

More Aesthetic, Multi-Port Laparoscopic Appendectomy Using Conventional Instruments with Invisible Scar: A Case-Match Study

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ABSTRACT

Introduction: Laparoscopic appendectomy (LA) has become one of the most frequently performed abdominal surgeries worldwide, surpassing the traditional open technique. Over time, the increasing experience of surgeons in minimally invasive surgery and, notably because patients' aesthetic and cosmetological concerns have allowed surgeons to modify these techniques. In our study, we aimed to introduce the invisible scar laparoscopic appendectomy (ISLA) modified technique and present early postoperative outcomes.

Methods: Our study included 66 patients who underwent LA between August 2022 and April 2024. Half of these patients were in the ISLA group, and the other half were in the control group. The sequence of priority for matching the prognostic variables was age, sex, laparoscopic appendicitis grade, and body mass index. We retrospectively examined and compared the demographic data, discharge times, 30-day postoperative readmission rates, and operative data of these patients between the groups.

Results: There was no significant difference in postoperative 30-day complications, length of hospital stays, and drain usage between the two groups ($p=0.708$, $p=0.841$, and $p=0.708$, respectively). The duration of the operation was slightly longer in the ISLA group ($p=0.006$).

Conclusion: ISLA can be performed safely by experienced surgeons with appropriate case selection.

Keywords: Laparoscopy, appendectomy, invisible scar

Introduction

Since its inception, laparoscopic appendectomy (LA) has gained widespread adoption globally, surpassing the traditional open technique pioneered by McBurney (1,2). The advent of minimally invasive surgery and the growing expertise among surgeons have facilitated the increased application and technical refinement of LA over time. As a refinement of the standard 3-port access procedure, modifications have been made, including the reduction in the number of ports, variation in port entry sites, and downsizing of port dimensions (3-6).

Nowadays, increasing aesthetic concerns of patients have become a primary reason for these changes. Growing concerns about body image show that more and more patients want to remove scars from their navels for cosmetic reasons or due to belly piercings or tattoos (7). Some

studies have shown that patients prefer scarless surgeries as long as the complication rates of the chosen surgical method are comparable to the current standard treatment (8,9). In fact, some studies indicate that people prefer scarless abdominal surgeries even if there is a slight increase in risk (10).

The aim of our study is to introduce the invisible scar laparoscopic appendectomy (ISLA) modified technique, utilizing standard laparoscopy instruments. In this technique, port entry locations have been adjusted to ensure that all incisions are situated below the bikini line. We also aim to present the early post-operative outcomes. In ISLA, all incisions are hidden by the suprapubic anatomical folds, which combines the advantages of multiport standard LA, with better cosmetic results. Additionally, there is the possibility of converting the procedure to traditional laparoscopic surgery at any time.



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Methods

The study commenced following approval from the University of Health Sciences Türkiye, Erzurum Faculty of Medicine Scientific Research Ethics Committee (approval number: 119, date: 10.07.2024). A total of 66 patients who underwent LA at the Clinic of General Surgery, Dr. Nevruz Erez State Hospital between August 2022 and April 2024 were retrospectively scanned and included. There were a total of 33 patients who underwent ISLA from the bikini line (group 1, n=33). As the control group, the same number of patients who underwent standard LA by the same surgeons in the same time period were of the same gender, similar age and body weight, and had laparoscopic grading system of acute appendicitis score $\leq 3A$ were selected (group 2, n=33) (11). The priority sequence of matching the prognostic variables was age, sex, laparoscopic appendicitis grade, and body mass index (BMI). Demographic data, BMI, American Society of Anesthesiologists (ASA) scores, discharge times, 30-day postoperative readmission status, and operative data were extracted from the hospital information management system and archive file records. In addition, patients were contacted via the phone numbers registered in the system and were asked whether they had applied to any external center regarding the surgery within the 30-day post-operative period, and this information was recorded. All patients were informed about this procedure before the operation and their informed consent was obtained.

Case Selection

In all cases, the diagnosis of acute appendicitis was confirmed preoperatively based on clinical presentation, laboratory values, and radiologic studies. Preoperative computed tomography (CT) scans were conducted for all patients. The surgeries were performed by two different surgeons employing identical methods (as described below). This approach was not favored by surgeons for selecting the surgical method for patients diagnosed with acute appendicitis during the specified time frame, particularly in cases where patients presented with maybe there was adhesions in the suprapubic region such as those with a history of cesarean section or existing surgical scars in visible abdominal areas. This method was not chosen in patients without aesthetic concerns and, due to there may be possible difficulties in the initial placement of the trocar, especially in obese patients with a BMI >30 . Standard LA or conventional surgery was performed in cases of complicated acute appendicitis, which including perforation or intra-abdominal abscess evident on preoperative CT scans.

Operative Technique

Standard Laparoscopic Appendectomy

After induction of anesthesia, patients are placed in the supine position with the left arm positioned, prepared, and draped. After the necessary preparations are completed, a vertical 10 to 12 mm incision is made under the navel for the first trocar entry. Afterwards, pneumoperitoneum is provided by entering the abdomen with the Verres needle or Hasson technique, and a 10/12 mm trocar is inserted. A 10 mm 30-degree angled telescope is routinely used. After general intra-abdominal exploration, a 5 mm working trocar is inserted from the midline in the suprapubic region and another 10/12 mm working

trocar from the lateral side of the left rectus muscle. LA is started on the left side in the Trendelenburg position (trocar entry locations are shown in Figure 1). After the mesoappendix dissection performed with laparoscopic energy devices, the appendix root is routinely closed with two non-absorbable polymer locking clips. Once the appendectomy is completed, the appendix is removed from the port in the umbilicus with the help of an endobag. The fascia of the umbilical trocar sites are routinely closed, and, if necessary, a drain is placed from the 5 mm trocar site. All patients in group 2 were operated on in this way.

Invisible Scar Laparoscopic Appendectomy

After induction of anesthesia, patients are placed in the supine position with the left arm closed, prepared and draped. After the necessary preparations are completed, the patient is placed in the Trendelenburg position to move the intra-abdominal organs away from the pelvis under the influence of gravity. This is done before the incision is made for the first trocar entry. Before the surgery, a transverse incision of 1.5 cm is made from the midline, approximately 2 cm above the symphysis pubis. This incision is below the line connecting the bilateral anterior superior iliac spine, marked at the level of the patient's daily underwear. The anterior abdominal fascia is passed through a vertical incision and the rectus muscles are reached. The rectus muscles are lateralized and the Retzius space is entered. In this interval, finger dissection is performed in the preperitoneal area to allow the peritoneum to be pulled out of the abdomen. The peritoneum is held with surgical instruments; the abdomen is entered with an open method, and the first 10/12 mm trocar is placed. Afterwards, a 10/12 mm trocar is inserted from the left inguinal region in the appropriate area according to the tracing of the inferior epigastric vessels by transillumination. In the continuation of the surgery, the camera is taken into the left 10/12 mm trocar, and another 5 mm trocar is inserted from the right inguinal region (Figure 2).



Figure 1. Standard LA port placement. Informed consent was obtained from the patient to use the image for scientific purposes
LA: Laparoscopic appendectomy

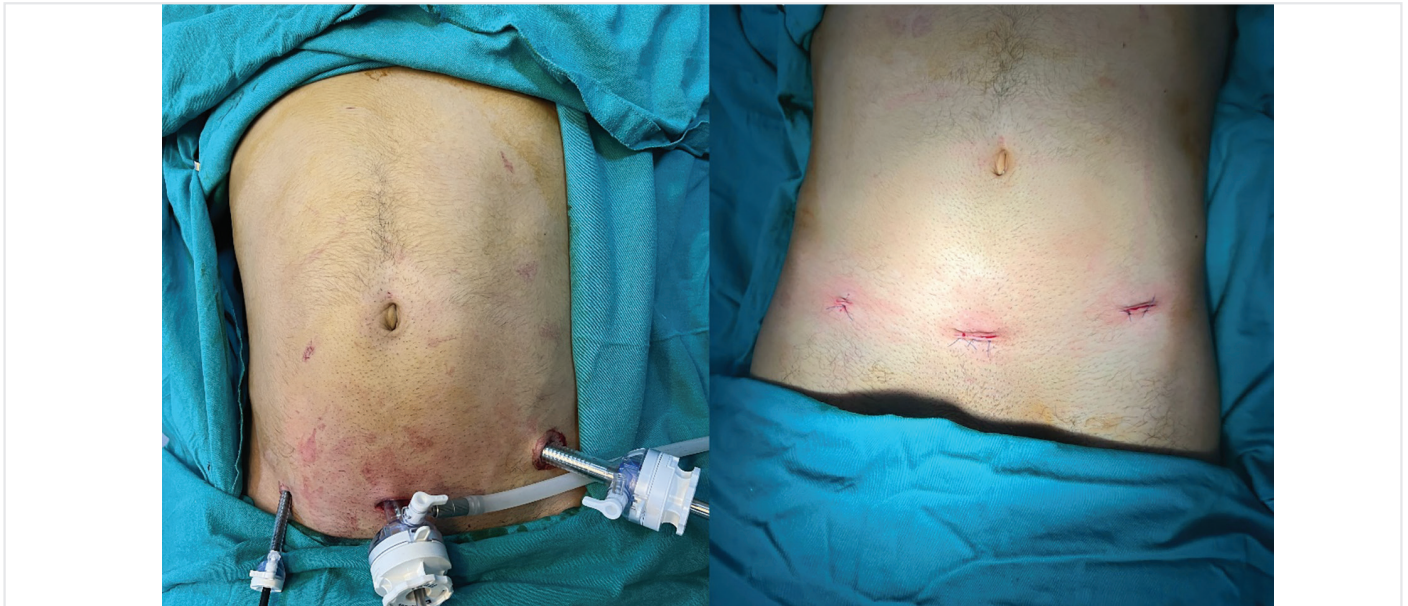


Figure 2. ISLA technique port placement and postoperative view. Informed consent was obtained from the patient to use the images for scientific purposes
ISLA: Invisible scar laparoscopic appendectomy

Afterwards, the patient is placed on the left side and the appendectomy is initiated. After mesoappendix dissection performed with laparoscopic energy devices, the appendix root is routinely closed with two non-absorbable polymer locking clips. Appendectomy is completed and then the appendix is removed from the port in the suprapubic region with the help of an endobag. The fascia of the suprapubic trocar sites is routinely closed and if necessary, a drain is placed from the 5 mm trocar site. All patients in group 1 were operated on in this way.

Statistical Analysis

Statistical analyses were performed using SPSS version 27.0. Descriptive statistics were presented as frequencies and percentages for categorical variables, and as means, standard deviations, medians, interquartile ranges, for numerical variables. The Student's t-test was applied for comparing numerical variables between two independent groups when the assumption of normal distribution was satisfied. In cases where normality was not assumed, the Mann-Whitney U test was utilized. The chi-square test was employed to examine group proportions. A p-value of less than 0.05 was considered indicative of statistical significance.

Results

A total of 66 patients were included in the study, with 33 patients in the ISLA group and 33 patients in the control group. All patients included in the study were classified as ASA I-II. Patients with a laparoscopic appendicitis grade of 3A or lower were included. The mean age of the patients was 24.29 ± 5.81 years, and the mean BMI was 24.18 ± 1.85 kg/m². The average duration of surgery was 48.80 ± 13.30 minutes. The ISLA group and the standard LA group were similar in terms of age, gender, BMI, laparoscopic appendicitis grade, and ASA score (Table 1).

There was no significant difference in postoperative 30-day complications between the two groups ($p=0.708$). Complications were observed in a total of 8 patients across both groups. In the ISLA group, postoperative

atelectasis developed in 1 patient, while superficial incisional surgical site infection developed in 2 patients. In the control group, postoperative subileus developed in 2 patients, superficial incisional surgical site infection in 2 patients, and atelectasis in 1 patient. These complications were classified as grade 1-2 according to the Clavien-Dindo classification.

The duration of the operation was longer in the ISLA group ($p=0.006$). There was no statistically significant difference in either hospital stay or drain usage ($p=0.841$ and $p=0.708$, respectively). The demographic and clinical characteristics of the ISLA and control groups are shown in Table 1.

Discussion

In recent times, there has been an extraordinary surge in interest in aesthetics and cosmetology, leading individuals to place greater emphasis on their appearance than ever before. Consequently, surgical scars have emerged as a significant concern. People resort to various measures such as anti-scar creams, tattoos for camouflage, and other methods to conceal surgical scars, underscoring the pressing need for innovative surgical techniques. All of these lead to the development of new surgical techniques and natural orifice transluminal endoscopic surgery procedures. These procedures, which are performed without any incision on the skin, are becoming more popular day by day (12). Our aim in this study is to present the ISLA method and its early results, which are similar to those of the standard method but in a more aesthetic way.

The benefits of standard LA over the open technique are mirrored in ISLA. These include the potential for extensive intra-abdominal exploration, reduced hospitalization duration, diminished postoperative pain and reduced narcotic usage, earlier resumption of normal activities, and decreased risk of wound infection (3,13). Our study found no significant disparities between groups regarding hospital stay, wound infection,

Table 1. Comparison of demographic and clinical characteristics between ISLA and control groups

		Group 1, ISLA (n=33)	Group 2, Control (n=33)	p
Age (median-IQR)		22.0-6	25.0-9	0.306
Sex	Female, n (%)	17 (51.5)	23 (69.7)	0.131
	Male n, (%)	16 (48.5)	10 (30.3)	
BMI (median-IQR)		24.0-2	24.0-3	0.112
ASA score	ASA I, n (%)	29 (87.9)	28 (84.8)	0.720
	ASA II, n (%)	4 (12.1)	5 (15.2)	
WBC (x10 ⁶ /L) (median-IQR)		13,000-3,000	14,000-4,000	0.820
CRP mg/L (median-IQR)		9.0-8	13.0-8	0.118
Length of hospital stay (hr) (median-IQR)		24-0	24.0-0	0.841
Complication	Yes, n (%)	3 (9.1)	5 (15.2)	0.708
	No, n (%)	30 (90.9)	28 (84.8)	
Operation time (min) (median-IQR)		50.0-18.0	40.0-5.0	0.006
Lap app grade	Grade 0, n (%)	1 (3.0)	1 (3.0)	0.650
	Grade 1, n (%)	6 (18.2)	5 (15.2)	
	Grade 2, n (%)	22 (66.7)	19 (57.6)	
	Grade 3A, n (%)	4 (12.1)	8 (24.2)	
Presence of drain	Yes, n (%)	3 (9.1)	5 (15.2)	0.708
	No, n (%)	30 (90.9)	28 (84.8)	

ISLA: Invisible scar laparoscopic appendectomy, IQR: Interquartile range, BMI: Body mass index, ASA: American Society of Anesthesiologists, WBC: White blood cell, CRP: C-reactive protein, hr.: Hour, min.: Minute

and other early postoperative complications. However, due to the lack of recorded discharge prescriptions, the impact of postoperative antibiotics on groups, particularly concerning complications like wound infection, remains unknown. The primary advantage of ISLA lies in its cosmetic appeal. Its superiority in aesthetics over standard or conventional open surgery is evident. By positioning all port entry sites beneath the patient's underwear, ISLA eliminates any visible scarring and allows patients to wear clothing of their choice. Furthermore, the incisions at the port entry points, aligned parallel to the skin's Langer's lines, promote optimal tissue healing.

The method by which the initial trocar entry should be made in laparoscopic surgery and which method is safer have been the subject of many studies. Ahmad et al. (14) reported in their meta-analysis that there is not enough evidence to support the use of one laparoscopic entry technique over another. The question of surgical safety always comes to mind in this technique. Contrary to popular belief, when appropriate patient selection occurs, the procedure is as safe as standard LA. The instruments used and the surgery performed are the same as the standard ones. In this technique, only the port entry locations are different. The most important point is that the first port is entered into the abdomen properly and safely (15). Since the method used by Ersoz et al. (16) for laparoscopic cholecystectomies is applied in appropriate cases in our clinic, our experience in entering the first port safely has increased over time. We recommend that the first port be entered via the open method from the suprapubic region, as described above. Although entering the first port from the lateral side may be easy in very thin patients, it may become difficult as BMI increases. We do not recommend routine Foley insertion before starting the surgery, but

patients should ensure they urinate before being taken to the operating room. We do not find it safe to insert a Verres needle to achieve pneumoperitoneum from the first port entry site. Since we cannot sufficiently retract the abdominal wall in the suprapubic region from the intra-abdominal organs, we think that it may cause unwanted organ injuries, especially the bladder. In addition, accidental air insufflation into the preperitoneal area may make the continuation of the surgery very difficult. Entering the first port after reaching the abdomen with the Verres needle from the left upper quadrant, at the Palmer point, and providing pneumoperitoneum, is not a method we recommend. The lengthening of the peritoneum and preperitoneal area under the arcuate line while entering the trocar makes trocar insertion into the abdomen difficult. If this method is to be chosen, we recommend that the first port be entered with a video trocar. The first port entry may take more time and be more troublesome than standard LA. Once the first port is entered, the rest of the surgery is the same as standard LA, except for working in a slightly more uncomfortable position. After entering the ports, the camera is replaced with a 10/12 mm trocar on the left lateral side to increase the comfort of the surgeon.

Study Limitations

The biggest limitations of our study are: it is retrospective; the sample size is small; and patients are selected based on the method. The main reason for the small sample size is that ISLA was performed by only 2 surgeons who worked in our institution for a short time during the same period. In our study, the operation time was found to be longer in the ISLA group. This may be explained by the difficulty of the first trocar entry. The surgery times we calculate are based on the patients'

intubation and extubation times in the anesthesia form and may give misleading results. Although a difference of 10 minutes is statistically significant, we think this period is acceptable when applying an unconventional method in surgical practice and that the difference will decrease further as surgeons become more experienced. Likewise, not knowing the discharge prescriptions can be misleading regarding the development of postoperative wound infection. Prospective studies in larger patient groups are needed to prove the reliability of this method.

Conclusion

As a result, the prevalence of LA, its frequent performance in a young patient group, and the dramatic increase in aesthetic concerns among people, recently lead to an increase in the number of patients waiting for better cosmetic improvement, regardless of the surgical procedure performed. All these reasons lead surgeons to develop new methods that do not create additional costs, low complication rates, and a short learning curve. In this study, we propose modified LA as a new procedure, performed with standard laparoscopic instruments and resulting in invisible scars below the bikini line, that can be applied easily and safely, does not require additional costs, and has high patient satisfaction. We believe that in appropriate cases, in experienced hands, this method is as safe as standard LA, but more aesthetic. We recommend that surgeons carefully select the appropriate patient and apply this method only after gaining sufficient experience in using standard LA and laparoscopic instruments.

Ethics

Ethics Committee Approval: The study commenced following approval from the University of Health Sciences Türkiye, Erzurum Faculty of Medicine Scientific Research Ethics Committee (approval number: 119, date: 10.07.2024).

Informed Consent: All patients were informed about this procedure before the operation and their informed consent was obtained.

Footnotes

Authorship Contributions: Surgical and Medical Practices - A.D., H.Ş., M.G., E.K., Ö.A., M.Gül.; Concept - E.K., Ö.A., Design - E.K., Ö.A.; Data Collection or Processing - M.G., M.Gül.; Analysis or Interpretation - M.G., M.Gül.; Literature Search - A.D., H.Ş., M.G.; Writing - A.D., H.Ş., E.K.

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