Single-port laparoscopic-assisted appendectomy using the nephroscope for percutaneous nephrolithotomy at low cost

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Context
Laparoscopic appendectomy had been accepted over the last years, as a goal of improved diagnostic accuracy and wound complication rate, over the open procedure. However, the new techniques require single port and manoeuverable instruments, which are expensive. In this study, the cost of single-port laparoscopic appendectomy is reduced through conventional instrumentation using a side-arm viewing operative laparoscope, which is the nephroscope used for percutaneous nephrolithotomy.
Aim
The aim of this study was to present the retrospective experience of reducing the cost of single-port laparoscopic-assisted appendectomy using the nephroscope for percutaneous nephrolithotomy.
Settings and designs
The study design was a retrospective case series one.
Materials and methods
Our study was conducted between December 2014 and August 2015. The study included 40 patients with clinical diagnosis of acute appendicitis. Patients with complicated appendicitis, obese patients (BMI $\geq$35 kg/m^2) and those who needed the insertion of another port were excluded from the study.
Statistical analysis
Continuous variables were expressed as mean and SD. Categorical variables were expressed as frequencies and percentage.
Results
The study included 40 patients, 24 (60%) male and 16 (40%) female. The mean operative time was 35±12 min. The age of participants ranged between 8 and 25 years. There was no significant perioperative morbidity or mortality. The mean follow-up period was 6 months.
Conclusion
Our experience with this technique of single-port laparoscopic-assisted appendectomy using the nephroscope for percutaneous nephrolithotomy demonstrates its feasibility and safety at a very low cost.

Keywords:
appendectomy, laparoscopic-assisted appendectomy, nephroscope, single-incision laparoscopy, single-port laparoscopy

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Introduction

Incisions used for open appendectomy vary widely, but the most common is proposed by McBurney (oblique incision in the right iliac fossa). The cosmetic result is poor when the incisions are oblique, horizontal, or vertical. Most appendectomies are performed in children and adolescents, and the cosmetic result is an important factor at these ages [1]. Scars remain lifelong and may change with the advancement of the age of the patient, becoming often unsatisfactory in appearance.

During the past two decades, general surgery had been shifted from open to minimally invasive surgery. This was aided by the development of laparoscopic technology, which enables surgeons to perform increasingly complex tasks through small incisions. Laparoscopic appendectomy (LA) was one of the first reported laparoscopic cases in general surgery by de Kok in 1977 [2].

Different techniques for the laparoscopic approach have been reported in the literature for better aesthetic results and reduction in hospital costs without compromising safety of the operation. The first LA performed using three ports was described by Semm in 1983 [3]. In 1992, a LA using a single umbilical puncture was proposed by Pelosi and Pelosi [4]. In 1998, Esposito reported an initial

experience in performing one-trocar appendectomy in children [5].

Ongoing active surgical research to further reduce the morbidity introduced novel endoscopic techniques such as SILS and NOTES [6]. The technique of NOTES is not yet widely accepted, as it requires opening of normal viscera with risk for contamination. Since the first report of single-incision laparoscopic surgery (SILS) for acute appendicitis, it had been proposed as the next evolution in minimally invasive surgery. The increased interest in single-incision laparoscopic appendectomy (SILA) had seemed to be primarily focused on better cosmesis (scarless abdominal surgery performed through an umbilical incision), less incisional pain and conversion to standard multiport laparoscopic surgery if needed [7].

The instruments that are needed for SILA include SILS port and specialized customized dissector and graspers. However, using these instruments in SILS might increase healthcare costs. To reduce costs, many authors have used their own tools for SILS [8]. In this report, we describe laparoscopic-assisted appendectomy through the use of a side-arm viewing laparoscope, which is the nephroscope that is used for percutaneous nephrolithotomy (Karl Storz, Tuttlingen, Germany). We conducted this study to present the retrospective experience of single-port laparoscopic-assisted appendectomy at low cost.

Materials and methods

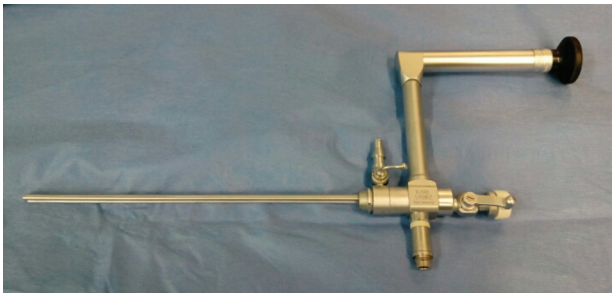
Our study is a retrospective study that was conducted between December 2014 and August 2015 after approval of the ethical committee. The study included 40 patients with acute appendicitis. The diagnosis of acute appendicitis was based on patient history, physical examination (abdominal pain in the right lower quadrant or migration of pain from the periumbilical area to the right lower quadrant, rebound tenderness, fever, elevated white blood cells count and elevated C reactive protein) and ultrasonographic (US) findings. Abdominal US was used as the first diagnostic tool.

Totally, 40 patients with acute appendicitis without suspicion of complications underwent laparoscopic-assisted appendectomy after obtaining informed consent. In four patients, in whom the appendectomy was considered impossible to be safely completed with transumbilical laparoscopic-assisted approach (TULAA) because of an inadequate exposition and exteriorization through the umbilical incision (severe inflammatory appendiceal adhesions, retrocecal with subserosal position of the appendix, obese patient with a BMI of 35 kg/m^2, short and fatty mesoappendix), two additional 5 mm trocars (one placed in the midline suprapubic and the other placed in the left iliac fossa) were introduced to perform a LA. Two patients with clinical and US diagnosis of acute complicated appendicitis (appendiceal abscess, diffuse peritonitis) underwent open appendectomy after trial of LA. The four patients who underwent LA and the two patients who underwent open appendectomy were excluded from the study.

Technique

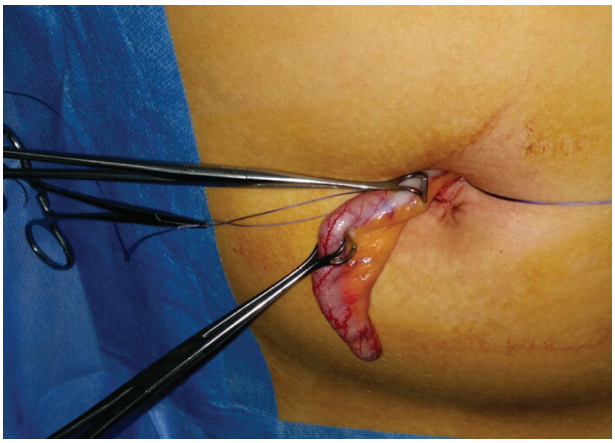
The patient is positioned in the supine position under general anaesthesia. A 10 mm trocar is inserted in 'open' technique through a transverse supraumbilical incision. The pneumoperitoneum is obtained by CO_2 insufflation. Systematic exploration of abdominal cavity is carried out using a side-arm viewing operative laparoscope, which is the nephroscope that is used for percutaneous nephrolithotomy (Karl Storz) (Fig. 1). Through the working channel of the nephroscope, the appendix is dissected free using a Maryland dissector. The tip of the appendix is grasped using a grasper and brought out through the umbilicus. The mesoappendix and appendix are then divided extracorporeally (Fig. 2).

Figure 1



The nephroscope for percutaneous nephrolithotomy

Figure 2



The mesoappendix and appendix are divided extracorporeally

The scope is then reinserted to ensure that there is no bleeding and then the port site is closed in layers. When the appendectomy is considered impossible to be safely completed with any laparoscopic technique, it was converted to an open surgery and excluded from the study.

Results

The study included 40 patients, 24 (60%) male and 16 (40%) female. The mean operative time was 35± 12 min; operative time was taken from the time of first skin incision to the complete skin closure. The age of participants ranged between 8 and 25 years with a mean age of 13.075 years. Delivery of the appendix through the umbilical incision was easy in 36 (90%) patients, whereas in four (10%) patients with less adequately movable caecum, delivery of the appendix was not easy and managed with retraction of umbilical incision towards the caecum to facilitate the appendiceal exposition and resection.

Postoperative pain was evaluated at 12 h, day 1 and day 2 postoperatively using a visual analogue scale, which ranged from 0 to 10, where 0 is no pain and 10 is extremely painful. The pain was most intense on day 0 and was controlled with simple analgesia. The mean hospital stay was 1.325 days; it ranged from 1 to 2 days, and it was calculated from the time of presentation at the casualty to the time of discharge.

Patients were evaluated during the postoperative period for complications such as bleeding, shoulder pain, postoperative ileus, vomiting, surgical site infection, intra-abdominal abscess or seroma and were discharged when deemed fit by the operating surgeon. There was no significant perioperative morbidity or mortality. The appendectomy specimen was histopathologically confirmed and was suggestive of appendiceal inflammation.

Patients were followed up at 1 week for wound examination and histopathology report analysis. At follow-up, two (5%) patients presented with wound infection and nobody presented with intraperitoneal abscess. The mean follow-up period was 6 months. Cosmetic results were considered good or excellent by parents in all patients, including those with wound infection (Fig. 3).

Figure 3

The wound after 6 months

Discussion

Single incision, transumbilical, laparoscopic assisted appendectomies have been well described in the literature and have been shown to be safe and effective alternatives to the traditional laparoscopic multiport appendectomy with a comparable postoperative complication rate [9–16]. With the new instrumentation, this procedure may now be easier and safer. This technique gives the surgeon the advantages of both open and laparoscopic approaches. The patient benefits from the decreased invasiveness of multiple ports placed in the conventional multiport LA, and also benefits from the single wound with less postoperative pain and better cosmetic result.

This method decreases the amount of equipment needed during the operation with only one instrument placed through the single port, and also it decreases the operating room time with only one incision to open and close; thus, it is much more cost-effective. Moreover, in a recent study, Montalto *et al.* [17] found a significant reduction in the postoperative cytokines in TULAA compared with open appendectomy, suggesting a less surgical trauma.

This operation is learned quickly and easily. The limitations include dense adhesions, perforated appendicitis, generalized peritonitis, or a retrocecal subserosal appendix, which may require the addition of an extra port or conversion to multiport LA. The conversion rate is much more in adults than in children because the distance between the caecum and umbilicus is shorter and the abdominal wall is suppler in children [11].

The aim of this study was to perform SILS at a very low cost. In this study, SILA was performed as an extra-abdominal procedure similar to the study carried out by Deie *et al.* [18], who had suggested that the extra-abdominal procedure is quicker and easy, and thus may lower overall costs. We used a single port and a single instrument through the working channel of the nephroscope (Karl Storz) similar to a study conducted by

Stylianos *et al.* [19]. The mean operative time was 35± 12 min; it was dependent on how easy it is to exteriorize the appendix. Reasons for the shorter operative time with TULAA include extracorporeal ligation of the mesoappendix and appendix, and easier laparotomy and closure of the umbilical incision compared with multiport LA, similar to the result published by Visnjic [20].

Postoperative pain was controlled with simple analgesia. It seemed to be less than that seen in open or conventional laparoscopic appendectomies; this may be due to a single small incision of 10 mm. There was no significant perioperative morbidity or mortality. At follow-up, two (5%) patients presented with wound infection. Cosmetic results were considered good or excellent by parents in all patients, including those with wound infection. TULAA provides nearly scarless surgery by placing a single incision within the umbilicus, which is in agreement with the study carried out by Stylianos *et al.* [19].

Conclusion

In conclusion, this technique is a safe, effective and feasible procedure with the advantages of combining open and laparoscopic techniques to provide a cost-effective treatment method with excellent cosmetic results. In TULAA, exteriorization of the appendix is a key component of its efficacy and cost-effectiveness. It is a practical procedure for patients who cannot afford expensive procedures and in resource-limited set-ups of developing countries. TULAA should be the initial procedure of choice for most cases of appendicitis.

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Conflicts of interest

There are no conflicts of interest.

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