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CASE REPORT

Modified technical protocol for single-port laparoscopic appendectomy using needle-type grasping forceps for acute simple appendicitis: A case report

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Abstract

BACKGROUND

Because of the mild inflammatory status in acute uncomplicated appendicitis, our team developed a novel technical protocol for single-port laparoscopic appendectomy using needle-type grasping forceps (SLAN) and achieved positive clinical outcomes. However, the intraoperative procedure lacked stability and fluency due to a series of problems highlighted by the small incision design of the protocol (only 1 cm long). Therefore, there is a growing clinical demand to further optimize the SLAN protocol.

CASE SUMMARY

An adult male patient was admitted for persistent right lower abdominal pain with preoperative computed tomography findings suggestive of appendicitis accompanied by localized peritonitis. A modified technical protocol for SLAN based on minimally invasive surgical principles was used, and the patient was confirmed to have acute simple appendicitis by postoperative pathological analysis. Postoperative recovery was uneventful, and no postoperative complications, such as incision infection or severe incision pain, were observed. The patient was discharged successfully on postoperative day 2.

CONCLUSION

The modified technical protocol of SLAN may be a new minimally invasive surgical alternative for patients with acute simple appendicitis.

Key Words: Acute appendicitis; Single-port laparoscopy; Appendectomy; Minimally invasive surgery; Case report

Core Tip: The single-port laparoscopic technique is widely used by surgeons worldwide because it results in minimal surgical stress and fast postoperative recovery. Our center first reported a modified protocol of single-port laparoscopic appendectomy using needle-type grasping forceps (SLAN) for an adult patient with acute simple appendicitis, further expanding the indications and safety of the initial protocol. The patient recovered smoothly after surgery, the pain response was mild, the umbilical incision was small and hidden, the cosmetic effect was good, and no postoperative complications were observed. Our results showed that the modified technical protocol of SLAN may be a preferential surgical option for acute simple appendicitis.

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INTRODUCTION

Acute uncomplicated appendicitis is mild, and early surgical resection remains an indispensable treatment despite controversy over the choice of antibiotics or further appendectomy[1-3]. In 2019, based on the minimally invasive surgical concept, our center designed a novel technical protocol for single-port laparoscopic appendectomy using needle-type grasping forceps (SLAN). The initial technical protocol reduced the size of the abdominal incision to only 1 cm, resulting in satisfactory clinical results, such as mild pain response, fast postoperative recovery, and good cosmetic results, especially compared with those of the conventional three-port laparoscopic appendectomy (CLA)[4-6].

However, given the 1-cm long umbilicus incision, which can contain only two 5-mm trocars simultaneously, many key technical issues, such as the difficulty of appendix retrieval, sterile gauze insertion and the instability of pneumoperitoneum pressure maintenance, are highlighted. Preliminary retrospective clinical results revealed that SLAN has a long operative time (mean 66 minutes)[6], which undoubtedly increases the burden of surgery on both patients and surgeons. Additionally, the inability to place longer Ham-o-lock clips increased the difficulty of surgery, prolonged the learning curve of surgery, and increased potential safety concerns. Therefore, our center further improved and optimized the initial technical protocol based on the concept of minimally invasive surgery.

CASE PRESENTATION

Chief complaints

A 56-year-old man was admitted to our hospital on April 16, 2024, with persistent right lower abdominal pain for 58 hours.

History of present illness

The patient had persistent right lower abdominal pain without a precipitating cause 58 hours prior, accompanied by fever, no nausea or vomiting, no shoulder back radiation pain, and no remission of abdominal pain after symptomatic treatment in the local hospital. He visited our hospital for further diagnosis and treatment.

History of past illness

The patient was previously healthy and had no history of abdominal surgery or surgical contraindications, such as severe cardiovascular or cerebrovascular disease.

Physical examination

The patient's temperature was 38.1 °C, and the right lower abdominal muscles were tense, accompanied by tenderness and rebound tenderness of the right lower abdomen region and weak bowel sounds.

Laboratory examinations

Through preoperative and postoperative 24-hour routine blood test results, interleukin 6 and C-reactive protein were detected and compared (Table 1), and the preoperative coagulation and biochemical function data were within normal ranges.

Table 1 Indicators for inflammatory-related tests preoperatively and 24 hours postoperatively

	Preoperative	Postoperative
WBC ($\times 10^9$/L)	6.41	7.12
NEU (%)	71.4	60.9
CRP (mg/L)	40.23	42.86
IL-6 (pg/mL)	13.2	6.74

WBC: White blood cell; NEU: Neutrophil ratio; CRP: C-reactive protein; IL-6: Interleukin-6.

Imaging examinations

A preoperative abdominal computed tomography scan revealed appendicitis with localized peritonitis (Figure 1).

FINAL DIAGNOSIS

Preoperative clinical evidence suggested a diagnosis of acute appendicitis with localized peritonitis.

TREATMENT

The surgical and clinical research protocols were followed, and informed consent was obtained before surgery. A modified SLAN technical protocol was used. General anesthesia was achieved with the patient lying flat, and the laparoscopic display screen was placed on the right side. A 1 cm incision was then made below the umbilicus, CO_2 pneumoperitoneum was established, a 13 mmHg pressure was applied, and a 1 cm trocar was inserted into the abdominal cavity. The position of the patient was changed so that they were head-down and left-leaning, with the surgeon standing to the lower left and the assistant standing to the upper right (Figure 2). A 5 mm caliber laparoscopic lens with 30 leaners (STORZ corporation, Germany) was inserted for abdominal exploration, and no collateral injury was observed. The prececal appendix was approximately 6 cm × 0.8 cm in size and was filled with edema, and the root of the appendix was slightly adherent. The fecal stones were not palpable. The incision was then lengthened 5 mm along the left side of the umbilicus, a 5 mm trocar (used for laparoscopic lens viewing) was inserted into the abdominal cavity, and needle-type grasping forceps (Approval No. Zsyjx 20140056; Hangzhou Kangji Medical Instrument Co., Ltd., Hangzhou, China) were placed at the McBurney point. Sterile gauze strips were inserted into the right iliac fossa to prevent bleeding and exudation. Longer Ham-o-lock clips were used to shut the root and distal parts of the appendix. An ultrasound scalpel was used to cut the mesangium of the appendix to the root, and the appendix was finally resected. To confirm that there was no bleeding or secondary injury, the sterile gauze strip was withdrawn, and a disposable bag was applied to remove the appendix smoothly through a 1 cm trocar to avoid contamination and infection of the incision. The CO_2 pneumoperitoneum was released, and the skin around the umbilical incision was disinfected with iodine and alcohol. Finally, the incision was sutured with 3-0 absorbable threads.

OUTCOME AND FOLLOW-UP

The surgical duration was 28 minutes. Postoperative 12-hour and 24-hour visual analog scale scores were all 1 point. The patient passed gas on postoperative day (POD) 1, was discharged with permission to resume daily activities and exhibited a well-healed incision on POD 2 (Figure 3A). Postoperative pathological results confirmed the diagnosis of acute simple appendicitis (Figure 3B). No postoperative complications, such as incision infection, incision hernia or intestinal obstruction, occurred 1 month after surgery.

DISCUSSION

Acute appendicitis is one of the most common acute abdominal conditions worldwide, and a minimally invasive and cost-effective surgical intervention would benefit 96.5–100/100000 adult patients annually[7], especially patients with acute uncomplicated appendicitis, including acute simple appendicitis and gangrenous appendicitis, which can induce mild inflammation[8]. Therefore, our center modified the CLA technique on the basis of minimally invasive surgical methods. Although previous clinical studies have shown that SLAN is superior to CLA[1-3], the limitations and limitations of SLAN are particularly conspicuous, such as longer surgical duration, instability of CO_2 pneumoperitoneum pressure, and inability to insert sterile gauze and longer Ham-o-lock clips. In particular, the morbid appendix tends to be

Figure 1 Preoperative abdominal computed tomography scan suggested appendicitis with localized peritonitis.

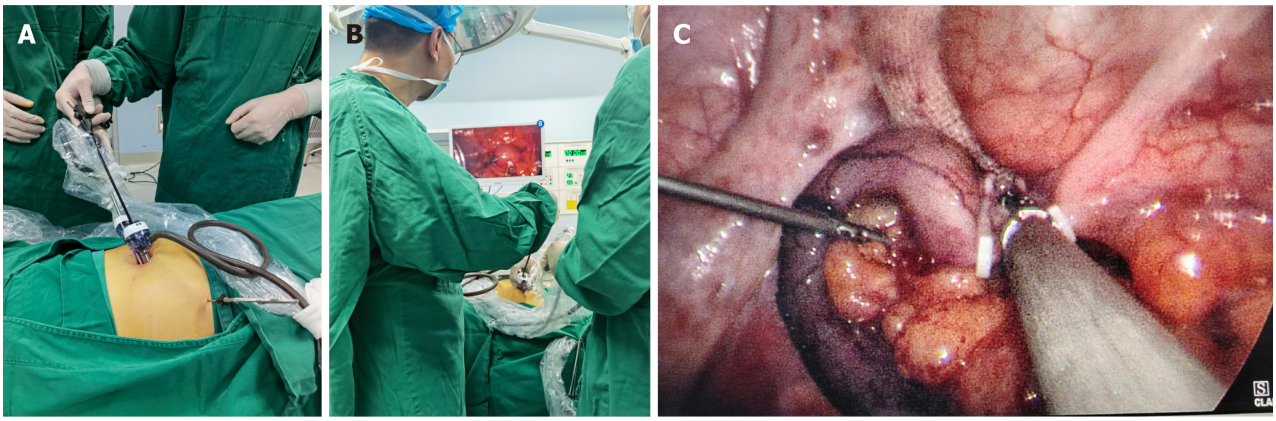

Figure 2 Intraoperative arrangement. A: Intraoperative device placement: A 1 cm trocar (for primary operation) and a 5 mm trocar (for laparoscopic observation) were inserted into the abdominal cavity *via* the umbilical incision, and a needle-type grasping forceps (Approval No. Zsyjx 20140056; Hangzhou Kangji Medical Instrument Co., Ltd., Hangzhou, China) were inserted at the McBurney point; B: Surgeon's standing position: The laparoscopic display screen was on the right side of the patient, while the surgeon stood down to the left and the assistant at the upper right; C: Intraoperative laparoscopic images: The appendix was located in the anterior position of the cecum, and the surface was hyperemic and edematous; needle-type forceps were inserted into the abdominal cavity to assist with traction of the appendix's mesentery; sterile gauze was inserted into the right iliac fossa to clear bleeding and exudation; longer Ham-o-lock clips were placed to shut the root and distal part of the appendix; and an ultrasonic scalpel was applied to cut the appendix accompanying its mesentery.

thicker and even greater than 1 cm in edema frequently, which limits its clinical indications and surgical safety.

Our center further optimized the previous technical protocol of SLAN based on a deep learning review of previously reported articles regarding single-port laparoscopic appendectomy[9]. A 1 cm trocar was inserted into the abdominal cavity *via* a 1 cm incision in the umbilicus for abdominal exploration. If severe complications are observed during the operation, the CLA protocol can be directly modified without increasing the number of unnecessary surgical incisions or the surgical duration. If a single-port laparoscopic procedure can be conducted according to the intraoperative evaluation results, the incision should be lengthened 5 mm along the left umbilicus, and a 5 mm trocar should be inserted. Compared with the initial SLAN protocol, the modified protocol was not inferior in terms of clinical outcomes, such as postoperative passing gas time, first postoperative out-of-bed activity time, and postoperative hospital stay. In particular, the modified protocol showed satisfactory effectiveness, including stable pneumoperitoneum pressure and successful placement of sterile retrieval bags, sterile gauze, and longer Ham-o-lock clips, which ensures aseptic principles and safety and prevents infectious complications, such as postoperative intra-abdominal hemorrhage, stump fistula of the appendix, incision infection, and the formation of an abdominal abscess. Although the incision was increased to 1.5 cm, our results indicated no increased pain response; conversely, good postoperative incision cosmetic results were observed for masked incision selection (Figure 3A). The surgical duration is shorter (28 *vs* 66 minutes)[6], and the surgical procedure is smoother, which reduces the learning curve and facilitates clinical application.

Although this case report introduces a novel modified minimally invasive surgical protocol for an adult patient with acute simple appendicitis, its results are insufficient to fully and comprehensively demonstrate the advantages and disadvantages of this technique. There is still a long way to go in the modification of single-port laparoscopic surgery. First, key equipment needs to be further designed and improved, such as more robust and reliable needle-type grasping forceps, single-port laparoscopic puncture devices suitable for 1-1.5 cm incisions, and specialized disposable bags to avoid appendiceal curling. Second, high-quality studies, especially prospective randomized controlled studies, are warranted to evaluate the feasibility and safety of this technique.

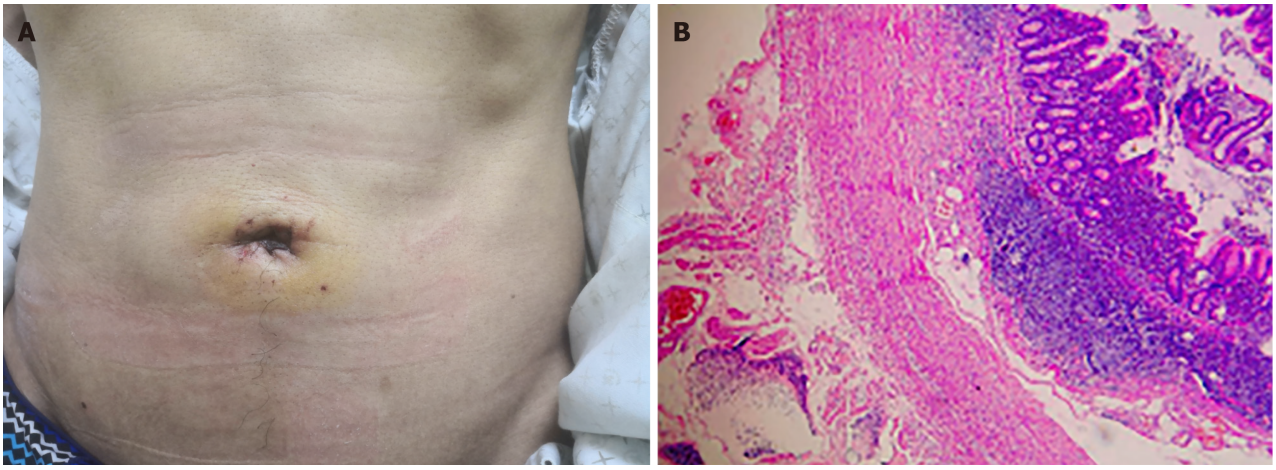

Figure 3 Postoperative outcomes. A: Postoperative day 2 incision appearance; B: Postoperative pathologic outcome (200 × HE staining).

CONCLUSION

This case report introduces the key technical points of a modified SLAN protocol, which enhances the fluency of the procedure, reduces the operative time, expands surgical indications, and increases surgical safety. Moreover, positive clinical outcomes, including postoperative passing gas time, pain response, and incision appearance, suggest better clinical application potential and generalizability. Further high-quality prospective clinical studies are warranted to obtain higher-level evidence on evidence-based medicine.

FOOTNOTES

Author contributions: Chen Y and Guo SG designed research; Chen Y performed surgical procedures; Chen Y, Fan ZQ, Fu XA, and Zhang XX performed research; Zhang XX and Yuan JQ participated in patient care and analyzed data; Chen Y wrote the paper. All authors reviewed and approved the final manuscript.

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