.7 mg) than in Group TAP (15.30 ± 4.0 mg) and Group SWI (16.93 ± 5.9 mg). Postoperative pain scores were significantly lower in Group LEA than in the other groups. Time to first rescue analgesia was significantly longer in Group LEA (47.41 ± 24.3 min) than in Group TAP (27.41 ± 11.9 min) and Group SWI (16.67 ± 5.1 min). Patient satisfaction scores were significantly higher at 24 and 48 hours in Group LEA (9.89 ± 0.3 and 9.96 ± 0.1, respectively) than in Group TAP (9.67 ± 0.5 and 9.89 ± 0.3) and Group SWI (9.37 ± 0.8 and 9.44 ± 0.7). No significant side effects were noted.

Conclusion: In patients undergoing major gynecologic surgery, LEA resulted in lower morphine consumption, longer time to first rescue analgesic request, and higher

Öz

Amaç: Çalışmamızda major jinekolojik cerrahide lomber epidural analjezi (LEA), transversus abdominis plan (TAP) bloğu ve cerrahi yara infiltrasyonunu (SWI) postoperatif analjezi, hasta memnuniyeti ve yan etkiler açısından karşılaştırdık.

Gereç ve Yöntem: Seksen bir hasta üç gruba randomize edildi: lomber epidural blok (Grup LEA), TAP blok (Grup TAP) ve cerrahi yara infiltrasyonu (Grup SWI). Demografik veriler, cerrahi özellikler, hemodinamik değişkenler, toplam morfin tüketimi, ilk kurtarma analjezik isteğine kadar geçen süre, ağrı skorları ve yan etkiler postoperatif 1, 2, 6, 12, 24, 36 ve 48. saatlerde kaydedildi. Hasta memnuniyeti skorları da postoperatif 24 ve 48. saatlerde kaydedildi.

Bulgular: Kalp hızı Grup LEA'da diğer gruplara kıyasla daha düşüktü. Ameliyat sonrası 48 saatlik toplam morfin tüketimi Grup LEA'da (9,63±5,7 mg), Grup TAP'a (15,30±4,0 mg) ve Grup SWI'a (16,93±5,9 mg) göre anlamlı derecede düşüktü. Ameliyat sonrası ağrı skorları Grup LEA'da diğer gruplara göre anlamlı derecede düşüktü. İlk kurtarma analjezisine kadar geçen süre Grup LEA'da (47,41±24,3 dk), Grup TAP'a (27,41±11,9 dk) ve Grup SWI'ya (16,67±5,1 dk) göre anlamlı derecede uzundu. Hasta memnuniyeti skorları 24 ve 48. saatlerde Grup LEA'da (9,89±0,3 ve 9,96±0,1) Grup TAP'a (9,67±0,5 ve 9,89±0,3) ve Grup SWI'ya (9,37±0,8 ve 9,44±0,7) göre anlamlı derecede yüksekti. Postoperatif önemli bir yan etki görülmedi.

Sonuç: Majör jinekolojik cerrahi geçiren hastalarda LEA TAP blok ve SWI ile karşılaştırıldığında yan etki riskini artırmadan daha düşük morfin tüketimi, ilk kurtarma

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patient satisfaction scores without increasing the risk of side effects compared to TAP block and SWI.
Keywords: Epidural analgesia, gynecologic surgery, local anesthetic infiltration, postoperative pain management, side effects, transversus abdominis plane block.

analjezi süresinde uzama ve daha yüksek hasta memnuniyet skorları ile sonuçlandı.
Anahtar kelimeler: Epidural analjezi, jinekolojik cerrahi, lokal anestezik infiltrasyonu, postoperatif ağrı yönetimi, yan etki, transversus abdominis alan bloğu.

INTRODUCTION

Uncontrolled acute postoperative pain after gynecologic abdominal surgery may lead to patient dissatisfaction, postoperative complications, and the development of chronic pain. Opioids, particularly morphine, are commonly used to control postoperative pain; however, their use is associated with a range of opioid-induced side effects, including nausea, vomiting, sedation, and ileus[1]. Therefore, strategies that provide effective analgesia while minimizing opioid requirements are essential for optimizing recovery after major gynecologic surgery.

Enhanced Recovery After Surgery (ERAS) protocols are designed to minimize metabolic stress and support the restoration of normal physiological functions. A central component of these protocols is the routine use of multimodal analgesia (MMA) regimens to reduce opioid consumption and mitigate opioid-related adverse effects[1]. Within MMA strategies, local anesthetics administered via central or peripheral nerve blocks or wound infiltration have been widely adopted to decrease opioid requirements and improve postoperative pain management[2].

Although previous studies have compared surgical wound infiltration (SWI) with either transversus abdominis plane (TAP) block or lumbar epidural analgesia (LEA), to our knowledge, no study has directly compared all three methods with respect to postoperative analgesia and morphine consumption following major gynecologic surgery[3,4]. A recent review on ERAS protocols in gynecologic/oncology highlighted that a direct comparison of LEA, TAP block, and SWI is lacking and that further evidence is required[5,6].

The present study evaluated and compared the impact of LEA, ultrasound-guided TAP block, and SWI on postoperative morphine consumption, pain levels, side effects, time to first rescue analgesia, and patient satisfaction in major gynecologic surgery. We hypothesized that a single dose of LEA, by providing both somatic and visceral analgesia through blockade of multiple dermatomes and affecting deeper pain pathways, would result in superior postoperative pain control compared with the other two methods. The primary outcome was postoperative morphine consumption, and secondary outcomes were time to first rescue analgesia, postoperative pain levels, satisfaction scores, and side effects.

MATERIALS AND METHODS

Study design and sample

In compliance with the Declaration of Helsinki, the study received approval from the faculty ethics committee (Cukurova University Faculty Ethics Committee, date: 8 September 2022, IRB number: 174/7), and was registered on ClinicalTrials.gov (NCT05845385). Written informed consent was obtained after informing the participants. Of 105 patients assessed for eligibility, 81 fulfilled the inclusion criteria and were prospectively recruited for this double-blind and randomized study.

Patients aged between 18 and 70 years, classified as American Society of Anesthesiologists (ASA) physical status I-II, and scheduled for elective major gynecologic surgery with a Pfannenstiel incision were eligible for inclusion. Exclusion criteria included sensitivity to the study drugs, cardiogenic or hypovolemic shock, infection at the site of lumbar puncture, coagulopathy or anticoagulant therapy, emergency or urgent surgery, chronic opioid use, lack of capacity to understand the pain scale, and presence of any contraindications for patient-controlled analgesia (PCA) device use. All patients received detailed information regarding the study protocol, the visual analog scale (VAS), scored from 0 (no pain) to 10 (most severe pain), as well as the use of the PCA device during the preoperative anesthesia consultation.

Monitoring and anesthesia

Patients were routinely monitored with oxygen saturation (SpO_2), diastolic blood pressure (DBP), systolic blood pressure (SBP), electrocardiography (ECG), and heart rate (HR) in the operating room. Anesthesia induction was achieved using intravenous (IV) propofol and was maintained with 6%

desflurane in a mixture of 40% O_2 and 60% N_2O. Neuromuscular blockade was induced with an IV bolus of rocuronium (0.6 mg/kg) and maintained with supplemental doses of 0.3 mg/kg administered every 45 minutes. No opioids were administered intraoperatively.

Following completion of the surgical procedure, anesthesia was discontinued, and patients were ventilated with a 50% O_2 and 50% air mixture. Reversal of neuromuscular blockade was achieved with IV administration of neostigmine (0.05 mg/kg) and atropine (0.015 mg/kg), followed by extubation and transfer of the patient to the post-anesthesia care unit (PACU). Patients with modified Aldrete scores of 9 or higher were transferred from the PACU to the clinical ward according to a traditional protocol after 1 hour of observation.

Randomization and study groups

Patients were randomized in a 1:1:1 ratio into LEA, TAP, and SWI groups using a computer-generated sequence. According to group allocation, patients received a single dose of epidural block (Group LEA) or ultrasound-guided (USG-guided) bilateral TAP block (Group TAP) or surgical wound infiltration (Group SWI) just before extubation.

In Group LEA (n = 27): Prior to anesthesia, with the patient seated, a lumbar epidural catheter was inserted at the L_{3-4} or L_{4-5} intervertebral space. Placement was verified using a test dose consisting of 40 mg lidocaine and 15 µg epinephrine. For postoperative analgesia, 20 mL of 0.125% bupivacaine was administered through the catheter before extubation, after which the catheter was removed.

In Group TAP (n = 27): A bilateral USG-guided TAP block was administered at the conclusion of surgery and prior to extubation, using 20 mL of 0.125% bupivacaine (10 mL per side).

In Group SWI (n = 27): A total of 20 mL of 0.125% bupivacaine was infiltrated at the surgical incision site at the conclusion of surgery, before extubation.

All analgesic procedures (LEA, TAP block, and SWI) were performed by the same experienced anesthesiologist (with at least 3 years of experience), who did not take part in outcome evaluation, thereby ensuring double-blind conditions.

Management of postoperative pain and nausea-vomiting

Prior to peritoneal closure, a loading dose of morphine HCl (0.1 mg/kg) was administered to all patients as a part of the MMA protocols. The analgesic interventions for the study groups were performed by the same anesthesiologist who was not involved in the follow-up evaluations.

After full recovery from anesthesia, the use of PCA was commenced. The PCA device (CADD Legacy PCA pump, Smiths Medical MD, Inc. St. Paul, MN) was loaded with 40 mg morphine HCl in 100 mL normal saline. Morphine was given in bolus doses of 0.02 mg/kg at 15-minute intervals, without any continuous background infusion. All patients were ordered intramuscular (IM) diclofenac three times a day. If the analgesic protocol was insufficient, a 50 mg IV dose of meperidine was provided as rescue analgesia. Prophylaxis for postoperative nausea and vomiting (PONV) was achieved using 4 mg of IV ondansetron.

Data collection

Demographic data, ASA physical status, duration of surgery, length of hospital stay, SBP, DBP, HR, and SpO_2 values, pain scores (at rest; VAS_{rest} and on movement; $VAS_{movement}$), side effects (bradycardia, nausea, vomiting, and hypotension) were recorded at 1, 2, 6, 12, 24, 36, and 48 hours postoperatively. Hypotension was defined as SBP less than 90 mmHg, while bradycardia was defined as HR less than 60 beats/minute. Morphine loading dose, postoperative PCA morphine consumption, time to first rescue analgesic request, patient satisfaction scores at 24 and 48 hours, and length of hospital stay were also recorded. Patient satisfaction was assessed by 10-point patient satisfaction score (0 = not satisfied, 10 = very satisfied). Postoperative data were evaluated and recorded by an anesthesiologist from the pain team who was blinded to the study. In addition, the statistician who analyzed the results was also blinded.

Statistical analysis

Sample size calculation was conducted using G*Power software (version 3.1.9.4). Using data from Carney et al. and Guo et al., a sample size of at least 27 patients per group was required, assuming that the postoperative morphine consumption would be 30% lower in the epidural group (approximately 10 mg) and 30% higher in the local anesthetic infiltration

group (approximately 18 mg), with a 3-sided design at the 5% a significance level, 80% power, and 5% type I error[3,4].

Statistical analysis was performed using the IBM SPSS Statistics version 20.0 statistical software package (IBM Corp. Released 2011, IBM SPSS Statistics for Windows, Version 20.0 Armonk, NY: IBM Corp). Categorical variables were evaluated as numbers and percentages, and continuous variables as means and standard deviations. Chi-squared test was used for categorical variables, and one-way ANOVA test was used for demographic variables. One-way ANOVA test was used for normally distributed data and the Kruskal-Wallis test was used when variables had an abnormal distribution. If the difference between the groups was significant, the Bonferroni adjusted Mann-Whitney U test was performed to examine which groups differed from each other. Repeated measures analysis was used to evaluate the change in measurements over time. The statistical level of significance for all tests was assumed to be 0.05.

RESULTS

Of the 105 patients selected, 81 patients were included in the study, with 27 patients in each group (Figure 1). Demographics and surgical characteristics, length of hospital stay of the groups were similar (Table 1).

Table 1. Demographic data and surgical characteristics

Variable	Group LEA (n=27)	Group TAP (n=27)	Group SWI (n=27)	p value
Age (year)	42.5±6.0 43 (39-47)	40.4±7.4 40 (36-46)	41.1±8.0 38 (36-49)	0.550
Height (cm)	162.4±7.1 162 (159-165)	161.8±6.5 163(158-165)	159.2±4.9 158(155-165)	0.139
Weight (kg)	73.4±8.2 75 (65-80)	68.1±9.3 70 (60-75)	69.9±7.8 70 (63-75)	0.071
BMI (kg/m^2) -18.5-24.9 -25-29.9 -30-34.9 -35-44.9	 3 15 9 0	 9 13 5 0	 5 18 3 1	 0.152
ASA physical status -I -II	 3 24	 8 19	 10 17	 0.082
Duration of surgery (min)	114.8±25.6 120 (90-125)	102.0±27.6 90 (80-120)	109.6±38.8 100 (80-130)	0.172
Type of surgery -Myomectomy -TAH -TAH+BSO -Ooferectomy/polipectomy	 17 7 0 3	 14 6 0 7	 16 5 1 5	 0.645
Intraoperative fluid (mL)	1231.5±527.0	1016.7±342.5	1168.9±574.1	0.373
Length of hospital stay (day)	2 (2-5)	2 (1-3)	2 (1-5)	0.150
Postoperative side effects -Bradycardia -Nausea -Vomiting -Hypotension	 5 11 2 1	 5 11 1 1	 6 13 6 0	 0.925 0.818 0.072 0.599

All data presented as number of patients or mean±SD and median (minimum-maximum). ASA: American Society of Anesthesiologists; BMI: body mass index; BSO: bilateral salpingo-ooferectomy; LEA: lumbar epidural analgesia; TAP: transversus abdominis plane; SWI: surgical wound infiltration; TAH: total abdominal hysterectomy.

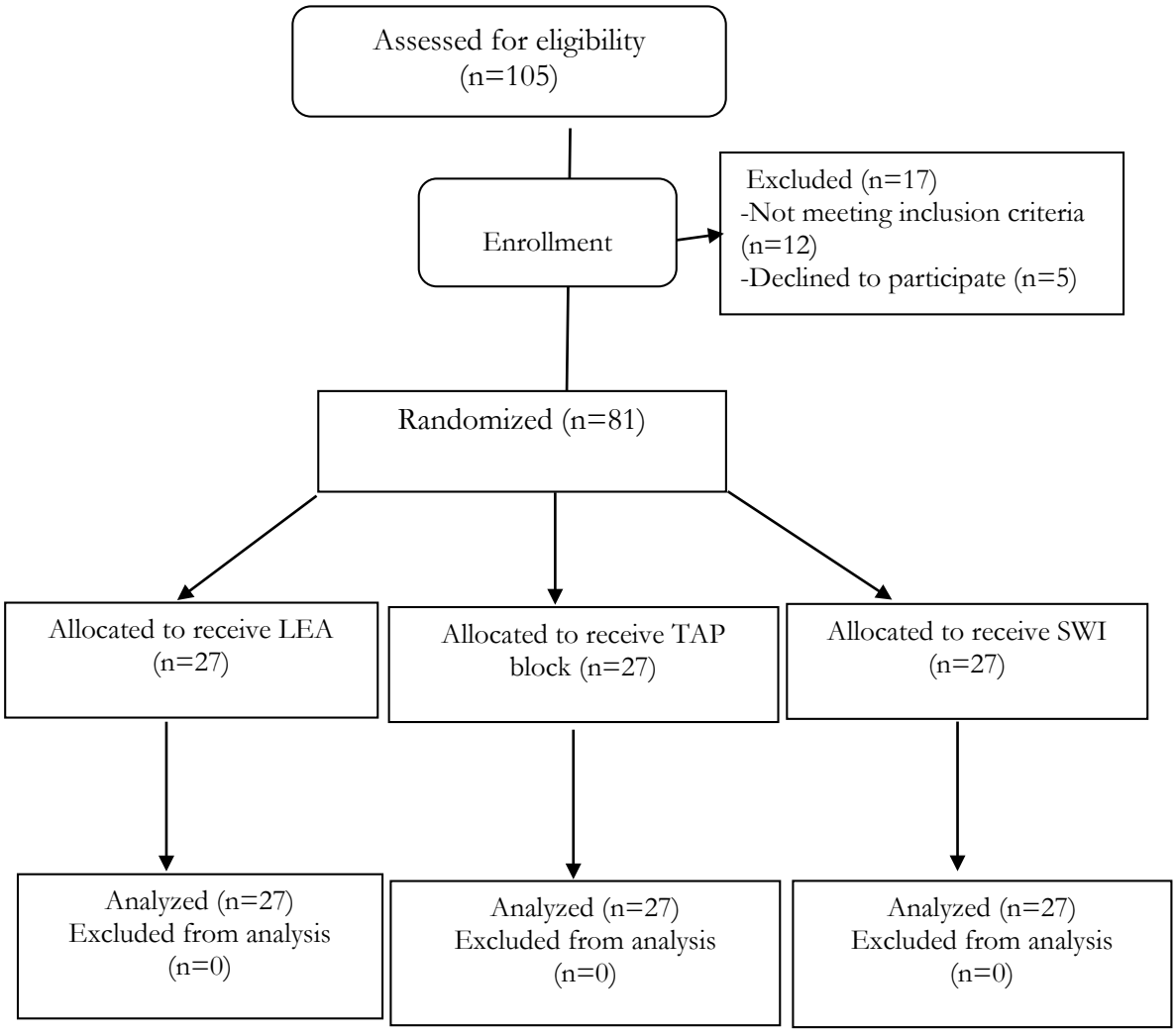

Figure 1. Flow diagram of the study.

LEA: Lumbar epidural analgesia, TAP: Transversus abdominis plane, SWI: Surgical wound infiltration.

Postoperative SBP, DBP, and SpO_2 variables of the groups were similar ($p > 0.05$). However, HR variables were significantly lower in Group LEA than in Group SWI at 2 hours ($p = 0.020$) and in Group TAP at 1 and 24 hours ($p = 0.030$ and $p = 0.045$, respectively) (Figure 2).

Postoperative VAS_{rest} scores were significantly lower in Group LEA compared to in Group SWI and Group TAP at 1, 2, 6, and 12 hours (Figure 3) ($p < 0.001$). In Group TAP, VAS_{rest} score was significantly lower than in Group SWI at 2 hours (Figure 3) ($p < 0.001$).

Postoperative $VAS_{movement}$ scores were significantly lower in Group LEA than in Group SWI and Group TAP at 1, 2, 6, 12 and 24 hours (Figure 4) ($p < 0.001$). In Group TAP, $VAS_{movement}$ score was significantly lower than in Group SWI at 2 hours (Figure 4) ($p < 0.001$).

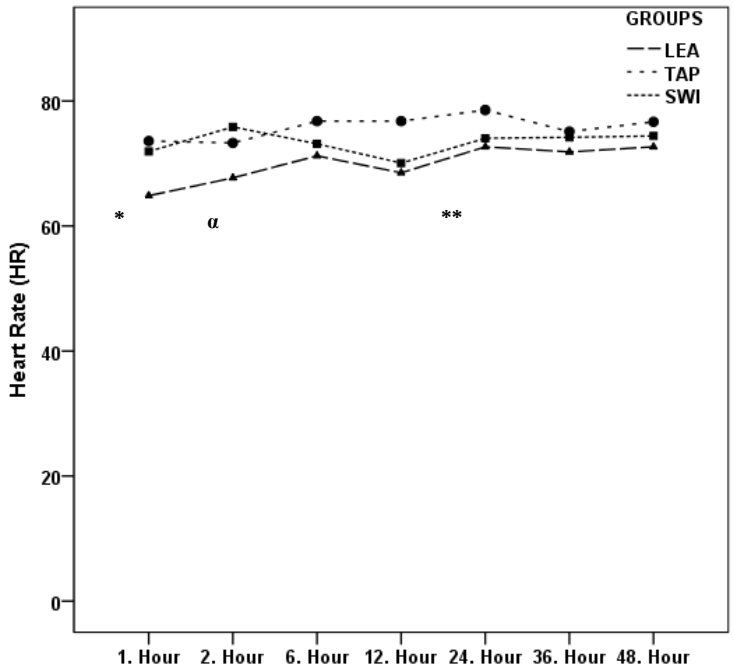

Figure 2. Postoperative heart rate values of the groups.

[α]p=0.020, compared with Group SWI, *p=0.030 and **p=0.045 compared with Group TAP. LEA: Lumbar epidural analgesia, TAP: Transversus abdominis plane, SWI: Surgical wound infiltration.

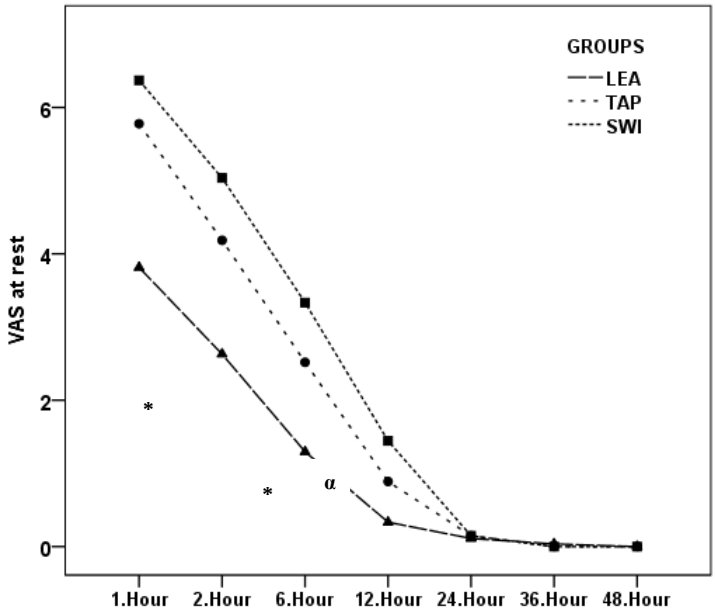

Figure 3. Postoperative pain scores at rest.

[*]p<0.001 compared with Group TAP and Group SWI, [α]p<0.001; compared with Group SWI.[a] VAS: Visual Analog Scale, LEA: Lumbar epidural analgesia, TAP: Transversus abdominis plane, SWI: Surgical wound infiltration.

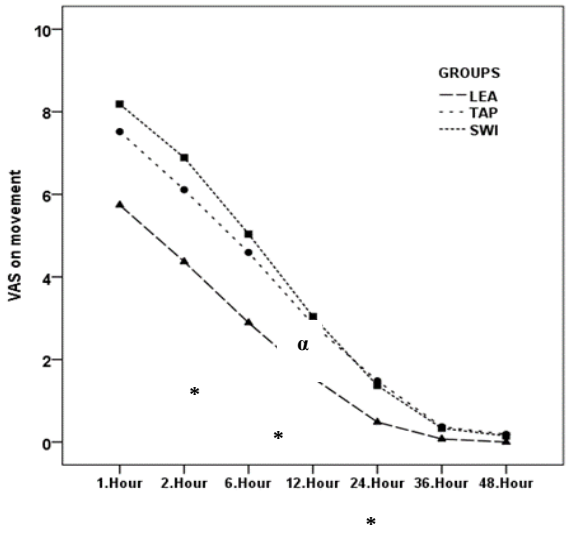

Figure 4. Postoperative pain scores on movement.

p<0.001 compared with Group TAP and Group SWI, αp<0.001; compared with Group SWI. VAS: Visual Analog Scale, LEA: Lumbar epidural analgesia, TAP: Transversus abdominis plane, SWI: Surgical wound infiltration.

Postoperative PCA morphine consumption was significantly lower in Group LEA, compared with Group TAP and Group SWI at all study time points (Table 2) ($p = 0.005$ at 1 hour, $p < 0.001$ at other time points). It was significantly lower in Group TAP than in Group SWI only at 6 hours (Table 2) ($p < 0.001$).

Table 2. Postoperative morphine consumptions, time to first rescue analgesic request and patient satisfaction scores

Variable	Group LEA (n=27)	Group TAP (n=27)	Group SWI (n=27)	p value
Morphine consumption (mg)				
-1 h	1.15±0.6*	1.48±0.6	1.78±0.8	0.005
-2 h	3.48±1.8*	4.96±1.4	5.52±1.6	<0.001
-6 h	7.22±4.3*	9.59±2.0α	11.52±3.3	<0.001
-12 h	9.00±4.8*	13.41±2.4	15.67±5.9	<0.001
-24 h	9.59±5.6*	15.00±3.8	16.56±6.1	<0.001
-36 h	9.63±5.7*	15.30±4.0	16.93±5.9	<0.001
-48 h	9.63±5.7*	15.30±4.0	16.93±5.9	<0.001
Time to first rescue analgesia (min)	47.41±24.3	27.41±11.9γ	16.67±5.1β	<0.001
Patient satisfaction scores				
-24 h	9.89±0.3*	9.67±0.5α	9.37±0.8	0.027
-48 h	9.96±0.1*	9.89±0.3α	9.44±0.7	<0.001

All data presented as mean±SD. *p<0.001 compared with Group TAP and Group SWI, αp<0.001 compared with Group SWI, βp<0.001 compared with Group TAP and Group LEA, γp<0.001 compared to Group LEA. LEA: lumbar epidural analgesia; TAP: transversus abdominis plane; SWI: surgical wound infiltration; PCA: patient controlled analgesia

The time to first rescue analgesia was longer in Group LEA than in Group TAP and Group SWI ($p < 0.001$), and in Group LEA than in Group TAP (Table 2) ($p < 0.001$). Only two patients in Group TAP and eight patients in Group SWI needed rescue analgesic in the first postoperative hour despite PCA morphine. No patient needed rescue analgesia during the other study periods.

Patient satisfaction scores at 24 and 48 hours were

significantly higher in Group LEA than in Group TAP and Group SWI ($p < 0.027$, $p < 0.001$, respectively), and in Group TAP than in Group SWI ($p < 0.001$, $p < 0.001$, respectively) (Table 2).

There were no statistically significant differences in the incidence of postoperative side effects (hypotension, bradycardia, nausea and vomiting) between the groups (Table 1).

DISCUSSION

This is the first study to compare the efficacy of LEA, TAP block and SWI with similar doses and concentrations of bupivacaine (0.125% bupivacaine, 20 mL) on postoperative morphine consumption after major gynecologic surgery. We found that postoperative morphine consumption and pain scores were significantly lower in Group LEA than in Group TAP and Group SWI without an increase in the incidence of side effects.

Multimodal analgesia protocols are strongly recommended for pain relief to reduce the amount of opioids during and after surgery for pain management as a part of ERAS protocols. Within this concept, recent systemic meta-analyses and reviews have reported an almost universal reduction in postoperative VAS scores with neural blocks, well beyond the duration of action of the local anesthetics. Today, it has been clearly demonstrated that intraoperative administration of neural blocks is not only a solution for postoperative pain control but also aligns well with the concept of reduced perioperative opioid usage[7]. In the present study, we used IV PCA morphine in all study groups for pain management and evaluated the efficacy of the neural blocks on opioid consumption. Since PCA morphine consumption was found to be significantly lower in LEA group during the all study time periods, our results suggest that a single dose of LEA with 0.125% bupivacaine (20 mL) provides effective and longer lasting analgesia than TAP block and SWI after major gynecologic surgery.

There are conflicting results in the literature evaluating the effect of thoracic epidural analgesia (TEA) with USG-guided TAP block or SWI on postoperative pain and analgesic consumption. Shaker et al. reported lower parenteral morphine consumption and a decreased incidence of hypotension with TAP block compared to TEA in patients undergoing major abdominal oncologic surgery[8]. Similarly, Mathew et al. compared the quality of postoperative recovery (QoR) in patients who underwent total abdominal hysterectomy with parenteral analgesia, epidural analgesia, and bilateral TAP block[9]. They reported similar postoperative QoR scores, but superior analgesia and reduced 24-hour morphine consumption with TAP block compared with parenteral and epidural analgesia. On the other side, Hamid et al. reported that TAP block was equivalent to TEA in terms of postoperative opioid consumption, the incidence of PONV, and length of hospital stay in patients undergoing colorectal surgery[10]. In another prospective randomised trial, Iyer et al. found a similar pain scores at rest during the first 16 hours between LEA (10 mL of 0.125% bupivacaine) and TAP block (20 mL of 0.125% bupivacaine) after lower abdominal surgery, but lower pain scores in Group LEA at 24 and 48 hours[11]. In addition, although postoperative paracetamol consumption was similar between the study groups, tramadol consumption was significantly higher in the TAP group at 48 hours. However, the quality of analgesia provided by the epidural catheter with reduced opioid consumption at rest and during coughing was superior to that provided by TAP catheters. In the present study, postoperative VAS scores at rest and on movement, as well as morphine consumption were significantly lower in Group LEA compared with in Group TAP and Group SWI, suggesting that epidural analgesia provides better pain control.

Turan et al. compared the effects of continuous epidural analgesia and bilateral TAP block with liposomal bupivacaine on pain management after abdominal surgery[12]. They found similar pain scores, opioid-related side effects (except for hypotension), length of hospital stay, QoR, and patient mobilization scores in both groups. Although the epidural group required less opioid, they experienced more hypotension compared to the TAP group. Similar results regarding epidural hypotension were also confirmed by two systematic reviews and meta-analyses[10,13]. In our study, we used a total of 20 mL of 0.125% plain bupivacaine in all groups, and we did not observe any clinically or statistically significant difference in the incidence of hypotension between the groups. This result may be related to our use of a single dose and low concentration of epidural bupivacaine. Although SBP and DBP were similar between our groups, HR values were found to be significantly lower in Group LEA than in Group SWI and Group TAP at different time points. The lower HR in Group LEA was thought to be related to better

control of sympathetic activity and stress response with LEA.

Local anesthetic infiltration of the surgical area is another commonly used method for postoperative analgesia. Similar to the TAP block literature, much of the previous research comparing epidural and SWI analgesia is conflicting. One meta-analysis reported lower pain scores with LEA than SWI on the first postoperative day, but found no difference in opioid consumption, length of hospital stay, or onset time of bowel peristalsis after liver resection[14]. Ammianickal et al. compared the analgesic efficacy of epidural analgesia and SWI for total abdominal hysterectomy and noted that epidural analgesia provided superior pain relief[15]. However, despite lower pain scores with LEA compared to SWI, several studies did not recommend the routine use of epidural analgesia for pain management after liver resection surgery due to an increased need for vasopressors[16,17]. Moreover, Mungroop et al. demonstrated that continuous SWI was non-inferior to epidural analgesia and provided similar pain scores after hepato-pancreato-biliary surgery within an enhanced recovery setting[18]. In the present study, postoperative pain scores at rest and on movement, and morphine consumption were lower in the LEA group than in the SWI group. Evidently, our results are opposite to those supporting routine local anesthetic infiltration of the surgical site after major gynecologic/oncologic surgery and therefore deserve further investigation.

Gasanova et al. compared the analgesic effect of bilateral USG-guided TAP block with 0.5% bupivacaine and SWI with liposomal bupivacaine in patients undergoing total abdominal hysterectomy[19]. They found lower pain scores at rest and with coughing in the SWI group at all time points, except at rest in the PACU. Although a comparable incidence of side effects, the SWI group required less opioid between 24 and 48 hours. However, a systematic review and meta-analysis found that SWI without liposomal local anesthetics had a similar analgesic effect to the TAP block only in the first postoperative hour and was associated with a shorter analgesic duration, earlier need for rescue analgesia, and poorer patient satisfaction[20]. Similarly, Grape et al. noted better postoperative pain scores, lower opioid consumption, and a lower incidence of PONV with TAP block than with SWI after laparoscopic cholecystectomy[21]. It has been clearly stated that TAP block and SWI provide effective and comfortable short-term postoperative analgesia, but TAP block has a longer-lasting effect[22,23]. In our study, patients in the TAP group had significantly better VAS scores and higher patient satisfaction scores than those in the SWI group.

Although the present study is the first randomized trial comparing three analgesic regimens (LEA, TAP block, and SWI), it has some limitations. First, patients who complained of pain (VAS score ≥ 4) despite the PCA regimen received rescue analgesia. This could be the most important limitation of this study. This is because patients with VAS scores ≥ 4 might prefer to push the PCA device button instead of requesting rescue meperidine. Second, we used 20 mL of 0.125% bupivacaine for postoperative analgesia in all groups. A higher dose and concentration of bupivacaine for the truncal blocks may be used to provide the best balance between pain control and side effects. Further studies may address the optimal dose and concentration of bupivacaine.

In conclusion, LEA with a single dose of 20 mL of 0.125% bupivacaine resulted in less morphine consumption, a longer time to first rescue analgesic request, and higher patient satisfaction scores compared to TAP and SWI blocks, without increasing the incidence of side effects in patients undergoing elective major gynecologic surgery with a Pfannenstiel incision. However, further randomized and multicenter studies are required to evaluate and compare the effects and outcomes of LEA, TAP block, and SWI.

Author Contributions: Concept/Design : CD, MT, MS, HÜ; Data acquisition: CD; Data analysis and interpretation: MT, HB; Drafting manuscript: CD, MT, EG, HÜ; Critical revision of manuscript: -; Final approval and accountability: CD, MT, EG, MS, HB, HÜ; Technical or material support: CD, MS; Supervision: HB, HÜ; Securing funding (if available): n/a.
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