

# SINGLE-ACCESS TRANSUMBILICAL LAPAROSCOPIC APPENDECTOMY USING CURVED REUSABLE INSTRUMENTS: AN INITIAL REPORT OF THREE CASES.

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## ABSTRACT

**Introduction:** The continuous evolution of laparoscopic surgery and the ambition of better cosmetic results raise the need for less invasive procedures. The umbilicus represents a natural scar and constitutes a well-healing site of access to the peritoneal cavity. Single-access Transumbilical Laparoscopy (SATL) is gaining popularity and can be an alternative surgical treatment for acute appendicitis. We report three cases of SATL appendectomy using curved reusable instruments.

**Patients and methods:** Three female patients, wanting minimal scarring (mean age – 30 years) were admitted to our hospital in April 2015 with acute abdominal pain in the right iliac area. A SATL appendectomy was performed using a standard 11-mm reusable trocar for a 10-mm, 30°- angled, rigid scope and curved reusable instruments according to DAPRI (Karl Storz-Endoskope, Tuttlingen, Germany) placed transumbilically.

**Results:** Neither a conversion to open surgery nor an insertion of extraumbilical trocars was necessary. The mean operative time was 101.6 +/- 24.66 minutes and the mean blood loss 6.66 +/- 11.54 mL. The mean scar length was 16.66 +/- 0.57 mm. No intraoperative complications were registered and the use of minimal pain killers allowed the discharge after 2 or maximum 4 days. After three months of follow-up no late complications occurred and the umbilical scar was not visible.

**Conclusion:** In young and scarless-demanding females with acute appendicitis SATL appendectomy can be performed safely and offers the possibility of surgical treatment without a visible scar.

**Keywords:** *single-access, single-incision, appendectomy, laparoscopy*

## INTRODUCTION

Appendectomy remains the most frequently performed surgical procedure in developed countries and approximately 8 % of the population experience appendicitis at some time in their lives. The open surgical approach was the gold standard until Semm published his preliminary experience in regard of laparoscopic appendectomy in 1983 (1). Multiple randomized prospective studies have confirmed the safety of laparoscopic appendectomy and the superiority

of laparoscopic approach over open approach in terms of pain, morbidity, postoperative recovery, hospital stay and cosmesis (2).

With the advent of Natural Orifice Transluminal Endoscopic Surgery (NOTES), presently there is a strong development in laparoscopic surgery to avoid or reduce the number of the abdominal incisions. In SATL, single incision is made within the umbilicus, which is a well-healing site for access to the peritoneal cavity and is defined as a natural

embryonic scar. In this context, this approach can be referred to as a subtype of NOTES or embryonic-NOTES (e-NOTES) (3).

Since the first report of single-incision laparoscopic appendectomy in 1992 by Pelosi et al. (4), a different type of laparoscopic techniques have been reported - fascial puncture technique, multi-channel port technique, glove technique, laparoscopic assisted technique, hybrid technique (5). The main advantages stimulating this approach are the cosmetic results, and probably the decreased abdominal trauma, the improved recovery of the patient, and the reduced need for pain killers due to the presence of a unique abdominal wall incision (6). Several questions remain to be addressed, concerning the feasibility and mostly the reproducibility of this technique, the cost of the procedure, the indications, selection criteria, limitations, effect on postoperative outcomes, and long-term results.

The authors report the first three cases of SATL appendectomy using curved reusable instruments.

## PATIENTS AND METHODS

We present three female patients, wanting minimal scarring, admitted to our hospital in April 2015 with acute abdominal pain in the right iliac area. Preoperative work-up was performed by standard hematological and biochemical laboratory evaluations and gynecologic consultation. All of them were with clinical and sonographic signs of uncomplicated appendicitis. Data were collected

prospectively in a dedicated database and reviewed retrospectively. The operating time was defined as the time from the skin incision to the application of the wound dressing. The length of hospital stay was calculated as the time from admission to discharge, counting the day of admission and operation as day 0.

## Surgical technique

The patient was positioned supine with the arms alongside the body and straight legs. The team stood to the patient's left side with the camera assistant on the surgeon's right. The umbilicus was incised, and using the Hasson technique the peritoneal cavity was entered. A purse-string suture using 1 polydioxone (PDS) was placed in the umbilical fascia. An 11-mm reusable trocar was inserted inside the purse-string sutures and the pneumoperitoneum was created. A 10-mm, 30°, rigid and standard length scope was used. Curved reusable instruments according to DAPRI (Karl Storz-Endoskope, Tuttlingen, Germany) were inserted into the abdomen through the same incision without trocars. The curved grasping forceps I (kept in the surgeon's nondominant hand) (Figure 1a) was inserted through a separate window outside the purse-string suture at 7-o'clock position. The other curved instruments (for the surgeon's dominant hand) such as the coagulating hook (Figure 1b), scissors (Figure 1c), and the suction device, as well as the straight 5-mm endoloop device (Ethicon, Johnson & Johnson, Cincinnati, OH, USA) were inserted inside the purse-string suture and parallel to the 11-mm trocar at 12 o'clock position. The appendix was exposed using



Figure 1. Curved reusable instruments according to DAPRI (Karl Storz- Endoskope, Tuttlingen, Germany): grasping forceps I (a), coagulating hook (b), scissors (c)

Table 1. Patients' characteristics.

Patients	Age years	kg	m	BMI kg/m <sup>2</sup>	ASA	T °C	Leuc x10 <sup>9</sup>	Abdominal sonography	Previous surgery
A	38	69	1.61	26.64	II	36.8	7.4	+	none
B	21	57	1.70	19.72	I	36.6	10.5	+	none
C	32	50	1.67	17.98	I	36.7	10.3	+	none
mean	30.3	58.6	1.66	21.44	I/II				
SD	+/-8.62	+/-9.60	+/-0.04	+/- 4.58					

Table 2. Operative and postoperative outcomes.

Patients	Time min	Blood loss ml	Hospital stay days	Intraoperative complications	Post-operative complications	Scar length mm	Follow-up months
A	130	20	2	none	none	17	3
B	90	0	4	none	none	16	3
C	85	0	2	none	none	17	3
mean	101.6	6.66	2.66	none	none	16.66	3
SD	+/- 24.66	+/- 11.54	+/- 1.15			+/- 0.57	

the curved grasping forceps I and the mesentery was controlled by the curved coagulating hook, from extremity to base (Figure 2, 3). Two preformed knots (endoloops) were placed at the base of the appendix, which was sectioned between them (Figure 4). The appendix was removed through the single-access in custom-made plastic bag (Figure 5). The umbilical fascia, including the separate opening for the grasper, was closed using absorbable sutures.

## RESULTS

The mean age was 30.3 +/- 8.62 years, the mean body mass index was 21.44 +/- 4.58, the patients' ASA scores were class I or II. The patients had no previous surgical history (Table 1). All patients had acute appendicitis.

Neither a conversion to open surgery nor an insertion of extraumbilical trocars was necessary. The mean operative time was 101.6 +/- 24.66 minutes and the mean blood loss 6.66 +/- 11.54 mL. The mean scar length was 16.66 +/- 0.57 mm. No intraoperative complications were registered. The patients' pain medication was

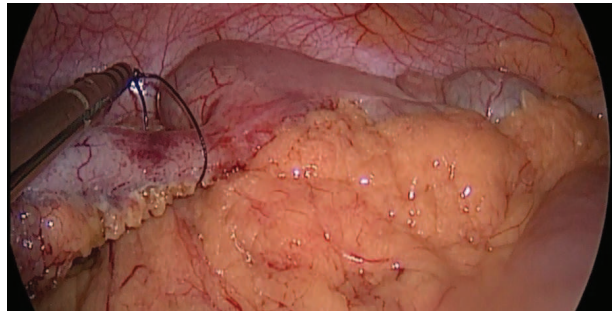
kept low. The mean duration of hospital stay was 2.66 +/- 1.15. After three months of follow-up no late complications occurred and the umbilical scar was not visible (Table 2).

## DISCUSSION

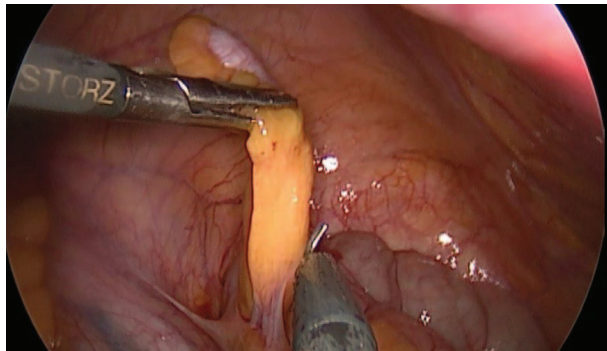
SATL appendectomy was developed and gained popularity rapidly in the recent decade, using either a single-port or three 5 mm trocars through a single 15-20 mm supraumbilical or periumbilical incision. Many trials have reported the feasibility and safety of SATL appendectomy compared with the standard Three-port Laparoscopic appendectomy (TPLA) (7,8,9). Accordingly, our cases confirm that SATL appendectomy can be performed without conversion to open surgery or insertion of supplementary trocars and without any type of complications. From a technical point of view, the objective during SATL appendectomy is to maintain the procedure as similar as possible to the principles of TPLA. In our technique, the curved instruments allowed the establishment of classic laparoscopic working triangulation inside



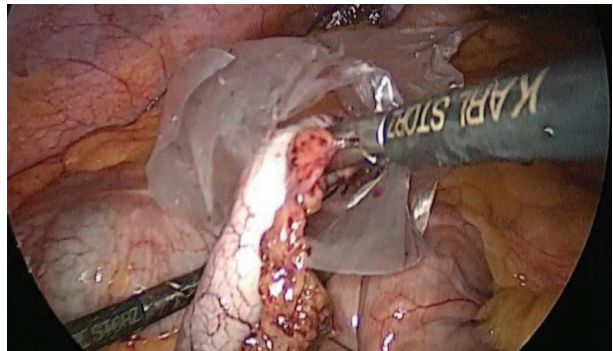
*Fig. 2. External surgeon's ergonomics.*



*Fig. 4. Endoloop at the base of the appendix.*



*Fig. 3. Absence of the conflict between the instruments' tips inside the abdomen.*



*Fig. 5. Appendix placed into a plastic bag.*

the abdomen as well as externally, differently from the common SATL. Additionally, the technique described here did not increase the cost of standard laparoscopy, because the most of the material used was reusable.

One point of criticism regarding SATL is the longer operative time. We believe that patient selection at the beginning of the learning curve is important to avoid conversion to standard laparoscopy and to reduce operative time. It has been shown that operative time was significantly longer with complicated appendicitis (gangrene, abscess, perforation, and/or peritonitis) (10). In addition, surgical difficulty level changes in obese patients, in patients with previous lower abdominal surgery, in retrocecal appendicitis, depends on how to divide the appendix (stapling or ligation) and may affect on operative time (11,12). However, Kye et al. performed SATL appendectomy for cases of complicated

appendicitis and showed comparable results in operative time and even better results in hospital stay and recovery time to daily life in comparison with TPLA (13). During SATL appendectomy, we recorded a mean total operative time of 101.6 +/- 24.66 min, which appears high compared to that of other authors (14,15,16). But in our technique the resection of the appendix is completely performed laparoscopically and not outside the umbilicus as reported. Furthermore, our data include the time to gain access to the abdomen and to close the umbilical fascia, which required a supplementary time. The learning curve of SATL appendectomy is between 5 to 10 cases (17).

The mesoappendix and appendiceal artery can be safely transected by an ultrasonic shears, a bipolar electrocautery, or an endoscopic clipping. In our technique we used coagulating hook and we recorded negligible mean blood



loss 6.66 +/- 11.54 mL witch is accordance with the results of other authors (18).

Cosmesis can be an important issue for many patients, as highlighted in a survey of 97 patients who had undergone routine elective or aesthetic surgical procedures. The survey found that many patients were dissatisfied with their scars and that nearly all patients (91%) would value even a small improvement in scarring (19). A recently published survey of 736 patients also highlighted patients' desire for improved cosmesis following surgery and found that single-incision laparoscopic surgery was preferred over both NOTES and open surgery (20). Our mean scar length was 16.66 +/- 0.57 mm and actually compares favorably with the 22 mm scar length reported in literature (21) which offers good cosmesis as the scar is hidden within the umbilical folds.

It is been controversial whether postoperative pain is less for SATL appendectomy compared to TPLA due to the effect of less access port sites. It is believed that the larger the transumbilical fascial incision is the more painful patients may experience post operation. While others demonstrated that postsurgical pain is mainly related to the injury of muscles and parietal peritoneum, regardless of the diameter of the trocar, and that for minimally invasive surgery, the less trocars, the less pain (22,23). For postoperative pain, we treated our patients with minimal pain therapy. In our technique we eliminate the muscular penetration and no larger fascial incision is required for port insertion, which might result in less postoperative pain.

Length of hospital stay for our chases of SATL appendectomy patients was similar to that reported in literature (14,15).

## CONCLUSION

In young and scarless-demanding females with acute appendicitis SATL appendectomy can be performed safely and offers the possibility of surgical treatment without a visible scar.

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