

# Transumbilical Laparoscopic-Assisted Appendectomy: A Safe and Useful Technique for Interval Appendectomy in Pediatric Population

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Received: August 22, 2013; Accepted: June 10, 2014

**Background:** The use of laparoscopic appendectomy for pediatric patients has been widely accepted and three trocars are usually necessary to perform a conventional laparoscopic appendectomy. However, single-port appendectomy represents an attractive alternative for children. Recently the use of a single umbilical incision to perform an appendectomy has been described.

**Objectives:** The purpose of this study was to review our initial experience with transumbilical laparoscopic-assisted appendectomy (TULAA) in the pediatric population.

**Patients and Methods:** A retrospective review of all pediatric patients aged 3-16 (median: 10.2 years) treated for appendicitis was performed from Jan 2010 to July 2013. Five mm infraumbilical port was used as camera port at 6 O' clock position. The incision was extended along the border of umbilicus to 9 O' clock position and another 5 mm working instrument was passed through different subfascial opening in the same incision. Patients variables (age and sex), intra-operative findings, duration of surgery, duration of stay, time of discharge, course in the ward, postoperative events like pain, nausea, vomiting and wound status were assessed. Postoperatively patients were followed up after 10 days, 3 months and 6 months. Cosmetic evaluation was done at 3<sup>rd</sup> and 6<sup>th</sup> months.

**Results:** Of 58 patients undergoing TULLA, 55 patients underwent TULAA successfully. The mean operative time was 52 minutes. Overall, the average length of stay was  $1.2 \pm 0.8$  days. Postoperative course was uneventful in all the patients. There were no significant episodes of nausea, vomiting and pain. Postoperatively at 3<sup>rd</sup> and 6<sup>th</sup> months of follow-up the appearance of scar was cosmetically acceptable to every patient as well as their parents. It is much cheaper because the procedure can be performed using only one camera port and another 5 mm instrument without the need of additional port. There is no need to use endoloops, staplers or electrocautery devices. None of our patients had any late post-operative complications (adhesive obstructions or port site herniation). Cases of advanced appendicitis may require additional trocars or "conversion" to conventional laparoscopic techniques.

**Conclusions:** The TULAA procedure is a preferable operation for interval appendectomy in children because it is simple and provides good cosmetic results.

**Keywords:** Appendectomy; Pediatrics

## 1. Background

Standard three ports laparoscopic appendectomy was described by Semm (1) in 1983 and since then the laparoscopic approach has gained wide acceptance among the pediatric surgeons. Different types of the laparoscopic approach have been described for better cosmetic results, reduction in costs, and charges for hospitals without compromising safety of the operation. The umbilicus acts as a unique site to gain access to the abdomen and to the appendix that has been widely reported in the literature. With the help of grasper, the appendix can be safely delivered out through it and appendectomy can be done outside the body [known as trans umbilical laparoscopic-assisted technique (TU-

LAA)] (2, 3). On the other hand appendectomy can be done inside the body using all the three ports through umbilicus known as single-site laparoscopic surgery (SILS) (4, 5). In addition to safety and rapidity of open appendectomy, the TULAA has advantages of better intra-abdominal visualization, less postoperative morbidity and good cosmetic outcomes.

## 2. Objectives

In this study we share our experience of TULAA, performed for interval appendectomy in pediatric age group, in a tertiary care center.

### Implication for health policy/practice/research/medical education:

According to our experience, transumbilical laparoscopic-assisted appendectomy (TULAA) is a safe, minimally invasive approach for interval appendectomy. It is also a suitable operation for training laparoscopic abilities and it has low instrumentation requirements. We, therefore, recommend its wide use in the pediatric surgical settings.

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### 3. Patients and Methods

A retrospective review of all pediatric patients aged 3-16 years treated for appendicitis was performed from January 2010 to July 2013. All patients with clinical suspicion and proven ultrasound appendicitis were admitted and managed conservatively with injectable antibiotics for 2 to 3 days. Response to conservative treatment was evaluated clinically and by decrease in WBC count. Those who responded to conservative line of management were electively offered TULAA 6 weeks after the initial attack. Patients who failed to respond to conservative management as well as patients of complicated appendicitis (appendicular perforation) were managed by either conventional three ports laparoscopic appendectomy or open procedure. Under general anesthesia, in the supine position, pneumo-peritonem was created using 5 mm infraumbilical port by open technique. Pressure kept from 5 to 10 mm of mercury depended on size of patient's body. Diagnostic laparoscopy was performed. Infraumbilical incision was extended slightly and a working instrument (grasper) inserted via same incision. The appendix was identified and retroperitoneal adhesions dissected and appendix was freed. Appendix was delivered through infraumbilical incision (Figure 1). The mesoappendix ligated and appendectomy was completed extracorporeally (Figure 2) along with inversion of the appendicular base with purse string suture. Incision is closed with subcuticular sutures (Figure 3). In case of difficult dissection, one additional 5 mm instrument was introduced through same incision. When the appendectomy is considered impossible to be safely completed with any laparoscopic technique, it was converted to an open access.

### 4. Results

From January 2010 until July 2013, 63 patients with an average age of 5 years (range 3-12) were admitted to our surgical ward with a diagnosis of appendicitis. Seven out of 63 patients presented with an appendicular mass and were treated conservatively according to the protocol: none required urgent surgery, and they all underwent interval TULAA 6 weeks later. Five patients underwent urgent surgery. In 3 out of 5 cases, a primary open access was chosen: in 2 cases for marked abdominal distension and in 1 case because of palpation of a mass at the induction of anesthesia. The remaining 2 cases underwent conventional laparoscopic appendectomy. Of all 58 TULAA, 3 were converted: in 1 case the intra-operative finding was in retrocaecal position, and in 2 cases significant adhesions present. The mean operative time for single-port TULAA was 52 minutes. Overall, the average length of stay was  $1.2 \pm 0.8$  days.

### 5. Discussion

Since inception of laparoscopic surgery in pediatric age group, it has undergone significant changes, the most recent of which is the introduction of single incision



Figure 1. Telescope Port With Delivered Out Appendix



Figure 2. Extracorporeal Appendectomy



Figure 3. Postoperative Wound

**Table 1.** Comparison Between SILS Performed by Multiports vs. Conventional Ports

Type	Multiports (Specially Designed Ports)	Conventional Ports
<b>Principle</b>	One-entry-multiple-working channel	One large caliber, two adjacent working ports.
<b>Instruments</b>	Highly maneuverable instruments (S-shaped, bent or articulating instruments)	Conventional instruments
<b>Advantages</b>	Independence of instrument movements Steady field of vision	Cost effective
<b>Disadvantages</b>	Costly ports and instruments	Limited movements

laparoscopic surgery. It can be done by using conventional laparoscopes and instruments, off angle scopes with separate working channels or with the use of specially designed curved instruments. Since introduction, varieties of terms were used by various groups of laparoscopic surgeons for describing the concept of single incision surgery. For the purpose of standardization and uniformity in reporting the laparo-endoscopic single-site surgery consortium for assessment and research (LESCAR) had recommended term laparoendoscopic single-site surgery (LESS). In pediatric surgery, two types of single incision surgery are described as discussed in Table 1.

The transumbilical laparoscopically assisted appendectomy (TULA) raised great interest among paediatric surgeons because it combines the advantages of laparoscopic surgery with those of open surgery. The TULAA technique was first described as umbilical one-puncture laparoscopic-assisted appendectomy (UOPLAA) by Valla et al. in 1999. It was performed in 200 cases of preoperatively selected children that showed no signs of advanced appendicitis or diffuse peritonitis. On the basis of above series we also selected TULAA the first choice of operation for interval appendectomy as it can be easily converted to a standard three-port laparoscopic appendectomy, which is widely reported in the literature for management of all forms of appendicitis (6). In literature review we found many reports describing SILS technique using multiports or using conventional three ports through umbilical defect as an alternative, to perform an endocorporeal laparoscopic appendectomy (4, 5, 7). The disadvantages of both of these were longer operating time, clashing of instruments (8), and increased cost of TULLA (9, 10). Petnehazy et al. (11) suggested that TULAA can be a simpler approach for appendectomy in obese children and a single incision has proved to be a quick and effective approach for this kind of patients have been approved also in our hands.

According to our experience TULAA is a safe, minimally invasive approach for interval appendectomy. It is also a suitable operation for training laparoscopic abilities, and it has low instrumentation requirements. We, therefore, recommend its wide use in the pediatric surgical settings.

## Authors' Contributions

Rahul Kumar Gupta: corresponding author, data collection, analysis, drafting the manuscript, operating surgeon; Abhaya Gupta: data collection, analysis, drafting the manuscript, operating surgeon, editing the manuscript; Paras kothari: data collection, analysis, drafting the manuscript, operating surgeon, editing the manuscript; Krushna Kesan: data collection, operating assistant; Kedar Mudkhedkar: data collection, operating assistant; Vishash dixit: data collection, operating assistant; Ravi Kamble: data collection, operating assistant.

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