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Mini-Laparoscopic Gynecological Surgery Using Smaller Ports Minimizes Incisional Pain and Postoperative Scar Size: A Paired Sample Analysis

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Abstract

Objective. The aim of this study was to assess postoperative incisional pain and cosmetic scores in mini-laparoscopic gynecological surgeries undertaken with different port sizes. *Material and Method*. In this prospective study, all women who underwent mini-laparoscopic gynecological surgery with 2.4-, 3-, and 5-mm lateral ports for benign gynecological conditions between March 2017 and April 2019 were included. The primary outcome was postoperative incisional pain at rest, walking, and after a provoked Valsalva maneuver assessed by numeric rating scale scores at 6 hours, 12 hours, 24 hours, and 3 days and 7 days after surgery. Secondary outcome measures included cosmetic scores of each port site (evaluated by using patient-observer scar assessment scale [POSAS]), operation time, and intra- and postoperative complications. *Results*. A total of 330 lateral port sites in 110 patients who underwent benign gynecological surgery via mini-laparoscopy were assessed for pain and cosmetic appearance. Pain scores at each time point were significantly lower for 2.4- and 3-mm ports than those for 5-mm ports; however, no significant difference was detected between 2.4-mm and 3-mm port sites (P = .6). The difference was more evident at 24 hours when routine analgesic drugs were stopped (P = .004). For POSAS scores, both 2.4-mm and 3-mm ports were superior to 5-mm port sites (P = .002); however, there was no significant difference between 2.4-mm and 3-mm port sites (P = .2). There were 2 port-related complications: one subcutaneous emphysema and one bleeding from a 5-mm trocar site 1 hour after surgery. *Conclusion*. Mini-laparoscopic gynecologic surgery using smaller ports resulted in decreased postoperative incisional pain and superior cosmetic appearance.

Keywords

mini-laparoscopy, gynecology, port size, pain, cosmesis

Introduction

Minimally invasive surgery has rapidly evolved during the last decade with special emphasis on less invasive techniques using smaller caliber instruments aiming to reduce postoperative pain and allowing a more rapid recuperation without compromising efficacy and safety. Smaller caliber instruments (mini-laparoscopy [mini-LS]) are expected to cause less abdominal wall trauma, reduce incision-related morbidity (incisional hernia and bleeding), and postoperative pain. Minimizing postoperative pain is particularly important in the era of the opioid crisis.[1] Patients who never used opioids are under the risk of becoming persistent opioid users after the postoperative recovery period,[2] and women are under an increased risk compared with men.[3]

Several studies in general surgery and a few studies in gynecology confirmed that mini-LS also known as "needlescopic" instruments offer a safe and efficient alternative to conventional laparoscopic instruments (con-LS);

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however, whether they are associated with decreased postoperative pain is still being questioned.[4-7] Sajid et al.[8] systematically analyzed randomized controlled trials (RCTs) on cholecystectomy and concluded that mini-laparoscopy is associated with a longer operation time and a higher conversion rate compared with con-LS, however, also with less postoperative pain and better cosmetic results.

Pain is self-declared and shows significant interindividual variability.[9] Pain perception and assessment do not necessarily correlate with the severity of injury but depend on patient's demographics, genetic factors, and psychosocial processes.[9] Because of these potential confounding factors, we decided to compare pain perception related to different laparoscopic port sizes in the same patient. The aim of this study was to prospectively assess the pain and cosmesis in patients undergoing mini-LS benign gynecological surgery.

Materials and Methods

Patients

This study includes a total of 139 consecutive patients who underwent mini-LS for benign gynecological disease between March 2017 and April 2019. All procedures were performed by 2 experienced surgeons (CT and DV) with ample experience in mini-LS.[10-12] The study was approved by the Koç University Institutional Review Board (2019.210.IRB1.033). Patients with chronic pain (n = 4), endometriosis with pain symptoms (n = 14), potentially pain-modifying diseases such as diabetes mellitus with microvascular complications, or peripheral neuropathy (n = 1) and patients aged >70 years (n = 2) were excluded. Six patients who underwent additional surgical procedures (lateral colposuspension n = 5, breast augmentation n = 1), 1 patient whose primary port was enlarged to 10 mm to aid specimen removal, and 1 patient with umbilical hernia were also excluded, leaving 110 patients for the final analysis.

The primary outcome was incisional pain at rest, with walking, and after a provoked Valsalva maneuver at 6 hours, 12 hours, 24 hours, 3 days and 7 days after surgery. Secondary outcomes included the cosmetic score of the port sites, operation time, and intra- and postoperative complications.

Surgical Method

All patients underwent a standardized anesthesia protocol, including induction with propofol (1-2 mg/kg) and fentanyl (1 mcg/kg), neuromuscular blockade with rocuronium (.6 mg/kg) and maintenance with desflurane (0.8 MAC), and remifentanil (.1-.2 mcg/kg/min). An additional dose of remifentanil was administered when necessary. Dexamethasone 4 mg was given for prophylaxis of postoperative nausea and vomiting. For postoperative analgesia, patients were given ibuprofen (400 mg) and paracetamol (1 g) and tramadol (1 mg/kg) approximately 30 minutes before the end of the surgery. In the recovery room, if necessary, fentanyl (25 mcg) was given. Postoperative pain in the first 24 hours was relieved with diclofenac potassium (50 mg) administered orally every 8 hours. Rescue analgesia consisting of paracetamol (1 g) administered intravenously and was provided on patients' request after the first 24 hours until discharge.

All procedures were performed in the dorsal lithotomy position. Abdominal cavity was insufflated followed by a 5-mm trocar entry from the umbilicus. Under direct visualization, a 2.4-mm percutaneous instrument (Minilap® Percutaneous System with Minigrip® Handle, Teleflex Incorporated, Morrisville, North Carolina, USA) and 3-mm and 5-mm ports were placed to the upper right, lower left, and lower right quadrants with different combinations according to surgeons' preference; however, a 5-mm lateral trocar was used in every patient. Intra-abdominal pressure was maintained at 12-13 mm Hg using warmed carbon dioxide (CO_2) throughout the surgery. Following completion of surgery, all trocars except the umbilical one were removed under direct vision. The umbilical trocar was removed after maximum evacuation of the insufflated CO_2 gas. After removal of the trocars, the length of the skin incisions was measured using a sterile ruler. All incisions were closed using subcutaneous 4-0 monocryl sutures. Excised specimens were removed from the peritoneal cavity through a posterior colpotomy or vaginally whenever a hysterectomy was performed.

Intraoperative variables (total volume of carbon dioxide insufflated, duration of surgery, and duration of anesthesia), postoperative rescue analgesic use, postoperative port diameters, and port-related complications were recorded on preprinted forms. The duration of surgery was defined as the time elapsed from insertion of the primary trocar to the removal of all trocars.

Intraoperative complication was defined as any event that required additional surgical procedures such as repair of iatrogenic physical injury or hemorrhage requiring a blood transfusion. Postoperative complications included febrile episodes, voiding difficulties or urinary tract infection, wound infection, vaginal vault hematoma, venous thrombosis, sepsis, and any condition requiring reoperation or readmission to the hospital after discharge.

Pain Assessment

Postoperative incisional pain was evaluated using a numeric rating scale (NRS). Before surgery, all patients were taught how to score pain by using the NRS (score 0: no pain; score 10: worst pain) and they were informed that

they would not be given additional analgesic medications unless requested.

The wounds were concealed by standard size non-transparent dressings to blind the patients and the assessors (SK and KC) to the port calibers. After discharge, the patients were contacted on postoperative days 3 and 7 and after 1 month. On postoperative day 3, they were called to ask for the pain scores. On postoperative day 7, they were invited to visit their doctors for routine postoperative control. At the visit, the pain scores were asked and then the wound dressings were removed. After 1 month, they were also called for total recovery and any morbidity related to surgery, and also an appointment was arranged for scar assessment at 6th week.

Cosmetic Scar Assessment

Six weeks after surgery, patients were invited to the hospital to assess for the appearance of port sites. Port sites were evaluated by using the patient-observer scar assessment scale (POSAS) which was initially developed for burn scars[13] but later used for a variety of wounds. It is composed of 2 subscales: the observer scar assessment scale (OSAS) and the patient scar assessment scale (PSAS).[14] The OSAS score comprises 6 domains, all graded on a 10-point scale, with one indicating normal skin and 10 indicating the worst scar imaginable; a summary score of 6 indicates normal skin, with 60 being the worst possible scar result. After scoring the domains, the observer then rates the overall scar appearance on an NRS that corresponds to a point scale. The PSAS has 6 domains, all graded by the patient on a point scale; one indicates the best or most normal result, and 10 indicates the worst or most disfiguring result. A summary score of 6 corresponds to normal skin, and 60 is the worst scar imaginable to the patient. The OSAS was completed by a single physician (AB) and the PSAS by patients themselves. Unfortunately, this part of the examination because of its nature cannot be blinded, so the assessor or the patient has to look at the scars to score them.

Statistical Analysis

Statistical analysis was performed using SPSS software (Statistical Package for the Social Sciences, Version 20; SPSS Inc, Chicago, Illinois, USA). Descriptive variables were presented using means and standard deviations or proportions. The pain and cosmetic scores among different port sizes and the pain scores among different time points or different maneuvers were evaluated by using the Wilcoxon or Friedman tests. Additional factors which may affect pain scores such as the type and duration of the surgery or history of abdominal surgery were evaluated by using logistic regression analysis. A P value $<.05$ was considered as statistically significant.

Results

Of the total 110 patients, 61 (55.5%) had hysterectomy ± salpingo-ophorectomy, 28 (25.5%) had ovarian cystectomy, 18 (16.5%) had adnexal surgery, and 3 (2.5%) had myomectomy. Sixty patients (54.5%) were operated by using 2 lateral trocars and 50 of them (45.5%) by using 3 lateral trocars. Patient and surgical characteristics such as maximum uterine length or mean myoma diameter, the operation time, and the duration of hospitalization are summarized in Table 1.

A total of 330 lateral port sites were assessed for the pain and cosmetic appearance at 6 time points. For each time point, lower pain scores were recorded for 2.4- and 3-mm ports compared with 5-mm ports (Figure 1). The difference was more evident at 24 hours when routine analgesic drugs were stopped ($P = .004$). No significant difference was detected between 2.4-mm and 3-mm ports ($P = .6$). The NRS scores at rest, during Valsalva maneuver, and during walking markedly declined 3 days after the surgery (Figure 1).

Only one port was enlarged (from 3 to 5 mm) during the surgery to facilitate the procedure. Despite the introduction of smaller trocars, each port was at least 1.5 times larger than its original size when measured on completion of surgery (Table 2). The average pain score at

Table 1. Baseline Characteristics of Patients Who Underwent Mini-Laparoscopic Gynecologic Surgery. Data are Expressed as Number (%), Mean ± SD or Median (Range).

	N = 110
Age, years	44 (±11)
BMI, kg/m^2	24 (±4)
Parity	
Nullipar	36 (32%)
More than one	74 (68%)
Previous cesarean section	43 (39%)
Previous abdominal surgery	38 (34%)
Surgical procedure	
Hysterectomy (±salpingoophorectomy)	61 (55.5%)
Ovarian cystectomy	28 (25.5%)
Adnexial surgery	18 (16.5%)
Myomectomy	3 (2.5%)
Maximum uterine length (cm)	8 ± 1.5
Main myoma diameter (cm)	3 ± 2.5
Mean operation time (minutes)	
Hysterectomy (±salpingoophorectomy)	117 ± 30
Ovarian cystectomy	92 ± 30
Myomectomy	85 ± 23
Adnexial surgery	68 ± 23
Mean duration of hospitalization (day)	1.6 ± .6
Additional analgesia requirement	9 (.08%)
Return back to daily activity (day)	6.6 ± 1.6

Abbreviations: SD = standard deviation; BMI = body mass index.

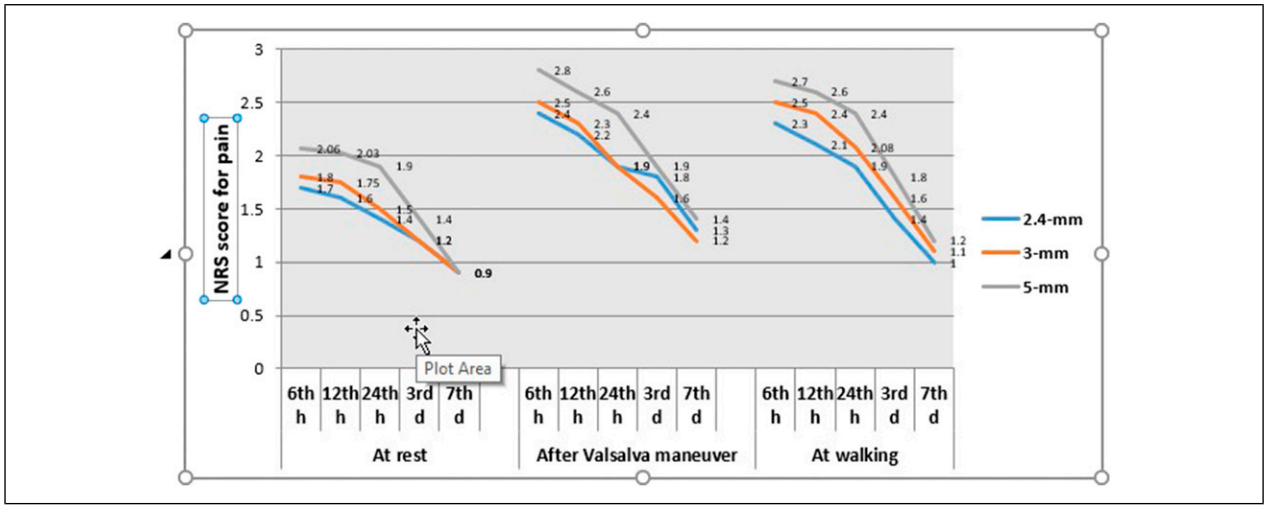

Figure 1. Numeric rating scale scores for postoperative trocar site pain assessment at different occasions.

Table 2. Port Related Parameters. Data are Expressed as Number (%), Mean ± SD or Median (Range).

	N = 110
Conversion to larger port	1 (.01)
Port diameter at the end of surgery	
2.4 mm	3.5 (±.6)
3 mm	5.5 (±.9)
5 mm	10 (±2.2)
Port site related complications	2 (.02%)
Overall postoperative pain NRS score at different time occasions	
At 6th hour	3 ± 1.5
At 12th hour	2.5 ± 1.5
At 24th hour	2 ± 1.5
At 3rd day	2 ± 1
At 7th day	1 ± 1
Overall postoperative pain NRS score at 24th hour according to the operation type[a]	
Hysterectomy (±salpingoophorectomy)	2.2 ± 1.3
Ovarian cystectomy	2.5 ± 1.3
Adnexial surgery	2.2 ± 1.3
Myomectomy	3.5 ± .5
Overall cosmetic score	
According to PSAS[b]	
2.4 mm	15.3 ± 6.6
3 mm	16.7 ± 7.8
5 mm	20.8 ± 8.4
According to OSAS[c]	
2.4 mm	14.8 ± 6.1
3 mm	15.3 ± 6.7
5 mm	19.3 ± 6.4

Abbreviations: PSAS = patient scar assessment scale; OSAS = observer scar assessment scale; NRS = numeric rating scale; SD = standard deviation.
[a]$P = .2$.
[b]$P = .002$.
[c]$P = .016$.

each assessed time point was very low (maximum 2.5 after routine analgesic drugs were stopped). Neither overall pain nor incisional pain was related to the type or duration of surgery ($P < .05$ for all). Regarding the POSAS scores, 2.4-mm and 3-mm port sites were significantly more favorable than 5-mm ports ($P = .002$), but no significant difference was noted between 2.4-mm and 3-mm ports ($P = .2$) (Table 2). Two port-related complications occurred: one subcutaneous emphysema and one bleeding from a 5-mm trocar site 1 hour after surgery. One patient had postoperative fever which was short-lived and relieved with intravenous paracetamol administration.

Discussion

Our study shows that mini-LS instruments significantly reduce incisional pain while improving its cosmetic appearance. Decreased incisional pain with smaller port sizes was more pronounced after discontinuation of analgesics. Because there was no significant difference between 2.4-mm and 3-mm ports with regard to pain and cosmetic appearance, we could not assert the notion that smaller port sizes are associated with more favorable outcomes. The benefit of using port <3 mm should be reconsidered.

Studies comparing mini-LS and con-LS in general surgery have yielded contradictory results regarding postoperative pain. Although some suggested that mini-LS causes less pain[7,15,16]; others failed to show a difference.[17-19] In an RCT, Ghezzi et al.[5] compared postoperative abdominal and shoulder pain after hysterectomy in patients undergoing mini-LS with 3-mm ports versus con-LS with 5-mm ports. Although mini-LS showed a similar efficacy and safety compared with con-LS with regard to the operation time, estimated blood loss, and complication rates, unexpectedly postoperative pain scores were not different.

Béguinot et al.[20] investigated the efficacy of mini-LS hysterectomy in a randomized noninferiority trial. Postoperative pain (at admission to the ward after surgery, and 6 and 24 hours after surgery) and incision scarring at 2 months were evaluated as secondary outcomes. Mini-LS hysterectomy (with 3-mm ports) was found to be inferior to con-LS (with 5-mm ports) in terms of operation time and subjective ease of the operation as judged by the surgeon. No significant difference was found among groups for postoperative pain, but patients reported less scar pain and firmness. However, in another study,[21] incisional pain was assessed rather than overall pain and compared with 3-mm ports, 5-mm ports were associated with more pain, which was similar to the 10-mm umbilical port. Nomura[4] compared mini-LS with 3-mm or 2.3-mm ports and con-LS with 5-mm ports in patients with endometriosis. Mini-LS with 2.3-mm ports was associated with a decreased rescue analgesic requirement and better cosmetic results compared with con-LS; however, the operation time was significantly longer. The contradictory results among studies are most likely because of the type of postoperative pain (overall, visceral vs incisional) evaluated. Postoperative pain can show variation between individuals. When different types of postoperative pain (overall, incisional, visceral, and shoulder) were evaluated,[15] it was found that overall pain showed a pronounced interindividual variability and incisional pain dominated in incidence and intensity over both visceral and shoulder pain. In this context, expected benefit obtained from smaller port sizes would be decreased incisional pain. Therefore, studies on minimizing postoperative pain with the use of smaller ports should evaluate incisional pain rather than overall pain. In this study, we showed that reducing the port size resulted in less incisional pain. However, port sizes <3 mm did not provide a significant benefit with regard to pain or cosmetic appearance.

Other major advantage of mini-LS is better cosmesis.[7,16,17,19] Although from a surgeon's perspective, efficacy and safety take precedence over cosmetic benefit in laparoscopy, healing with little or no scar is usually favored by patients. In our study, the use of smaller ports provide nearly scarless healing; however, no significant difference was observed between 2.4-mm and 3-mm ports. In our study cohort and our previous unpublished data,[10,22] the duration of mini-LS was not longer than con-LS and complication rates were similar. There was no intraoperative conversion from mini-LS to con-LS or open surgery. Grasping and coagulating power of mini-LS instruments were questioned in previous studies.[23,24] Based on our experience, grasping and hemostasis with 3-mm instruments are achieved as efficient as with conventional instruments; however, efficiency decreased with instrument sizes <3 mm. However, this observation should be tested in further studies to reach a reliable conclusion.

In our study, we included different types of surgery which were performed via mini-LS to generalize the results. To prevent potential biases related to different surgery types, paired sample analysis was used and the effect of the surgery on pain scores was evaluated as well. Furthermore, although the assessment of incisional pain is more challenging than other types of postoperative pain, it was notable to choose it as the study interest because of the scant evidence in the literature. On the other hand, it was not possible to evaluate the efficacy of mini-LS or to perform multiple comparisons in this type of study design.

Conclusion

Our study shows that smaller port sizes used in mini-LS are associated with less postoperative incisional pain than larger port sizes that are commonly used in con-LS. Furthermore, better cosmetic results were obtained with the use of smaller ports.

Authors' Note

Preliminary results of this study have been presented at the 46th AAGL Global Congress on Minimally Invasive Gynecology, Washington, DC, November 12-16, 2017.

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Study supervision: Cagatay Taskiran and Bulent Urman

Declaration of Conflicting Interests

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