International Journal of Surgery 21 (2015) 1–7

Contents lists available at ScienceDirect

International Journal of Surgery

journal homepage: www.journal-surgery.net

Original research

Novel approach of single-port laparoscopic appendectomy as a solo surgery: A prospective cohort study

Say-June Kim, Byung-Jo Choi, Sang Chul Lee*

Department of Surgery, Daejeon St. Mary's Hospital, College of Medicine, The Catholic University of Korea, Daejeon, Republic of Korea

HIGHLIGHTS

- Recently, increasing appendectomies are performed using single-port laparoscopic surgery (SPLS).
- In SPLS appendectomy, the role of human assistant does not seem to be absolutely critical one.
- Therefore, we effectively replaced the human assistant to a mechanical camera holder during SPLS.
- Our operations (solo-SPLS appendectomy) did not prolong operation time or increase complications.
- Solo-SPLS appendectomy could be safe and feasible when performed by surgeons competent with SPLS appendectomy.

ARTICLE INFO

Article history:
Received 8 April 2015
Received in revised form
21 April 2015
Accepted 13 July 2015
Available online 17 July 2015

Keywords:
Appendectomy
Laparoscopy
Solo surgery
Single-port laparoscopic surgery
Camera holder

ABSTRACT

Background: Recent advances in medical equipment and surgical techniques have enabled solo surgery, wherein a surgeon operates alone without the participation of other surgical members. However, the application of solo surgery in single-port laparoscopic surgery (SPLS) has been rarely reported.
Methods: Prospectively collected databases of 60 patients who underwent solo-SPLS for appendicitis between March 2013 and June 2014 were retrospectively reviewed. Making a transumbilical incision into the peritoneal cavity was facilitated by using a Lone Star self-retaining retractor. After the establishment of a single port through the umbilicus, we installed a mechanical adjustable camera holder (Endoworld®LAP53 Holding Systems). It was anchored to the operating table rail and firmly held the laparoscope with a possibility to adjust the same as required by the operator. The operative method was identical to the SPLS appendectomy, except for the use of these instruments.
Results: The median operation time was 50 min (25–120). None of the patients required open conversion, insertion of an additional port or help of a human assistant. The median length of hospital stay for all patients was 1.0 day (range: 1–3 days). The median dosage of required intravenous analgesics (ketorolac, 0.1 mg/kg of body weight) was 0.0 ampoule (0–4). The median interval to initiation of solid diet was 1 day (1–2). The incidence of postoperative complications was 8.3% (5/60).
Conclusions: Our results shows that solo-SPLS appendectomy could be performed without increasing operation time or postoperative complications when performed by a surgeon competent in performing SPLS appendectomy.

1. Introduction

Laparoscopic surgery has offered substantial benefits to the patients, including improved cosmesis, reduced pain, faster recovery time, and shorter hospitalization [1–3]. Laparoscopic surgery, however, has inevitably resulted in the dissociation of the operator's hand and eye; the camera is directed not by the operating surgeon himself but rather by a camera assistant. Therefore, the surgeon often suffers inconveniences resulting from indirect observation and manipulation. In addition, the camera assistant also tends to feel tired and difficult in focusing due to monotonous task of guiding the camera. Ultimately, failure to achieve optimal coordination can lead to disturbances in the surgeon's concentration, resulting in the detriment of the procedure. To overcome these difficulties, the novel concept of solo surgery has been proposed [4,5].

* Corresponding author. Department of Surgery, Daejeon St. Mary's Hospital, College of Medicine, The Catholic University of Korea, Daeheung-dong 520-2, Joong-gu, Daejeon, Republic of Korea.
E-mail address: zambo9@catholic.ac.kr (S.C. Lee).

http://dx.doi.org/10.1016/j.ijsu.2015.07.010
1743-9191/

Solo surgery is defined as the practice wherein a surgeon operates alone without the assistance of any other members of a surgical team, except for a scrub nurse. Solo surgery is established by replacing human assistant(s) by mechanical adjustable instrument holder(s). Thus far, solo surgery has been mostly applied to multiport laparoscopic surgery [5–8]. Therefore, two or more instrument holders have been frequently used in such solo operations, rendering the process fairly complicated. In this study, we attempted to overcome these complicities by applying the techniques for single-port laparoscopic surgery (SPLS) into solo surgery. We termed this procedure "solo-SPLS". Solo-SPLS has simplified solo surgery by reducing number of instrument holders. It can be reasonably postulated that solo-SPLS has the cost saving effect by reducing the number of operating members. On the other hand, it should be determined whether solo-SPLS would be associated with lengthening of operation times or worsening of clinical outcomes. Most of all, the introduction of this novel therapy should also guarantee patient safety and operative feasibility. Therefore, we were intended to explore the safety and feasibility of solo-SPLS by analyzing our early experience of 60 consecutive appendectomies by solo-SPLS technique.

2. Methods

2.1. Study design and data collection

This study was an analysis of database that had been prospectively collected, from patients who underwent solo-SPLS for acute appendicitis between March 2013 and June 2014 at the Department of Surgery of Daejeon St. Mary's Hospital, College of Medicine, the Catholic University of Korea. The study was approved by the ethics committee at Daejeon St. Mary's Hospital (IRB code: DC14RISI0051). The data were gathered from the patients' electronic medical records. Studies were assessed using the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) Statement [9].

In our institution, the first solo-SPLS appendectomy was performed in March 2013. We then accumulated solo-SPLS experience by applying the solo-SPLS technique to various operations, such as appendectomy, cholecystectomy, and splenectomy. From December 2013 onward, solo-SPLS was first attempted in all patients being operated for appendicitis, regardless of the history of prior laparotomy, degree of inflammation, obesity, or presence of comorbidities. Exclusion criteria for solo-SPLS appendectomy included suspicious malignancy, morbid obesity (body-mass index of >35 kg/m^2), American Society of Anesthesiologists physical status classification of IV or V, severe medical illness such as recent history of myocardial infarction, and refusal to participate in the study. In this study, we analyzed the first 60 patients who underwent solo-SPLS appendectomy in our institution.

Each patient was asked to self-estimate the severity of abdominal pain using a visual analogue scale (VAS), with scores ranging from 0 (no pain) to 10 (the worst pain imaginable) on the day of operation and postoperative days 1 and 2. With respect to postoperative complications, urinary retention was defined as the need for prolonged catheterization ($\geq$5 days) or as the reinsertion of a Foley catheter because of an inability to void urine.

2.2. Operative technique

Under general anesthesia, the patient was placed in a supine position. The patient's left arm was adducted in order to provide sufficient space for the operating surgeon. The operating surgeon was located on the left side of the patient. Only one operative monitor was required for solo-SPLS appendectomy; the monitor was placed on the opposite site of the operator, i.e., on the right side of the patient (Fig. 1).

After routine painting and draping of the patient, a vertical 10-mm transumbilical skin incision was made. We used a Lone Star retractor (3307G; Cooper Surgical, Trumbull, CT) for fascial exposure during solo-SPLS (Fig. 2). The Lone Star retractor system is a product designed for the maximum exposure of the narrow operative field with minimum effort. It has been mainly used in anal surgical procedures, such as anorectal anastomosis via the anal canal or anal fistula repair to facilitate the exposure of the anal canal. The Lone Star Retractor System consists of self-retaining retractor rings and elastic stays. After putting the Lone Star Retractor centered in the umbilicus, the first stay (3311-8G, 3-mm sharp hook, Cooper Surgical) was placed. The stay was pulled in the desired direction with the desired tension and was then placed in one of the slots of the retractor. Likewise, four stay sutures were placed counter-directionally to maximally expose the fascial layer of the umbilicus. With the fully exposed fascial layer, the fascia was transversely incised and the peritoneum was entered. At this time, two or three transfascial stay sutures were pre-established to facilitate later fascial closure.

Thereafter, a single-port device was inserted via umbilicus. Initially, we used a homemade glove port, which is mainly composed of a multi-trocar connected surgical glove and a wound retractor [10]. More recently, a commercial Glove port (431AT-2W, Nelis, Bucheon, South Korea) was typically used for the convenient reason. After the establishment of the single port, the abdomen was insufflated with CO_2 to a pressure of 12 mmHg. Then, the solo surgeon installed a mechanical adjustable camera holder (Endoworld®LAP53 Holding Systems, Karl Storz, Tullingen, Germany) by anchoring to the operating table rail. The camera holder has a

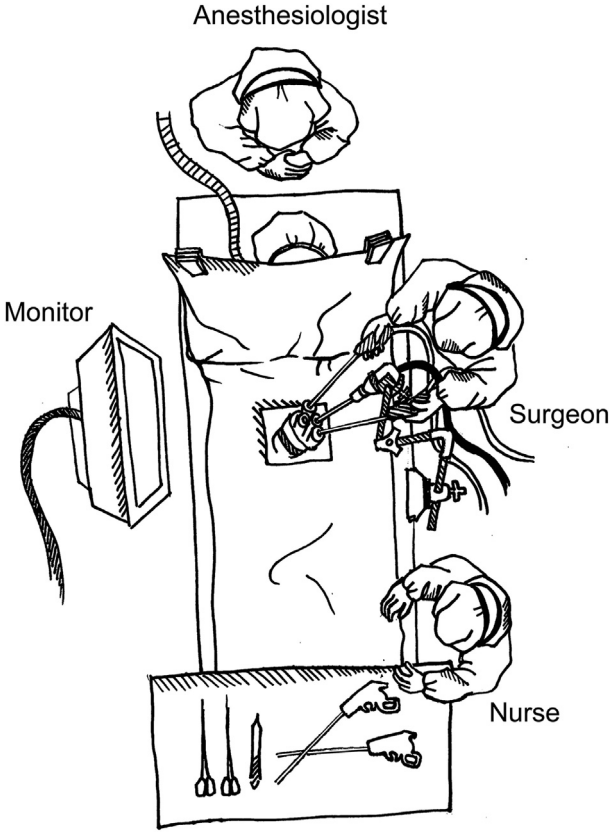

Fig. 1. Operative settings for solo-SPLS appendectomy.