

Comparative Study of Postoperative Analgesic Effects of Intraoperative Levobupivacaine Local Infiltration Anesthesia and Transversus Abdominis Plane Block Following Gynecologic Laparoscopy

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Abstract

Objectives: We aim to assess the postoperative analgesic effect of intraoperative levobupivacaine local infiltration anesthesia (LA) and transversus abdominis plane (TAP) block in gynecologic laparoscopy.

Materials and Methods: We conducted a retrospective analysis on the data of 260 patients treated by gynecologic laparoscopy (adnexal surgery, hysterectomy, and myomectomy) between January 2019 and December 2020 at Minoh City Hospital, Osaka Japan. Patients were divided into two groups: intraoperative LA group and TAP block group. We assessed clinical characteristics, surgical results, postoperative numerical rating scale (NRS) pain scores, and the frequency of analgesic use up to 24 h after surgery in overall and by each type of surgery. Pearson's χ^2 test, Fisher's exact test, and Wilcoxon/Kruskal-Wallis test were used for statistical analysis. Multiple regression analysis was used for multivariate analysis.

Results: NRS pain score was statistically significantly higher in the LA group than in the TAP group 1 h after surgery in overall ($P = 0.04$), with NRS difference of 0.4 which was not clinically significant. No significant differences were observed in NRS pain scores at 3, 6, 12, and 24 h after surgery or in the frequency of analgesic use up to 24 h after surgery in overall and by type of surgery. Endometriosis was associated with increased postoperative pain at 1 h after surgery in adnexal surgeries ($P = 0.04$) and suggestive for all surgeries. Younger age was related to more frequency of analgesic use up to 24 h after surgery in overall, adnexal surgeries, and hysterectomy.

Conclusion: Intraoperative levobupivacaine LA may have similar postoperative analgesic effects as TAP block in gynecologic laparoscopy.

Keywords: Gynecologic laparoscopy, levobupivacaine, local anesthesia, postoperative pain

INTRODUCTION

Minimally invasive laparoscopic surgery has become the standard treatment in gynecological surgery over the past 30 decades. Gynecologists and patients favor laparoscopic approach compared to laparotomy because of shorter hospital stays, faster recovery time, less blood loss, and

reduced postsurgical pain.^[1] Increasing trends in minimally invasive gynecologic surgery is expected to reduce patients' postoperative pain and postoperative analgesic use. However, some studies report that patients who undergo laparoscopic surgery suffer severe postsurgical pain and require high

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doses of analgesics immediately after surgery.^[2] This could be in part due to patients undergoing laparoscopic surgery receiving inadequate analgesic in the anticipation of laparoscopic surgeries being less painful.

To reduce postsurgical pain, trocar site local infiltration anesthesia (LA) is a simple intraoperative procedure that can be conducted by gynecologic surgeons before trocar site wounds' closure. Trocar site local anesthetic injection in laparoscopic surgery has been reported to decrease postoperative pain, but the reported effect is still inconsistent.^[3-6] Transversus abdominis plane (TAP) block is another intraoperative procedure that has been reported to decrease postoperative pain.^[7] TAP blocks often require skilled techniques dependent on the experience of surgeons and anesthesiologists. However, the effect of TAP block on postsurgical pain has been inconsistent in gynecologic laparoscopic surgeries.^[8] Furthermore, the efficacy of TAP blocks may be limited for some patients. For example, TAP block for the obese patients can be difficult and prolonged general anesthesia time could diminish the effect of TAP block if it was administered at the beginning of the surgery. While studies suggest that these two intraoperative anesthetic methods could reduce postsurgical pain in gynecologic laparoscopic surgeries, only two studies from the US and Europe have reported that postsurgical pain outcomes comparing TAP and LA in gynecological laparoscopic surgeries and its effects on postoperative pain remain inconclusive.^[9,10] Therefore, we conducted the first study to compare postoperative analgesic effects of intraoperative levobupivacaine local infiltration anesthesia and TAP block following gynecologic laparoscopy in Japanese population.

MATERIALS AND METHODS

Study population

This retrospective study included 289 women who underwent gynecologic laparoscopy (adnexal surgery, hysterectomy, and myomectomy) at Minoh City Hospital, Japan, between January 1, 2019, and December 31, 2020. All patients provided written informed consent for necessary treatment before their surgeries. Ethical approval for this study was provided by the Ethical Committee of Minoh City Hospital on August 2, 2021. The ethical approval number is R0308B44. Twenty-nine patients were excluded from the analysis: 18 patients who underwent neither levobupivacaine local infiltration anesthesia (LA) to trocar sites nor TAP block following gynecologic laparoscopy, three patients who were pregnant, one patient who underwent surgery with umbilical hernia repair surgery following gynecologic laparoscopy, six patients whose skin incisions of 4 cm or more were added for the removal of large tumors, and one patient who underwent laparotomy

because intestinal perforation was found after gynecologic laparoscopic surgery [Supplemental Figure 1]. All patients were informed about TAP block when they were briefed on general anesthesia. Patients received TAP block right before or after surgery upon request. If the patients did not request receiving TAP block, they received LA intraoperatively as it was the standard of practice at the time.

Patients were divided into levobupivacaine local infiltration anesthesia (LA) to trocar sites group (the LA group) and TAP block (the TAP group) following gynecologic laparoscopy (laparoscopic adnexal surgery, total laparoscopic hysterectomy [TLH], or total laparoscopic myomectomy [TLM]). We retrospectively evaluated clinical characteristics, surgical outcomes (i.e., operation time, estimated blood loss), postoperative numerical rating scale (NRS) pain scores, and the frequency of analgesic use up to 24 h after surgery. We abstracted information on patient's age, body mass index (BMI), American Society of Anesthesiologists (ASA) class, operation time, estimated blood loss, surgery treated for endometriosis, analgesic drugs administration at the end of surgery, postoperative NRS pain scores at 1, 3, 6, 12, 24 h after surgery, and the frequency of analgesic use up to 24 h after surgery from electronic medical records. These data were routinely recorded as part of standard clinical practice. Operative time was recorded from the first skin incision to the last suture placement. Blood loss was estimated from the contents of suction devices and the weight of gauze. The administration of analgesics at the end of surgery was decided by an anesthesiologist before general anesthetic extubation. Nonsteroidal anti-inflammatory drugs (NSAIDs) or acetaminophen was administered at the end of surgery. No narcotic analgesics were administered by anesthesiologists at the end of surgery. The primary outcome was postoperative NRS pain scores at 1, 3, 6, 12, and 24 after surgery. The secondary outcome was the frequency of analgesic use up to 24 h after surgery.

In our hospital, the types of analgesics used postoperatively for the benign surgery included NSAIDs, acetaminophen, eptazocine, or pentazocine.

Indication for surgery and details on procedures

All operations were performed under general anesthesia with a pneumoperitoneum of ≤ 10 mmHg in the lithotomy position.

General anesthesia for all gynecologic patients were conducted by total intravenous anesthesia using propofol and remifentanyl and/or fentanyl added intraoperatively. All surgeries were supervised by board-certified laparoscopic gynecologic surgeons and performed by a skilled surgeon or the attending physician. Adnexal surgeries include laparoscopic salpingo-oophorectomy, cystectomy, and salpingectomy.

The most common indications for adnexal surgery were benign ovarian tumors such as dermoid cyst, serous cyst, mucinous cyst, and endometriotic cyst. Nine patients underwent salpingectomy for tubal pregnancy and one patient was diagnosed of metastatic malignant ovarian tumor after laparoscopic salpingo-oophorectomy. We performed laparoscopic adnexal surgery with three or four ports. First abdominal access was achieved by open method on the umbilicus. The length of incision on the umbilicus ranged from 15 to 30 mm. For cases with 15-mm umbilical skin incision, we positioned 12-mm trocar on the umbilical and other three trocars (5 mm) in the lower abdomen of the patients. For cases with 30-mm umbilical skin incision, we position E.Z access and Lap protector (Hakko Medical Ltd., Japan) on the umbilical incision and 2 trocars (5 mm) in the lower abdomen of the patients. The most common indications for TLH were uterine myoma and adenomyosis. Eight patients underwent TLH for endometrioid carcinoma Grade 1 (stage IA). We performed TLH with four ports including an umbilical trocar (12 mm) and three lower abdomen trocars (5 mm). The uterus was removed transvaginally; however, if vaginal removal was not possible, the umbilical skin was extended to 30 mm and we positioned E.Z access and Lap protector (Hakko Medical Ltd.) on the umbilical incision.

All indications for TLM were uterine myoma for infertility. We performed TLM with three ports with E.Z access and Lap protector (Hakko Medical Ltd.) placed on the 30-mm umbilical skin incision and two lower abdomen trocars (5 mm).

In the LA group, 10–20 ml of 0.25% levobupivacaine was administered as intraoperative local infiltration anesthetic to the umbilical trocar site and lower abdominal trocar sites by the gynecologic surgeon after the surgeon sutured the fascia. In the TAP group, 40 ml of 0.25% levobupivacaine was administered as TAP block by the anesthesiologist with significant experience under ultrasound guidance before the start of the surgery or after the surgery was finished.

Statistical analysis

The Shapiro–Wilk *W* test was used to examine normally distributed continuous variables. The homogeneity of the variances was assessed with the Bartlett test. Continuous variables that are not normally distributed or ordinal variables were analyzed by Wilcoxon/Kruskal–Wallis test. Categorical variables were analyzed by Pearson χ^2 test and the Fisher's exact test. Multiple regression analysis was used for multivariate analysis. In multivariate analysis, the dependent variables were NRS pain score at 1 h after surgery and the number of times of analgesic drugs used within 24 h after surgery. Independent variables were patient's age, BMI,

ASA, operation time, estimated blood loss, surgery treated for endometriosis, analgesic drugs administration at the end of surgery, and type of the surgery.

Statistical results were considered to be significant when the $P < 0.05$. Statistical analyses were performed using JMP11.2.0 (SAS, Cary, NC, USA).

RESULTS

Of the 260 eligible patients, 183 patients received LA and 77 received TAP block. Among 115 patients who underwent laparoscopic adnexal surgery, 112 patients were categorized into the LA group and 39 patients were categorized into the TAP group. Among 94 patients who underwent TLH, 63 patients were categorized into the LA group and 31 patients were categorized in the TAP group. Among 15 patients who underwent TLM, eight patients were categorized into the LA group and 7 were categorized into the TAP group. We compared the LA group with the TAP group for overall surgeries and also by surgery type (i.e., adnexal surgery, TLH, and TLM). The patients' clinical characteristics are shown in Table 1. The LA group were significantly more frequently treated by the anesthesiologist with additional analgesics at the end of surgery compared to the TAP group overall and in each of the surgery types (i.e., adnexal surgery, TLH, and TLM) (overall surgeries, 131 [71%] vs. 19 [24%]; $P < 0.0001$). There were no significant differences in patient's age, BMI, ASA, operation time, estimated blood loss, and endometriosis in the two groups for overall surgeries and among those who underwent adnexal surgery. Among patients who underwent TLH, the LA group had a significantly higher BMI than the TAP group (21.5 [15–37.3] kg/m² vs. 20.8 [17.6–26.5] kg/m²; $P = 0.04$), and among those who underwent TLM, the LA group was significantly older than the TAP group (41.5 [32–53] years vs. 27 [27–40] years; $P = 0.04$).

NRS pain scores at 1, 3, 6, 12, and 24 h after surgery and frequency of analgesic use up to 24 h after surgery for overall surgeries and each surgery types are presented in Table 2. The LA group showed a significantly higher postoperative NRS pain score at 1 h after surgery compared to the TAP group for overall surgeries (2.1 ± 1.3 vs. 1.7 ± 1.6; $P = 0.04$). The postoperative NRS score at the 3, 6, 12, and 24 h after surgery had no significant differences for overall surgeries. There was no significant difference in postoperative NRS score at 1, 3, 6, 12, and 24 h after surgery and frequency of analgesic use up to 24 h after surgery for each surgery types.

Multiple regression analysis was performed to evaluate factors associated with postoperative pain at 1 h after surgery [Table 3] and frequency of analgesic use up to 24 h after surgery [Table 4]. Endometriosis surgery was

Table 1: Baseline characteristics by surgery type

	Overall		Adnexal surgery		TLH		TLM	
	LA	TAP	LA	TAP	LA	TAP	LA	TAP
<i>n</i>	183	77	112	39	63	31	8	7
Age (years)	45 (13-92)	45 (25-86)	39.5 (13-92)	46 (25-86)	47 (39-90)	46 (33-62)	41.5 (32-53)*	27 (27-40)*
BMI (kg/m ²)	21.4 (15-37.3)	21.0 (16.7-34.6)	21 (15.1-37.2)	21.4 (16.7-34.6)	21.5 (15-37.3)*	20.8 (17.6-26.5)*	25.9 (19.5-27.1)	20.7 (17.4-27.6)*
ASA	2 (1-3)	2 (1-3)	2 (1-3)	2 (1-3)	2 (1-3)	2 (1-2)	2 (1-2)	1 (1-2)
Operating time (min)	136 (35-378)	145 (52-288)	97.5 (35-219)	107 (52-251)	197 (105-378)	192 (124-288)	179 (96-262)	191 (168-252)
Blood loss (ml)	17 (0-1200)	20 (1-443)	10 (1-1200)	10 (1-269)	51 (0-958)	35 (5-250)	114 (15-262)	250 (15-443)
Endometriosis, <i>n</i> (%)	21 (11)	10 (12.9)	19 (65)	10 (34)	3 (100)	0	0	0
Analgesic drugs administration at the end of surgery ^{††} , <i>n</i> (%)	131 (71)*	19 (24)*	80 (71)*	11 (28)*	45 (71)*	7 (22)*	6 (75)*	1 (14)*

*The *P* were <0.05 between the LA group versus the TAP group, ^{††}NSAIDs or acetaminophen were administered at the end of surgery. Data are expressed as median (range). TLH: Total laparoscopic hysterectomy, TLM: Total laparoscopic myomectomy, LA: Local infiltration anesthesia, TAP: Transversus abdominis plane, BMI: Body mass index, ASA: American Society of Anesthesiologists class, NSAIDs: Nonsteroidal anti-inflammatory drugs

Table 2: Postoperative numerical rating scale pain scores and the number of analgesic drugs used up to 24 h after surgery

	Overall surgery			Adnexal surgery			TLH			TLM		
	LA	TAP	<i>P</i>	LA	TAP	<i>P</i>	LA	TAP	<i>P</i>	LA	TAP	<i>P</i>
<i>n</i>	183	77		112	39		63	31		8	7	
Postoperative time period (h)												
1	2.1±1.3*	1.7±1.6*	0.04	2.3±1.3	1.8±1.6	0.07	1.9±1.4	1.8±1.6	0.69	1.8±1.2	1.2±1.8	0.31
3	1.9±1.1	1.8±1.4	0.37	2.0±1.1	1.9±1.4	0.68	1.8±1.2	1.9±1.4	0.19	1.8±1.3	1±1	0.19
6	1.5±0.9	1.6±1.0	0.69	1.5±0.8	1.5±0.9	0.76	1.5±1.1	1.6±1.3	0.97	1.3±1.4	1.7±0.7	0.32
12	1.5±0.9	1.5±0.9	0.82	1.6±0.9	1.7±1.0	0.66	1.3±0.8	1.5±0.8	0.72	1.2±0.7	1.2±0.7	0.83
24	1.3±0.7	1.5±0.8	0.35	1.3±0.6	1.5±0.9	0.81	1.3±0.7	1.4±0.8	0.89	1.8±1.1	1±0.5	0.53
Frequency of analgesic use up to 24 h after surgery	2.7±1.4	2.9±1.4	0.45	2.6±1.4	2.8±1.9	0.81	2.7±1.5	3.1±1.9	0.24	3.0±1.9	2.5±1.9	0.63

*The *P* were <0.05 between the LA group versus the TAP group. Data are expressed as mean±SD. TLH: Total laparoscopic hysterectomy, TLM: Total laparoscopic myomectomy, LA: Local infiltration anesthesia, TAP: Transversus abdominis plane, SD: Standard deviation

related to increased postoperative pain at 1 h after adnexal surgery (*P* = 0.04), and similar trend was observed in overall surgery with borderline significance (*P* = 0.06) [Table 3]. TAP block was related to decreased postoperative pain at 1 h after adnexal surgery (*P* = 0.04). Younger age was a risk factor associated with increased frequency of analgesic use up to 24 h after overall surgery, adnexal surgery, and hysterectomy (*P* < 0.01) [Table 4].

We further examined the NRS pain scores after surgery stratifying patients by whether patients had surgically confirmed endometriosis or not given that endometriosis is a painful condition which may influence postsurgical pain [Supplemental Table 1]. Among patients who underwent surgery for endometriosis, there was no difference in NRS pain scores 1 h after surgery between patients in the LA and TAP groups. When comparing the NRS pain scores between patients with and without endometriosis, the mean values tended to be higher in patients who underwent surgery for

endometriosis compared to those who underwent surgery for other indications.

DISCUSSION

In our study, the LA group showed a significantly higher postoperative NRS pain score at 1 h after surgery compared to the TAP group for overall surgeries, and similar trend was observed among those who underwent adnexal surgery.

Previous studies showed that TAP and LA had no significant difference for postoperative pain in gynecologic laparoscopic surgery.^[9,10]

Our results showed statistically significant difference between patients treated with LA and TAP block with the difference in NRS pain score at 1 h after surgery being 0.4.

The prior report by Gallagher *et al.* showed that the minimum clinically significant difference in acute abdominal pain was 1.6 in the visual analog scale measurement.^[11]

Table 3: Factors associated with numerical rating scale pain scores at 1 h postsurgery

	Overall		Adnexal surgery		TLH		TLM	
	β	P	β	P	β	P	β	P
Analgesic type during surgery								
LA	Reference		Reference		Reference		Reference	
TAP	-0.11	0.11	-0.17	0.04	-0.05	0.66	-0.016	0.97
Age (years)	-0.06	0.39	-0.003	0.97	-0.13	0.25	-0.52	0.34
BMI (kg/m ²)	0.01	0.8	-0.02	0.79	0.03	0.75	1.3	0.16
ASA	-0.06	0.4	-0.07	0.44	-0.08	0.53	0.11	0.79
Blood loss (ml)	-0.04	0.47	-0.03	0.63	0.06	0.65	-0.65	0.31
Endometriosis	0.12	0.06	0.17	0.04	-0.01	0.92		
Analgesic drugs at the end of surgery ^{††}	0.01	0.86	-0.04	0.66	-0.03	0.75	-0.65	0.55
Operative time	-0.007	0.93	0.04	0.56	-0.08	0.53	0.59	0.4
Type of surgery								
Adnexa surgery	0.05	0.51						
Hysterectomy	0.02	0.7						
Myomectomy	Reference							
Freedom adjusted R ²	0.04		0.06		0.04		0.65	

^{††}NSAIDs or acetaminophen were administered at the end of surgery. All variables in the table were mutually adjusted. TAP block was negatively related to the postoperative pain at 1 h after adnexal surgery. NSAIDs: Nonsteroidal anti-inflammatory drugs, TLH: Total laparoscopic hysterectomy, TLM: Total laparoscopic myomectomy, LA: Local infiltration anesthesia, TAP: Transversus abdominis plane, BMI: Body mass index, ASA: American Society of Anesthesiologists class

Table 4: Factors associated with analgesic use within 24 h postsurgery

	Overall		Adnexal surgery		TLH		TLM	
	β	P	β	P	β	P	β	P
Analgesic type during surgery								
LA	Reference		Reference		Reference		Reference	
TAP	0.03	0.6	0.02	0.8	0.02	0.8	0.37	0.64
Age (years)	-0.29	<0.0001	-0.26	0.008	-0.39	0.0006	0.06	0.93
BMI (kg/m ²)	0.0006	0.99	-0.004	0.57	-0.004	0.96	0.18	0.88
ASA	0.037	0.59	0.04	0.66	0.065	0.58	-0.4	0.5
Blood loss (ml)	0.005	0.93	-0.01	0.9	0.13	0.28	-0.53	0.56
Endometriosis	0.05	0.43	0.05	0.47	-0.002	0.98		
Analgesic drugs at the end of surgery ^{††}	-0.11	0.11	0.15	0.086	-0.059	0.6	0.61	0.69
Operative time	-0.07	0.44	-0.15	0.08	-0.22	0.07	0.6	0.56
Type of surgery								
Adnexa surgery	-0.09	0.24						
Hysterectomy	0.09	0.2						
Myomectomy	Reference							
Freedom adjusted R ²	0.08		0.08		0.18		0.23	

^{††}NSAIDs or acetaminophen were administered at the end of surgery. NSAIDs: Nonsteroidal anti-inflammatory drugs, TLH: Total laparoscopic hysterectomy, TLM: Total laparoscopic myomectomy, LA: Local infiltration anesthesia, TAP: Transversus abdominis plane, BMI: Body mass index, ASA: American Society of Anesthesiologists class

Another previous study also reported the levels of change on standard pain scales that represent clinically important differences to patients for future pain therapy clinical trials.

The scales evaluated were absolute pain intensity difference (0–10 scale) and pain relief (0 [none], 1 [slight], 2 [moderate], 3 [lots], 4 [complete]).

The best cutoff points for the absolute scales were absolute pain intensity difference of 2 and pain relief of 2 in the previous study.^[12]

Recent randomized controlled study of TAP block and local anesthetic trocar site infiltration of bupivacaine in gynecological laparoscopy showed that there was a statistically significant difference in the mean pain score differences at 2 h after surgery, but the mean pain score differences did not reach clinical meaningful significant difference of 2.^[9,12]

Hence, the randomized controlled study concluded that TAP block did not provide a significant clinical benefit compared with local anesthetic trocar site bupivacaine infiltration.^[9]

In our study, the difference in NRS pain score at 1 h after surgery being 0.4 between patients treated with LA and TAP block may not be clinically significant given the minimal differences in the NRS pain score between LA and TAP block group.

Furthermore, our study had differences in the dose of 0.25% levobupivacaine used between the LA and TAP groups. In the LA group, 10–20 ml of 0.25% levobupivacaine was administered. In the TAP group, 40 ml of 0.25% levobupivacaine was administered. LA group was getting potentially only a quarter to a half of the dose of the TAP block group, which could explain why patients in the LA group were experiencing more pain score than the TAP group. Thus, it is possible that if more anesthetic agent was used for the LA group, the difference in postoperative pain could potentially be even less and intraoperative levobupivacaine LA may have similar postoperative analgesic effect as TAP block in gynecologic laparoscopy. Further prospective studies controlling for dose are needed to determine this.

LA is a simple intraoperative procedure that can be conducted by gynecologic surgeons before trocar site wounds closure, while TAP block procedure is time-consuming, complications may still occur, and it requires sonographic equipment and technical skills.^[13,14]

If TAP block does not show a clinically significant difference in pain compared to LA, LA may be sufficient to relieve pain in gynecologic laparoscopic surgery because of its simple procedure.

In the subanalysis of endometriosis status, the mean values of postoperative 1-h NRS pain scores in endometriosis surgery between LA and TAP group tended to be higher in both groups than in nonendometriosis surgery. Pain such as dysmenorrhea, dyspareunia, and chronic pelvic pain is a common symptom in endometriosis. Pain in endometriosis can be triggered by multiple mechanisms including nociception, inflammation, and alterations in peripheral and central nervous system pain processing. Pain in endometriosis is also associated with psychological distress and fatigue, both of which may amplify pain.^[15] As-Sanie *et al.* showed that women with chronic pelvic pain demonstrate increased pain sensitivity at a nonpelvic site compared with healthy women in a control group.^[16] Since endometriosis patients are more likely to be sensitive to pain compared to those without, our results observing increased postoperative pain among endometriosis patients are in line with prior literature. Furthermore, given that endometriosis patients may have different pain perception compared to those without, our results suggest that endometriosis patients undergoing surgery may require additional treatment for reducing postoperative pain.

Younger age was a risk factor associated with increased frequency of analgesic use up to 24 h after overall surgery, adnexal surgery, and hysterectomy in our study. A previous prospective cohort study reported that younger patients undergoing elective colorectal surgery experienced more pain after surgery. The pain score was reduced by as much as 0.7 NRS units per 10 years on average on the day of surgery and remained significant on postoperative days 1 and 2, despite the fact that patients were given extra analgesia on demand.^[17] A recent meta-analysis investigated pain perception and pain tolerance with age and showed that a loss of pain sensitivity occurs with an increase in pain thresholds among older adults.^[18] Furthermore, a previous review pointed that older patients were more likely to have reduced clearance of opioid such as morphine or fentanyl administered perioperatively, resulting in prolonged analgesic effect.^[19] Thus, younger patients are expected to have greater pain sensitivity and rapid metabolism of analgesia compared to older patients and therefore requiring more frequent analgesic use postsurgery.

In our study, we used levobupivacaine as anesthetic for local anesthesia and TAP block. Levobupivacaine is a new long-acting amide local anesthetic which has been developed after the evidence of bupivacaine-related severe toxicity on the central nervous system.^[20] The pharmacokinetic properties of levobupivacaine are similar to that of bupivacaine. In human studies, levobupivacaine has been confirmed to have a lower risk of cardiac and central nervous system toxicity compared with bupivacaine. A favorable safe and drug effect profile of levobupivacaine has led to widespread use.^[21] However, there are only few reports on postoperative pain using levobupivacaine local infiltration anesthesia in laparoscopic gynecologic surgery.^[3,22]

This is the first study reporting postoperative analgesic effect of intraoperative levobupivacaine local infiltration anesthesia (LA) and TAP block in gynecologic laparoscopy in the Japanese patient population. However, our study has several limitations. Our study was not a randomized controlled study but an observational retrospective study, and therefore, our results could be biased by indication or unmeasured confounders. Our study was also limited as the timing of the TAP block (i.e., whether to be done preoperatively or postoperatively) was decided by the anesthesiologist. However, in a previous double-blind crossover study, the mean duration of the sensory blockade was 10.3 h for TAP block with 20 ml of 0.25% levobupivacaine.^[23] Since the median operative time in the TAP group was 145 min for all procedures, 107 min for adnexa surgery, 192 min for TLH, 191 min for TLM, we expect that the timing of TAP has little effects.

CONCLUSION

Our study showed statistically significant but not clinically significant difference in postoperative analgesic effect between patients who received LA and TAP block in gynecologic laparoscopic surgeries. Endometriosis and younger age were independently associated with increased postoperative pain independent of intraoperative anesthesia type.

Patients who received endometriosis surgery tended to report more severe postoperative pain. Additional postsurgical pain management may need to be considered to alleviate pain in young patients and endometriosis patients undergoing laparoscopic surgeries.

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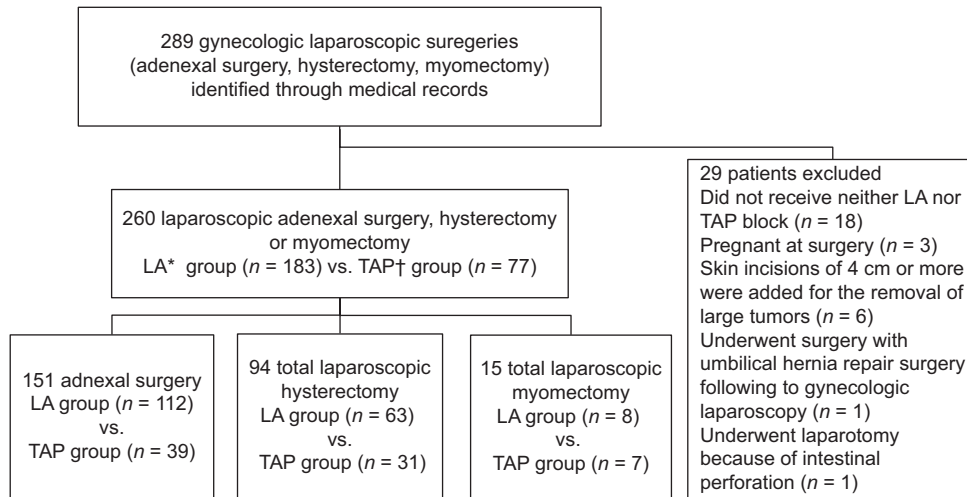
Conflicts of interest

Akiko Otake, Naoko Sasamoto, Noriko Sato, Ryota Kumasaka, Yoshimitsu Yamamoto, and Kazushige Adachi complied with the journal's Conflict of Interest Policy.

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SUPPLEMENTARY MATERIAL



Supplemental Figure 1: Study participant flowchart. *LA: Local infiltration anesthesia, †TAP: Transversus abdominis plane block group

Supplemental Table 1: Postoperative numerical rating scale pain scores and frequency of analgesic use up to 24 h after surgery stratified by endometriosis status

	Endometriosis			No endometriosis		
	LA (n=21)	TAP (n=10)	P	LA (n=162)	TAP (n=67)	P
Postoperative time period (h)						
1	2.6±1.3	2.4±1.7	0.77	2.0±1.3	1.6±1.6	0.035
3	2.1±1.2	2.0±1.4	0.58	1.9±1.1	1.8±1.4	0.45
6	1.5±0.8	1.5±0.7	0.98	1.5±0.9	1.6±1.1	0.68
12	1.9±1.2	2.1±1.1	0.63	1.4±0.8	1.5±0.8	0.97
24	1.5±0.7	1.2±0.4	0.2	1.3±0.7	1.5±0.9	0.14
Frequency of analgesic use up to 24 h after surgery	3.1±1.2	2.6±1.5	0.17	2.6±1.5	3.0±2	0.23

Data are expressed as mean±SD. TAP block was negatively related to the postoperative pain at 1 h after adnexal surgery. NRS ranging from 0 to 5. NRS: Numerical rating scale, LA: Local infiltration anesthesia, TAP: Transversus abdominis plane, SD: Standard deviation