

ORIGINAL RESEARCH

Minimization of Wound with the Assistance of a Needle Grasper in Single-Incision Laparoscopic Appendectomy

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ABSTRACT

Background: The present study was conducted for evaluating minimization of wound with the assistance of a needle grasper in single-incision Laparoscopic Appendectomy (SILA). **Materials & Methods:** A total of 30 appendectomies were SILA and 10 appendectomies were NASILA. NASILA involved creating a 12-mm umbilical incision and introducing a glove port. A needle grasper was then inserted through a 2.5-mm wound in the suprapubic area. In contrast, SILA entailed making a 2.5-cm transumbilical wound. The results were analyzed using SPSS software. **Results:** A total of 30 patients were enrolled in the SILA group, with a male proportion of 43.3%, and 10 patients were included in the NASILA group, with a male proportion of 50.0%. There was a notable difference in the distribution of appendicitis status between the two groups. **Conclusion:** NASILA exhibited higher operative convenience compared to SILA.

Keywords: Laparoscopy, Single Incision, Needle Grasper.

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INTRODUCTION

Acute appendicitis is one of the most common causes of acute abdomen worldwide. It has a high incidence rate and necessitates emergency care. Early surgical intervention is a main treatment strategy.¹⁻³ With the development of minimally invasive surgical techniques and improvement of surgical instruments, laparoscopic appendectomy has gradually replaced open surgery and is now the most common surgical approach. Many laparoscopic techniques are currently available. However, considering the mild inflammatory status and uncomplicated surgical procedures for patients with acute uncomplicated appendicitis, better postoperative outcomes can be expected if the numbers and length of surgical incisions can be further reduced. Acute appendicitis is a major health issue worldwide, and in particular, the coronavirus disease 2019 pandemic has been associated with a significant increase in the proportion of patients with complicated appendicitis.^{4,5} Although the roles of medical or surgical interventions remain controversial, early surgery is considered an effective option and has been widely adopted.^{6,7} With socioeconomic development and increasing demands

on cosmetic appearance and minimally-invasive surgery, more minimally-invasive surgical procedures (e.g., endoscopic surgeries) without creating an incision in the abdominal wall, have emerged.⁸ However, their applications have been limited due to the high levels of operating difficulties and equipment requirements, and long learning curves. In contrast, since George Kelling described laparoscopy in 1901,⁹ laparoscopic surgery has been increasingly applied in clinical settings due to its relatively simple operation, short learning curve, and feasibility for comprehensive abdominal exploration. Compared with the traditional three-port approach, single-port laparoscopy has been confirmed to be effective and safe in the treatment of acute appendicitis, along with many other advantages, including less trauma, less pain, shorter hospital stay, and improved cosmetic effect.¹⁰⁻¹²

Single-incision laparoscopic surgery (SILS) was first described in the gynecology literature in 1969; tubal ligation being the first procedure routinely performed through a single incision at the umbilicus.^{13,14} The first published report in general surgery appeared in 1992 with appendectomies.¹⁵ Currently, the debate

continues of whether SILS has anything more to offer to the patient, to the surgeon, or to the health care industry compared with the conventional laparoscopic approach. As SILS' media coverage rises along with its popularity amongst surgeons, the importance of this debate gains more significance. Single-incision laparoscopic appendectomy (SILA) has been proposed as an evolutionary step in minimal invasive surgery, and recent systemic reviews and pooled analyses have demonstrated that SILA is comparable to conventional laparoscopic appendectomy for acute appendicitis in adults in terms of operation time, length of postoperative stay, pain scores, and conversion or complication rates.¹⁶ A meta-analysis of randomized controlled trials comparing SILA and conventional laparoscopic appendectomy showed that SILA is comparable to conventional laparoscopic appendectomy in selected patients, although SILA takes a longer time, and is more technically demanding.^{17,18}

The current practice of residents performing appendectomies is known to be safe and is not associated with a higher incidence of complications.¹⁹ The operative duration and complication rates were significantly reduced with the increased experience of residents.²⁰ Recently, it has been observed that SILA by a surgical trainee could be performed safely with good postoperative outcomes and short learning curves.²¹ Hence, this study was conducted to assess the effectiveness of needle grasper, which is utilized in the SILA (NASILA) procedure and is known as "Endo Relief".

MATERIALS & METHODS

A total of 30 appendectomies were SILA and 10 appendectomies were NASILA. NASILA involved creating a 12-mm umbilical incision and introducing a glove port. A needle grasper was then inserted through a 2.5-mm wound in the suprapubic area. In contrast, SILA entailed making a 2.5-cm transumbilical wound. The medical records of patients

who underwent either SILA or NASILA were retrospectively examined. The study compared operative and short-term postoperative outcomes, as well as the results of telephone interviews assessing scar appearance. Individuals under the age of 19 and patients not utilizing patient-controlled analgesics (PCA) were excluded due to potential variations in pain expression. Pregnant individuals and those who underwent an interval appendectomy were also excluded from the study. The intensity of postoperative pain was assessed utilizing a Numerical Pain Intensity Scale (NPIS), where a score of 0 indicated no pain and 10 represented the worst pain imaginable. Mann-Whitney U test was done. Fisher test was done. The results were analysed using SPSS software. A P value <0.05 was considered statistically significant.

RESULTS

A total of 30 patients were enrolled in the SILA group, with a male proportion of 43.3%, and 10 patients were included in the NASILA group, with a male proportion of 50.0%. There was a notable difference in the distribution of appendicitis status (not perforated: perforated without abscess: perforated with abscess) between the two groups. In the SILA group, additional trocars were inserted in 4 patients. The NASILA group exhibited a significantly shorter operative time compared to the SILA group. The NASILA group demonstrated a significantly lower highest numerical pain intensity score during the initial 24 hours after surgery compared to the SILA group. However, no significant differences were observed in terms of hospital stay and postoperative complications between the two groups.

Details of postoperative complications: 1 wound granuloma (C-D I), 1 superficial SSI (C-D II), 1 deep SSI (C-D II), 1 intraabdominal SSI (C-D II), 1 abdominal wall abscess (C-D IIIa) in the SILA group, and 1 superficial SSI (C-D II) in the NASILA group.

Table 1: Characteristics

Variable	SILA (n=30)	NASILA(n=10)	P-value
Male	13(43.3%)	5 (50%)	0.612
Age (years) Mean	45.8	36.4	0.933
Number of comorbidities			
0	20(66.7%)	7(70%)	0.612
1	7(23.3%)	2(20%)	
2	3(10%)	1(10%)	
Status of appendicitis			
Not perforated	20 (66.7%)	3(30%)	0.02 (Significant)
Perforated without abscess	9(30%)	5(50%)	
Perforated with abscess	1(3.3%)	2(20%)	

SILA: single-incision laparoscopic appendectomy; NASILA: needle grasper-assisted SILA

Table 2: Operative Outcomes

Variable	SILA (n=30)	NASILA (n=10)	P value
Operation time (minutes)			
Mean	60.5	49.6	0.01 (Significant)

Extent of surgery			
Appendectomy	26(86.7%)	9(90%)	0.712
Cecectomy	4 (13.3%)	1(10%)	
Additional trochar: yes	4(13.3%)	0 (0%)	0.418
Conversion to open: no	30(100%)	10(100%)	-
Drain: inserted	2 (6.7%)	1(10%)	0.786
EBL(mL), mean	18.2	24.4	0.331

NA: Not applicable; EBL:Estimated blood loss

Table 3: Postoperative outcomes

Variable	SILA (n=30)	NASILA (n=10)	P value
Highest NPIS for first 24 hours after OP (mean)	3.4	2.5	0.02 (Significant)
Additional painkiller during first 24 hours after OP			
Yes	3 (10%)	0(0%)	0.632
Hospital stays (days)			
Mean	3.2	2.6	0.132
Complication (C-D classification)			
0	25 (83.4%)	9(90%)	0.988
I	1(3.3%)	0	
II	3(10%)	1(10%)	
IIIa	1(3.3%)	0	

NPIS, numeric pain intensity scale; OP, operation; C-D, Clavien-Dindo

DISCUSSION

The single-incision laparoscopic appendectomy (SILA) is a virtually "scarless" procedure because a single port is located in the umbilicus.²² It results in reduced postoperative pain, minor discomfort, and fewer surgical scars.²³ A new surgical concept usually raises many questions regarding safety, usefulness, appropriateness, applicability, and cost.²⁴ The cost of novel surgical procedures is always a significant issue in most countries. The use of these devices in SILA may lead to an increase in healthcare expenses. Numerous authors have developed their own SILA devices.²² Hence, this study was conducted to assess the effectiveness of needle grasper, which is utilized in the SILA (NASILA) procedure and is known as "Endo Relief".

In the present study, a total of 30 patients were enrolled in the SILA group, with a male proportion of 43.3%, and 10 patients were included in the NASILA group, with a male proportion of 50.0%. There was a notable difference in the distribution of appendicitis status (not perforated: perforated without abscess: perforated with abscess) between the two groups. In the SILA group, additional trocars were inserted in 4 patients (13.3%). The NASILA group exhibited a significantly shorter operative time compared to the SILA group. A study by Kim BJ et al, evaluated the efficacy of our newly developed needle grasper (Endo Relief)-assisted SILA (NASILA). Hospital stay, postoperative complications, and complaint of scar were not significantly different between the 2 groups. NASILA was not inferior to SILA regarding cosmetic results. Operative convenience is higher in NASILA than in SILA, and the smaller surgical wound in NASILA minimizes postoperative pain.²⁵

In the present study, furthermore, the NASILA group demonstrated a significantly lower highest numerical pain intensity score during the initial 24 hours after surgery compared to the SILA group. However, no significant differences were observed in terms of hospital stay and postoperative complications between the two groups. Another study by Park BK et al, compared the efficacies of newly developed needle grasper-assisted (Endo Relief) single-incision laparoscopic appendectomy (NASILA) and single-incision laparoscopic appendectomy (SILA). The operative time and estimated blood loss did not differ significantly between both groups. The immediate postoperative pain score, i.e., the primary endpoint, was significantly lower in the NASILA group than in the SILA group. The complaints for scar status 1 month postoperatively did not differ significantly between the groups.²⁶ Laparoscopic appendectomy has replaced open appendectomy owing to its considerable advantages.¹⁵ For more than a decade, SILA has emerged as the preferred technique, since it yields better cosmetic outcomes.²⁷ However, since SILA involves the creation of only one wound, albeit a large one, it is reportedly associated with greater pain compared to conventional TILA.²⁸ Moreover, performing the procedure through one incision may lead to procedural difficulties during SILA due to the interference between instruments. These problems limited the widespread use of SILA. A retrospective study revealed the feasibility of NASILA with respect to the lower intensity of postoperative pain and shorter surgical time compared to SILA.²⁵ Advantage of NASILA is that there is less interference between the surgical tools, which makes surgery more convenient than SILA. SILA is associated with considerable interference between several

instruments, including cameras, which are inserted through a single hole.³⁰⁻³² The interim analysis in another study showed that the pain was significantly more severe after SILA, leading to discontinuation of the study.³² One study reported that although there was no difference during resting state, the pain intensity was higher when exercising or coughing after SILA.³³ In contrast, some studies found no difference in the pain associated with SILA and TILA. Additionally, a recently published meta-analysis found no difference in the pain associated with the 2 surgeries.³⁴

CONCLUSION

NASILA demonstrated non-inferiority to SILA in terms of cosmetic outcomes. NASILA also exhibited higher operative convenience compared to SILA, and the smaller surgical wound associated with NASILA contributed to minimizing postoperative pain.

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