

IMPLEMENTATION OF SINGLE INCISION LAPAROSCOPIC APPENDECTOMY AT A TERTIARY INSTITUTION IN THE BAHAMAS

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ABSTRACT

Background:

The aim of this study was to examine the inauguration of single-port laparoscopic appendectomy (SILA) for un-complicated appendicitis and demonstrate its efficacy and safety.

Methods:

Thirty-two patients who underwent single-port laparoscopic appendectomy between January 2014 and December 2014 were compared retrospectively with 20 prior consecutive patients who underwent surgery in the three-port manner. Length of hospital stay, operative time, conversion rate, and complications were used as the indicators of effective implementation.

Results:

Demographics were similar between the single-port and three-port groups. In the SILA series, operative duration was unchanged after the first 10 cases. An operative duration less than that of the conventional three-port method could be achieved after 30 cases

Conclusions:

Single-port laparoscopic appendectomy is a safe and feasible procedure. The learning curve could be overcome safely without major complications. Our preliminary analysis showed that 30 cases are sufficient to achieve an equivalent operative duration compared with conventional three-port laparoscopic appendectomy.

MeSH keywords: Laparoscopy, single incision, single port, appendectomy, CLA, CTLA SILC, SILS, LigaSure

1. INTRODUCTION

Appendectomy is one of the most common operations done by general surgery (1,9). In the Western World, appendicitis incidence is approximately 8% (1,2). With the advancement of minimally invasive surgery, open appendectomy that stood as the gold standard for more than a century has been replaced by laparoscopic appendectomy (1). Laparoscopic appendectomy has proven to result in decreased pain, fewer postoperative complications, and shorter hospitalization compared with conventional open appendectomy (2-7). Single-incision laparoscopic surgery, which emphasizes reducing the number and/or size of incisions that leads to better cosmesis, has been proposed recently (3-7). Other studies have produced conflicting reports about these advantages (3).

Management of acute appendicitis has been reported as one of several advancements in the single-incision method. Single incision laparoscopic appendectomy has been shown to be effective and safe for un-complicated appendicitis. The concept of inline viewing is utilized in single-port laparoscopy. This technique is more demanding than conventional three-port laparoscopic appendectomy. Retraction is compromised and there is difficulty in manipulating the instruments (8-12).

Concern remains about the cost-effectiveness of learning this newly developed laparoscopic surgical procedure. To test the feasibility and safety of SILS procedures, this approach has been used for relatively simple procedures, such as appendectomies and cholecystectomies (1,19,20). This study was conducted to define the learning curve for single-port

laparoscopic appendectomy and to evaluate the surgical safety during the learning period.

2. PATIENTS AND METHODS

At Doctors Hospital in Nassau Bahamas, approximately 1000 patients present annually to our emergency department for evaluation of abdominal pain. Data was collected using the Meditech electronic record keeping system. Acute appendicitis was diagnosed by either clinical manifestations or imaging studies. Abdominal computed tomography and ultrasonography were performed depending on clinical presentation. The patients who were managed non-operatively were excluded. From January 2014 and December 2014, 78 appendectomies were performed either laparoscopically or open. During this period, 38 patients underwent single-port laparoscopic appendectomy, and 32 patients were diagnosed as having un-complicated appendicitis intraoperatively. Complicated appendicitis was defined as either a perforated appendix or abscess formation due to perforation, thus 6 cases were excluded from our analysis. Nevertheless, our 6 cases of complicated appendicitis were managed successfully laparoscopically with drain placement in one patient and one conversion. Conversion was defined as the placement of additional port(s) or having to perform an open appendectomy. At our institution, a single surgeon performed all single-port laparoscopic appendectomies. To ensure standardization, the charts of this surgeon's cases over the previous year were examined. Twenty consecutive patients who had undergone three-port laparoscopic appendectomy from January 2013 to

December 2013 were also reviewed. Five additional patients were also excluded from this data set. Data and outcomes were compared between patients who received single-port laparoscopic appendectomy (SILA) and those who received conventional three-port laparoscopic appendectomy (CTLA). Patient demographic and clinical data, including age, sex, body mass index, and imaging study results, were recorded. Operative time and conversion from single-port to three-port laparoscopic appendectomy were recorded as well. All patients were commenced on oral intake within 6 hours of operation. Any deviations from this were recorded. The length of hospital stay, and complications were reviewed.

OPERATIVE METHOD

Patients were placed in a supine position with arms placed to the sides. The surgeon was on the patient's left and the assistant to the right of the patient. A television monitor and the insufflator system Karl Storz HD were placed to the right leg of the patient. A 2.0–2.5 cm vertical trans-umbilical skin incision was made and directed down into the peritoneum (Fig. 1). Vicryl 2/0 stay sutures were placed at the fascial end of incision to facilitate ease of port introduction. A special single incision port (GelPOINT™ port) was placed through the incision using retraction on stay sutures (Fig. 2). The GelPOINT™ advanced access platform enables a single incision approach by facilitating triangulation of standard instrumentation through a single incision.

The GelPOINT™ platform accommodates varying abdominal walls and incision sizes, provides continuous access and ensures improved articulation

of 5mm to 12mm instruments. The Alexis wound protector/retractor offers atraumatic retraction and protection, maintains moisture at the incision site, while providing convenient extracorporeal resection and specimen retrieval (Figs. 3 and 4).

After pneumoperitoneum was established using 15mmHg, a 10/12mm trocar and 2 x 5-mm trocars were then inserted through the GelPOINT™ in a triangular fashion. The platform was positioned to place the 10/12mm port at the 7 o'clock with other ports at 12 and 5 o'clock respectively. We used a standard length 10-mm 30° laparoscope placed in the 7 o'clock position. A straight grasper was used for lateral retraction in 5 o'clock port and 12 o'clock was used as the working port. Dissection of meso-appendix and division of the appendicular artery was performed using LigaSure™. A standard Maryland's dissector was used at times to aid dissection. The jaws were placed at a safe distance from the bowel wall to avoid injury. The base of the appendix was divided using a 35mm linear stapler. There was no need for a specimen bag retrieval of the appendix. The appendix was simply removed via the GelPOINT™ systems after disengagement of the cap. The Alexis wound protector isolated the wound edge. If pus was noted, the abdominal cavity was irrigated. Uncapping of platform deflated the abdomen. The Alexis O-ring was subsequently removed.

3. RESULTS

In total, 32 consecutive patients with un-complicated acute appendicitis treated with single-port laparoscopic appendectomy from January 2014 to December 2014 were enrolled in this

study. There were 20 men and 12 women with a mean age of 30.5 years (range, 5–47 years). Body mass index data for children ages 5 and under were not calculated. Despite this, there was no significant difference in average body mass index between the groups of single-port laparoscopic appendectomy (n=32) and three-port laparoscopic appendectomy (n=20). The preoperative image study including computed tomography and ultrasonography did not show a significant difference between these two groups of patients either.

The use of dissection instruments did not significantly differ between the single-port and three-port groups. LigaSure™ was used for the dissection of the meso-appendix in all cases. Energy transection is very effective in achieving hemostasis of the appendicular artery (28). Variables, including operative duration, number of conversions, length of hospital stay, and any complications, between the single-port and three-port groups are compared in Table 2. The operative duration of single-port groups was shorter than that of three-port groups (31.7 minutes versus 43.6 minutes). This was unexpected. This may

be due to the overall learning curve for laparoscopy as a whole with conventional cases recorded early in the surgeon's career. There were no cases converted from the single-port method to conventional three-port laparoscopic appendectomy or open appendectomy. The mean length of hospital stay was 2.1 days in the SILA group and 2.3 days in the CTLA group. No statistical difference was found between these two groups of patients in the results of the length of hospital stay. Six complications occurred in SILA group, one wound infection and two patient with paralytic ileus. All improved after conservative treatment with antibiotics and bowel rest respectively. No patient developed major complications during hospitalization. The recruited 32 patients who underwent single-port laparoscopic appendectomy were divided into two groups; the first 10 patients were placed in one group and the remainder in another group. Although no overall difference was found in operative duration among these groups, the anticipated change was a reduction in operative duration and complications with the accumulation of experience.

Table 1 Single incision Laparoscopic Appendectomy-Series. (n=32)

	Total	1 st 10 procedures	After 10 procedures
Mean Age	30.5(5-47)	28.4(5-47)	29.7(5-46)
Mean BMI (kg/m²) (n=30)		26.3	
Mean operative time (mins)	31.7	30.5	32.3
Blood loss	Minimal	minimal	minimal
Mean length of postoperative stay	2.1	2.2	2.1
Complications (n)		-wound infection (1) -prolonged ileus (2)	
Pathology (%)		Acute pathology 69%; rest normal	
Cosmesis score (/10)		patient dissatisfied with wound	

Table 2 Single port appendectomy versus conventional three port appendectomy in uncomplicated consecutive cases

	SILA(n=32)	CTLA(n=20)
Mean age	30.5	32.4
Mean BMI (kg/m-2)	26.3	25.4
Mean operative time (mins)	31.7	43.6
conversions	nil	nil
Length of Stay	2.1	2.3
Complications	Wound infection -1 Prolonged ileus-2	Wound infection-2 Prolonged ileus-3

4. DISCUSSION

Our main finding was that no significant improvement in operative time was accomplished after the first 10 cases for SILA. However, later in our series, a number of our cases were noted to be of shorter duration. Six cases had prolonged operative times due to anatomical difficulties. Also, staff unfamiliarity with the procedure and instruments may have led to periods of unduly delays. A possible explanation for the findings in the SILA group may be that single-port laparoscopic appendectomy can be safely performed early in the learning curve by surgeons who are already experienced in conventional laparoscopic surgery (1).

Concern remains regarding the cost-effectiveness and safety of learning and performing SILA. Compromised manipulation and limited view contributes to the higher degree of technical expertise required for SILA. We excluded complicated appendicitis in our study but we were able to successfully manage our 6 excluded patients with no conversions, or wound infections but as expected, longer hospital stays due to ileus or the need for therapeutic antibiotic courses. Wound

infection was present for each group, but insignificant in our study. We routinely clean the umbilicus with Bethidine during the preoperative preparation of the skin and postoperatively and it is assumed that this is sufficient to reduce the rate of surgical site infection. Due to the length of our study, we did not examine long-term complications, such as umbilical herniation. This will be reviewed in another study of this cohort of patients (1).

Attempting simple procedures like SILS appendectomies and cholecystectomies enhances technical skills for more advanced procedures. For surgeons completely unfamiliar with laparoscopic surgery, the minimum experience required to achieve a notable decrease in operative duration and length of hospital stay is reported to be about 20 cases (20-27). Initial reports suggested a significant increase in operative times for laparoscopic appendectomy (3). As in our study, these longer times occurred early in the learning curve when many surgeons were learning this approach. To save time we emphasize the team approach. We advocated using the same familiarized staff as much as possible. Because of the relative small number of cases done, we

use the same anesthetist and surgical assistant to maximize the learning experience. We have team meetings to discuss the procedural steps and ensure knowledge of the equipment. Having individuals who are knowledgeable with the procedure allows for greater efficiency and decreased errors.

We observed a general decrease in operative time as the surgeon's experience with single-port laparoscopic appendectomy increased. With the accumulation of surgical experience, the operative duration for single-port laparoscopic appendectomy surpassed the operative duration to that of CTLA. Our series did not show a significant reduction in complications, and length of hospital stay. The maturation of laparoscopic skills can minimize the complication rate to less than 10% (22-26).

Because our average length of hospital stay was only 2.1 days, it is too short to display significant differences compared with other groups. Our study was limited by the fact that our learning curve is only reflective of a single surgeon's experience. Larger studies are required to delineate the learning curve in the general population. Also we excluded 6 cases of complicated appendicitis. Nevertheless, these cases were successfully completed laparoscopically. It would be interesting to examine how these experiences impacted surgeon expertise and thus the learning curve. Because no improvements in operative duration were observed after 10 cases, we suppose that the learning benefit of the 6 cases is negligible. Anatomical and pathological differences continue to contribute to operative time. Many of the biases present in a retrospective study of this nature could be eliminated by a prospective study. Thus

overall, this study has shown that postoperative results of the single-port laparoscopic appendectomy are similar to those of conventional three-port laparoscopic appendectomy. We believe that our results suggest that the single-port laparoscopic appendectomy may also be an alternative choice in the emergency setting. Our study demonstrates that a surgeon with experience in conventional three-port laparoscopic appendectomy can quickly learn the skills required to adopt single-port laparoscopic appendectomy

5. CONCLUSIONS

Our series demonstrate equivocal results between single port laparoscopic appendectomy and conventional laparoscopic appendectomy. Simple procedures such as appendectomy will allow surgeons to learn skills required for more complex procedures. However, SILA should not yet be considered the gold standard for appendectomy. Larger series of long-term data examining multiple variables are important for making recommendations on the use of single port laparoscopy implementation.

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