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The outcomes of the 5 mm versus 11 mm primary trocar in gynecologic surgery — randomised study

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ABSTRACT

Objectives: To compare the effects of using 11 mm trocar and 5 mm trocar as primary ports on postoperative pain in benign gynecological laparoscopic surgeries.

Material and methods: The patients were divided into two groups as the primary port, group I (5 mm trocar) and group II (11 mm trocar) by block randomization.

Results: In the 5 mm trocar group, postoperative pain score and need for analgesia were less in level I and level II operations. Patient satisfaction was significantly higher in the 5 mm trocar group. The postoperative pain score was higher in patients who had trocar insertion attempts 3 times with the direct trocar method compared to patients with 1 or 2 trocar entry attempts.

Conclusions: The use of a 5 mm laparoscope in benign gynecological operations is an advantageous method due to low postoperative pain score, analgesic requirement, and high patient satisfaction.

Keywords: laparoscope; laparoscopy; port size; port trial; postoperative pain

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WHAT DOES THIS STUDY ADD TO THE CLINICAL WORK?

Laparoscopy is recommended as the gold standard in almost most gynecological surgery. The five-millimeter primary trocar can safely be used instead of a 10 mm laparoscope without a negative impact on the surgeon's performance and is associated with lesser postoperative pain.

INTRODUCTION

Laparoscopy is widely preferred in abdominal surgeries due to less postoperative pain, less hospitalization time, better cosmetic results, and more patient satisfaction [1] and is a treatment alternative to many malign and benign conditions [2, 3].

Smaller skin incisions and less postoperative pain due to less trauma to the abdominal wall is an important advantage of laparoscopy [4]. However, sometimes patients may have complaints of pain after laparoscopy operation. This pain can be secondary to shoulder pain, damage to tissues during a surgical operation, and port sites [5]. Postoperative pain can cause complications such as discomfort in patients, inadequate ventilation, atelectasis, prolonged ileus, and coronary ischemia [6]. Shoulder pain was related to intraperitoneal retention of carbon dioxide gas at the end of the operation [7, 8].

The sensation of pain occurs by stimulating peripheral nociceptors in tissue damage caused by cutting skin-subcutaneous tissues during surgery [9]. Many studies are stating that postoperative pain can be reduced through various local analgesic administrations to skin incisions [10–12]. The improvements in technology and surgery techniques in recent years have allowed surgery equipment used in laparoscopy to get smaller in size and enabled invasive interventions to

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get more minimal, so the mini laparoscopy procedure which allowed endoscopic equipment of 3 mm has been used in surgery [13].

This study was designed with the hypothesis that the damage to the tissue would abate with the reduction of skin incision and postoperative pain score would go down. Many studies have been carried out comparing postoperative pain outcomes in gynecological or non-gynecological cases [5, 6, 10, 11]. However, most of these studies were conducted using local analgesics and this causes errors in the pain score. It is known that postoperative pain is multifactorial [14]. In particular, it affects postoperative pain scores by enlarging the skin incisions to remove the organ from the abdomen in cases like cholecystectomy. Prior studies have heterogeneous surgical groups that decrease the effectiveness of the studies.

To our knowledge from the literature, this is the first double-blind study to compare postoperative pain scores in terms of primary trocar size by division into homogeneous groups according to the difficulty level of gynecological lazsaxjhuyparoscopic surgeries. This study was aimed to investigate the impact of primary port size on postoperative pain scores.

MATERIAL AND METHODS

This prospective randomized double-blind study was performed at the University of Health Sciences, Haydarpaşa Numune Training and Research Hospital Gynecology and Obstetrics Clinic between May 2019 and May 2021. The study included 250 patients who underwent laparoscopic surgery for benign gynecological problems. The Ethics Committee of Haydarpasa Numune Training and Research Hospital approved the study protocol (HNEAH-KAEK 2019/39-3057). All patients signed the written informed consent.

Exclusion criteria were:

1) patients with ASA (American Society of Anesthesiologists) score III and above;
2) patients < 18 years old;
3) emergency cases (torsion, Tubaovarian abscess; ectopic pregnancy);
4) presence of chronic pelvic pain;
5) regular use of non-steroidal anti-inflammatory drugs (NSAIDs) or opioids;
6) presence of deep infiltrating endometriosis;
7) patients who were converted to laparotomy from laparoscopy;
8) patients who have incision scar on their anterior abdominal wall;
9) malignancy.

Patients were randomized into two groups via block randomization. Group I — 5 mm primary trocar (5TS) and 5 mm laparoscope; group II — 11 mm trocar (11TS) and 10 mm laparoscope. The study enrolled a total of 250 women who underwent laparoscopy. After exclusion criteria, the study included 207 patients, group I (n = 103) and group II (n = 104). Figure 1 shows the flow chart of the study.

Each group was further categorized as level I and level II according to the operation difficulty level. Diagnostic

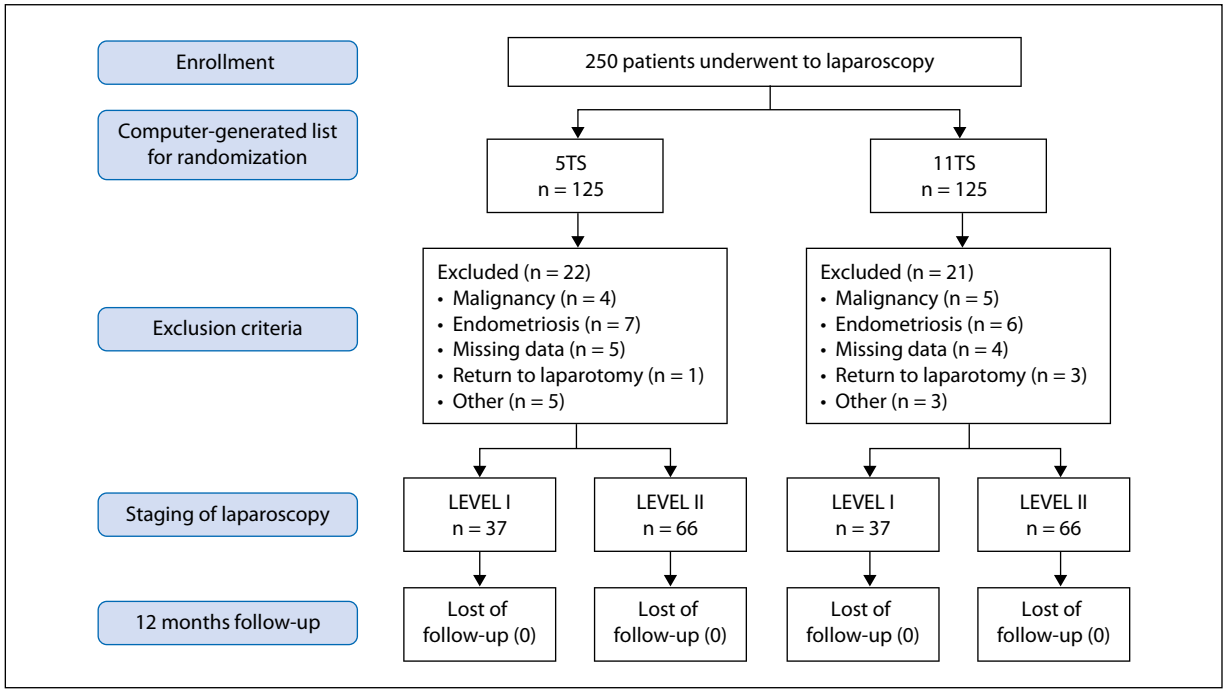


Figure 1. Sheme of the study participants; TS — trocar size

laparoscopy, ovarian cyst excision, uni or bilateral salphingo-oophorectomy, tubal ligation, and lateral suspension operations were level I surgery. Myomectomy, laparoscopic hysterectomy (with or without salphingo-oophorectomy), and laparoscopic Burch operations were level II surgery.

All patients were operated on by the same technique and the same surgical team. General anesthesia was performed with rocuronium bromide (0.6–0.9 mg/kg) A primary trocar (5 mm or 11 mm — COVIDIEN, VersaportTM Plus Auto SutureTMSingle Use V2 Bladed Trocar with Fixation Canula) was placed with the direct trocar technique. Intraperitoneal insufflation was provided with CO_2 at a rate of 2.5 L/min until the intra-abdominal pressure was 15 mmHg. 5 mm or 10 mm laparoscope was placed in the main trocar. Two ancillary trocars (5 mm —COVIDIEN, VersaportTM) were placed in the left and right lower abdominal region for level I operations. The 3rd ancillary trocar (5 mm — COVIDIEN, VersaportTM) was placed in the left paraumbilical region in level II operations. A single dose of antibiotics was administered to all patients.

All patients took information preoperatively about the visual analog score (VAS) (0 = no pain; 10 = maximal pain). The patients were blinded by the surgical technique and trocar size used. Two doses of non-steroidal anti-inflammatory drug (NSAID) were given after surgery. In the postoperative first 24 hours. The incision sites were closed with a standard size non-transparent sponge so that the patient could not see it. Postoperative pain was questioned by VAS at 1, 6, 12, and 24 hours by the study team, who did not know what size primary trocar. Hematocrit value was measured from the preoperative and the first postoperative day's blood sample.

The operation time was recorded as the time from the first skin incision to the last skin suture. The trocar insertion time was as the time from the first incision to the moment of entering the abdomen. The fascia of the patients in whom 11 mm trocar was used was closed with no: 1 Vicryl suture. The fascia of patients with 5 mm trocar was left open. The time for fascia closure was also recorded. The patients were followed up for twelve months for an early incisional hernia. Total hospitalization time was the time between the day of operation and the day of discharge. Likert scale questionnaire for patient satisfaction was applied to all patients.

The number of failed attempts was recorded for the primary port. The trocar-related complications or laparoscopic and surgery-related complications were reported. Trocar entry complications were trocar gas leakage, preperitoneal insufflation, and subcutaneous emphysema. Perioperative complications were minor and major vascular injuries, intestinal injuries, urinary injuries.

Statistical analyses

IBM SPSS Statistics 22 for statistical analysis (SPSS IBM, Turkiye) programs were used. While evaluating the study data, the compliance of the parameters to the normal distribution was evaluated with the Shapiro–Wilk test. In addition to descriptive statistical methods (mean, standard deviation, frequency), the Kruskal–Wallis test was used for the comparison of parameters that did not show a normal distribution between groups, and Dunn's test was used to determine the group that caused the difference. Mann–Whitney U test was used for comparisons of non-distributed parameters between two groups. Chi-square test, Fisher's Exact test, Fisher–Freeman–Halton test, and Continuity (Yates) Correction were used.

RESULTS

A 5 mm trocar (5TS) was used in 103 patients (49.8%) as the primary port and an 11 mm trocar (11TS) was used in 104 patients (50.2%).

There were 93 patients (44.9%) in the level I operation group and 114 patients (55.1%) in the level II group. The demographic and clinical characteristics of the groups are shown in Table 1. No significant difference was found between age, gravidity, and body mass index (BMI) in level I and level II groups according to trocar size. The mean operation time is 59.57 ± 34.08 minutes in level I operations and 89.87 ± 44.99 minutes in level II operations ($p < 0.001$). There was no significant difference between the groups using 5 mm and 11 mm trocar in terms of the estimated amount of bleeding ($p = 0.219$, $p = 0.447$). In the comparison of preoperative and postoperative hematocrit levels, there was no significant difference between the stages according to the types of trocars used. While intraoperative bladder injury (0.48%) was observed in only one patient among all cases, there was no postoperative complication. While there was no significant difference in trocar size in level I operations according to the Likert patient satisfaction questionnaire, it was significantly higher in patients in the 5TS group in level II operations ($p < 0.05$). The total hospitalization time was significantly shorter in the 5TS group for operations at both stages ($p < 0.005$). Table 2 shows the operation indications.

The patients' VAS scores for postoperative pain are shown in Table 3. The VAS scores of the 1st, 6th, 12th, and 24th hours in level I and II groups were significantly higher in patients using 11 mm primary trocar than patients using 5 mm primary trocar. The need for analgesia at 6 hours for postoperative pain was significantly higher in the 11TS group in the level I surgical group, however, no significant difference was found between the groups in the 1st, 12th, and 24th hours. However, in the level II group, the need for analgesia was significantly higher in

Table 1 . Demographic and clinical characteristics of level I and II surgeries

	Level I 5 mm TS Mean ± SD (med)	Surgery 10 mm TS Mean ± SD (med)	p value	Level II 5 mm TS Mean ± SD (med)	Surgery 10 mm TS Mean ± SD (med)	p value
Age	40.38 ± 11.57	39.91 ± 12.2	[1]0.854	38.02 ± 12.49	39.48 ± 12.06	[1]0.532
Gravidity	2.11 ± 1.63 (2)	2.52 ± 2.68 (2)	[2]0.798	2.5 ± 7.06 (0)	2.25 ± 2.69 (2)	[2]0.153
Parity	1.62 ± 1.26 (2)	1.75 ± 1.6 (2)	[2]0.981	1.05 ± 1.5 (0)	1.65 ± 1.8 (1)	[2]0.043*
BMI [kg/m^2]	25.75 ± 4.36	25.99 ± 6.24	[1]0.836	26.75 ± 6.08	26.57 ± 6.22	[1]0.875
Operation time [min]	61.35 ± 36.34 (60)	58.39 ± 32.78 (50)	[2]0.700	85.68 ± 42.03 (72.5)	95.63 ± 48.64 (90)	[2]0.360
Estimated blood loss (mL)	72.43 ± 86.41 (30)	88.04 ± 111.33 (50)	[2]0.219	367.42 ± 108.15 (350)	352.71 ± 93.42 (350)	[2]0.447
Hematocrit decrease [%]	3.18 ± 2.53	3.57 ± 2.17	[1]0.426	3.58 ± 2.97	4.28 ± 2.48	[1]0.187
Operative Complications	0	0		0	1 (2.1%)	–
Hospitalization [day]	2.16 ± 0.83 (2)	2.43 ± 0.63 (2)	[2]0.037*	2.27 ± 0.76 (2)	3.08 ± 1.09 (3)	[2]0.000*
Patient satisfaction						
So-so	2 (5.4%)	6 (10.7%)		4 (6.1%)	2 (4.2%)	
Pleased	10 (27%)	19 (33.9%)	[3]0.518	13 (19.7%)	21 (43.8%)	[3]0.021*
Very pleased	25 (67.6%)	31 (55.4%)		49 (74.2%)	25 (52.1%)	

[1]Student t-test; [2]Mann–Whitney U test; [3]Fisher–Freeman–Halton Test; *p < 0.05; BMI — body mass index; SD — standard deviation; TS — trocar size

Table 2. The distribution of operation indications

Operations	5 mm TS n (%)	11 mm TS n (%)
Diagnostic laparoscopy	3(2.9)	7(6.2)
Ovarian cyct excision	12(11.7)	20(19.2)
Salpingo-oopherectomy	14(13.6)	26(25)
Tubal sterilisation	3 (2.9)	2(1.9)
Lateral suspension	5 (4.9)	1 (1)
Myomectomy	2 (1.9)	7 (6.7)
TLH	56 (54.4)	38(36.5)
TLH + Burch	8 (7.8)	3 (2.9)
Total	103 (100)	104 (100)

TLH — total laparoscopic hysterectomy;TS — trocar size

11TS in the 6th and 12th hours, whereas there was no significant difference between the groups in the 1st and 24th hours.

Analgesia need in the 1st hour was 59.2% in the 5TS group and 75% in the 11TS group; it was 6.7% in the 5TS group and 36.5% in the 11TS group in the 6th hour; it was 5.8% in the 5TS group and 18.3% in the 11TS group in the 12th hour and it was found to be lower in the 5TS group ($p = 0.016$; $p = p = 0.000$; $p = 0.01$; $p < 0.05$). While there was no statistically significant difference between both groups in postoperative 24th hour, analgesia need was found 1% in the 5 mm trocar group and 5.8% in the 11 mm trocar group ($p = 0.119$; $p > 0.05$).

The VAS scores of patients were evaluated in Table 4 according to BMI, operation time, previous surgery, and trocar insertion trial parameters. There was no significant difference in the VAS score of the groups when patients were grouped as normal weight (BMI < 24.9kg/m^2), overweight (BMI = 25–29.9 kg/m^2), and obesity (BMI > 30 kg/m^2) according to BMI data.

A comparison of the postoperative 24-hour VAS scores of patients grouped according to the duration of their operations revealed a significant difference between the two groups. The group with an operation time exceeding 120 minutes exhibited a higher postoperative 24-hour VAS score ($p = 0.022$, $p > 0.05$).

There was no difference in patients' VAS scores according to previous surgical history. VAS scores at the 1st, 6th, and 24th hours were significantly higher in the group with 2 unsuccessful trocar insertions compared to the group with 1 or 2 trocar insertions ($p < 0.05$).

DISCUSSION

To our knowledge from the literature, this is the first double-blind study comparing postoperative pain scores in terms of primary trocar size concerning the difficulty level of gynecological surgeries. Briefly, the postoperative pain scores were significantly low in the 5 mm primary trocar groups compared to the 11 mm primary trocar group with both level I and II operations.

Predictive factors for postoperative pain include age, gender, presence of preoperative pain, type of surgery, and incision size [14]. Our study found no significant difference between patient groups given 5TS and 11TS in terms of age, gravidity, and BMI. As the laparoscopy became smaller in size, the resolution decreased too [15]. Operations of 5TS group

Table 3. The comparison of mean pain scores at each groups in stage 1 and stage 2 operations

	Level I 5 mm TS Mean ± SD (med)	Surgery 10 mm TS Mean ± SD (med)	p value	Level II 5 mm TS Mean ± SD (med)	Surgery 10 mm TS Mean ± SD (med)	p value
VAS scores						
1th hour	2.84 ± 2.18 (2)	5.55 ± 3.51 (7)	[1]0.000*	3.74 ± 2.79 (3)	5.9 ± 2.96 (6)	[1]0.000*
6th hour	1.7 ± 1.76 (1)	3.5 ± 2.62 (3)	[1]0.001*	1.98 ± 2.37 (1)	3.71 ± 2.6 (3.5)	[1]0.000*
12th hour	0.92 ± 1.21 (0)	2.16 ± 1.94 (2)	[1]0.002*	1.36 ± 1.89 (0)	2.42 ± 2.15 (2)	[1]0.004*
24th hour	0.35 ± 0.79 (0)	1.04 ± 1.33 (0)	[1]0.006*	0.67 ± 1.28 (0)	1.48 ± 2.04 (1)	[1]0.013*
Analgesic need						
1th hour	20 (54.1%)	40 (71.4%)	[2]0.136	41 (62.1%)	38 (79.2%)	[2]0.081
6th hour	4 (10.8%)	20 (35.7%)	[2]0.015*	7 (10.6%)	18 (37.5%)	[2]0.001*
12th hour	1 (2.7%)	8 (14.3%)	[3]0.081	5 (7.6%)	11 (22.9%)	[2]0.040*
24th hour	0 (0%)	3 (5.4%)	[3]0.273	1 (1.5%)	3 (6.3%)	[3]0.308

[1]Mann–Whitney U test; [2]Continuity (Yates); [3]Fisher's exact test; *p < 0.05; SD — standard deviation; TS — trocar size; VAS — visual analogue score

Table 4. Evaluation of visual analogue scores according to BMI group. operation time group. previous surgery and trocar insertion trial parameters

		n	VAS (1 hour) Mean ± SD (median)	VAS (6 hour) Mean ± SD (median)	VAS (12 hour) Mean ± SD (median)	VAS (24 hour) Mean ± SD (median)
BMI	< 25	104	4.78 ± 3.21 (5)	2.56 ± 2.38 (2)	1.62 ± 1.8 (1)	0.83 ± 1.35 (0)
	25–30	60	4.2 ± 3.15 (4)	2.82 ± 2.7 (2)	2.02 ± 2.14 (1.5)	0.85 ± 1.3 (0)
	> 30	43	4.58 ± 3.11 (4)	3.09 ± 2.69 (3)	1.67 ± 1.99 (1)	1.14 ± 1.98 (0)
	p[1]		0.530	0.606	0.503	0.769
Operation time	< 60 min	81	4.28 ± 3.28 (4)	2.46 ± 2.5 (1)	1.49 ± 1.78 (1)	0.74 ± 1.18 (0)
	60–90 min	71	4.54 ± 3.02 (4)	2.62 ± 2.33 (2)	1.68 ± 1.87 (1)	0.7 ± 1.18 (0)
	90–120 min	29	4.66 ± 3.43 (4)	3.14 ± 3.04 (2)	2.1 ± 2.32 (1)	0.9 ± 1.5 (0)
	> 120 min	26	5.46 ± 2.9 (5)	3.54 ± 2.53 (3)	2.31 ± 2.09 (2)	1.92 ± 2.47 (1)
	p[1]		0.412	0.190	0.226	0.022*
Previous surgery	No	141	4.57 ± 3.14 (5)	2.83 ± 2.53 (2)	1.79 ± 1.95 (1)	0.93 ± 1.39 (0)
	Yes	66	4.56 ± 3.24 (4)	2.56 ± 2.57 (2)	1.64 ± 1.94 (1)	0.83 ± 1.69 (0)
	p[2]		0.939	0.465	0.595	0.347
Trocar insertion trial	1	159	4.68 ± 3.18 (4)	2.82 ± 2.57 (2)	1.81 ± 1.97 (1)	0.94 ± 1.53 (0)
	2	43	3.63 ± 2.73 (4)	2.02 ± 2.1 (1)	1.21 ± 1.61 (0)	0.63 ± 1.27 (0)
	3	5	9.2 ± 0.84 (9)	6.4 ± 1.52 (6)	4.4 ± 1.52 (5)	1.8 ± 1.48 (2)
	p[1]		0.001*	0.003*	0.004*	0.055

[1]Kruskal–Wallis test; [2]Mann–Whitney U test; *p < 0.05; BMI — body mass index; SD — standard deviation; VAS — visual analogue score

in this study were completed using a 5 mm laparoscope and the 10 mm laparoscope was not used in any patient. There was no significant difference in the estimated blood loss and hematocrit levels in the study groups. None of the patients received a postoperative blood transfusion. There was one bladder injury in the 11TS group with level II surgery (0.48%). The urological injury in gynecological laparoscopy operations was 0.30% and the bladder injury was the most common type (0.18%) [16]. There was no other intra-operative complication in our study. The percentage of gas leakage was 1% in the 5TS group and 9.6% in the 11TS group. This was related to an increased gas leakage around the trocar with the increased skin incision size. Although there was no statistically significant difference, the first trocar insertion failure was 28.2% in the 5TS group and 18.3% in the 11TS group. These findings suggested that it was more difficult to pass the anterior abdominal wall with a small blade trocar.

In a popular study Acton (2016) revealed that hospitalization time was shorter in the total laparoscopic hysterectomy cases with 5 mm laparoscope compared to the

10 mm laparoscope group [17]. However, Acton (2016) conducted a randomized and controlled study two years later. They found no difference in terms of hospitalization times in the groups of laparoscopic hysterectomy performed with 5 mm and 10 mm laparoscope, while the operation time was shorter, and the 1st and 7th postoperative day pain scores were lower in the 5 mm laparoscope group [18]. On the other hand, our study found that the total hospitalization time to be shorter in 5TS with level I and II surgeries ($p = 0.037$, $p = 0.000$). There was no significant difference between 5TS and 11TS in the level I and level II laparoscopy surgery groups in terms of the mean operation time ($p > 0.05$).

Due to improvements in technology and surgical techniques, minimally invasive surgeries have been preferred in recent years. Smaller surgical instruments have the advantages of smaller skin incisions with better cosmetic results and less tissue trauma and postoperative pain scores [19, 20]. Although there were many studies on postoperative pain, most of them studied the effect of local analgesia. However, limited studies are investigating the trocar-specific postoperative pain [18, 19, 21–23].

In the study of Ghezzi et al. in 2005 [22], compared conventional laparoscopy (5 mm ancillary ports) with mini-laparoscopy (3 mm ancillary ports) in patients with adnexal mass. They used a 10 mm laparoscope. They did not state any significant difference in terms of postoperative pain between the groups. Ghezzi et al. [19] compared, in a different study, 76 laparoscopic hysterectomy cases in which 5 mm versus 3 mm ancillary trocars were used. They found no significant difference between the groups in terms of postoperative pain scores and analgesic use. Ghezzi et al. [22] in their first study included heterogenous gynecological pathologies such as ovarian metastasis of colon carcinoma, ectopic pregnancy, uterine myoma, acute appendicitis, and tuba ovarian abscess. Therefore, heterogeneous groups decreased the efficiency of the study.

In 2017 Wang et al. [21] examined the port-specific postoperative pain in benign gynecological laparoscopy cases. They compared incisions of 5, 10, and 15 mm for ancillary trocar and showed that postoperative pain increased with the incision size. Unlike other studies, in this study, we created homogeneous groups by grouping the patients into level I and level II according to the difficulty level of operation. The VAS pain score was found to be significantly lower both in level I and II 5TS group at the 1st, 6th, 12th, and 24th hour ($p < 0.005$). However, the analgesic need was found to be much in the 11TS group at the 6th hour in level I and the 6th and 12th hours in level II ($p < 0.005$). In this study, we questioned the primary port-specific postoperative pain and minimized the bias that might arise from placing ancillary trocars in different anatomical regions and made the groups more homogeneous.

Wang et al. [21] found no significant difference in the 24th hour VAS score according to operation time and previous surgery, whereas they found the 72nd-hour VAS score to be related. In this study, however, we found the 24th-hour VAS score to be related to the operation time ($p < 0.005$). Nevertheless, we did not find any significant difference between BMI and surgical history and postoperative pain. Furthermore, the 1st, 6th, and 12th-hour VAS scores were found to be significantly higher in patients with 3 times of trocar trials compared to those with 1 or 2 times of this trial.

The trocar site hernia was first announced by Maio et al. in 1991 [24]. In asymptomatic patients, an average of 0.27% trocar site hernia was detected in 0.27% of asymptomatic patients [25].

Although almost all are on trocar sites of 10 mm and above, some studies have reported incision hernia occurring in trocar sites of 5 mm [26]. The common opinion is that the fascia should be closed in trocars with a diameter of 10 mm or more [27, 28]. In 2004 Tonouchi et al. [29] divided the trocar site hernia into three groups that are early-onset, late-onset, and special type. The early-onset and special types are seen in the early period after surgery, while the late-onset hernia may occur months and years after the primary surgery. We did not close the fascia of any patient in the 5TS group, but we closed the primary trocar site fascia of all patients in the 11TS group. The fascia closure extended the operation for 3.93 ± 1.3 minutes on average. The port site hernia was not observed in our patients in the one-year follow-up.

In this study, an advantage of using a 5 mm laparoscope is that the laparoscope can be taken to the ancillary ports to easily monitor the regions that are not in the sight of the umbilicus in cases with a large uterus or intra-abdominal adhesions. However, the study has some limitations. Firstly, when gynecologic surgeries were separated as level I and II to create a homogeneous group, the number of groups decreased unevenly. The second is the analgesia used. We routinely administered NSAID (75 mg Diclofenac Sodium) two times a day to all postoperative patients. Although Diclofenac Sodium plasma half-life is short as two hours, it may affect some VAS scores. Thirdly, this study sought into the primary port-specific postoperative pain score. However, postoperative patients may not clearly distinguish pain around the umbilicus due to visceral pain.

CONCLUSIONS

In conclusion, the five-millimeter primary trocar can safely be used instead of a 10 mm laparoscope without a negative impact on the surgeon's performance and is associated with lesser postoperative pain.

Article information and declarations

Author contributions

EED, ZB and EK collaborated on designing the study, collecting and analyzing the data, and writing the manuscript. EED, EK and FV contributed to designing the study, collecting data, and editing the manuscript. ZB and EED assisted with data analysis and interpretation. EED, EK, FV and EK provided critical feedback and made revisions to the manuscript. All authors reviewed and approved the final version of the manuscript for submission.

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Conflict of interest

All of the authors declare that they have no conflict of interest.

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