Treatment of acute appendicitis with one-port transumbilical laparoscopic-assisted appendectomy: A six-year, single-centre experience

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ABSTRACT

Background: Laparoscopic appendectomy is a feasible and safe alternative to open appendectomy for uncomplicated appendicitis. In the past decade several laparoscopic procedures have been described using one or more ports. We report our experience in treating acute appendicitis with one-port transumbilical laparoscopic-assisted appendectomy (TULAA). **Patients and Methods:** We performed 231 TULAA on patients in the period from November 2001 to September 2007. We introduced an 11 mm Hasson's port using open technique; an operative channel with 10 mm telescope and an atraumatic grasper were used. After intra-abdominal laparoscopic dissection, the appendix was exteriorised through the umbilical access. The appendectomy was performed outside the abdomen as in the open procedure; the operation was completed using only one port in 227 patients (98%), two and three ports in two patients (1%) while conversion to open surgery was needed in two patients (1%). **Results:** The average operating time was 38 minutes and the median time to discharge was three days. Four (1, 7%) early postoperative complications (two suppuration of the umbilical wound) with no major complications were observed. **Conclusions:** Our results demonstrate that TULAA, which combines the advantages of both open and laparoscopic procedures, is a valid alternative form of treating uncomplicated appendicitis. If appendectomy cannot be completed with only one port, insertion of one or more ports may be necessary to safely conclude the procedure.

Key words: Appendectomy, laparoscopy, operative channel

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INTRODUCTION

Appendicitis is the most common acute abdominal surgical condition and a common source of misdiagnosis. Furthermore, the treatment of choice remains controversial. Endoscopic appendectomy was first described by Semm in 1983. Since then it has undergone several modifications, as reported in the literature.

Laparoscopic appendectomy can be performed by a laparoscopic-assisted technique (transumbilical laparoscopic-assisted appendectomy, TULAA; port-exteriorisation appendectomy (PEA); umbilical one-puncture laparoscopic-assisted appendectomy, UOPLAA and video-assisted transumbilical appendectomy (VATA) where the appendix is mobilized laparoscopically using one port and then drawn through a small abdominal opening and removed by standard open technique.[1-3] We report our experience with this surgical approach, focusing on some technical details which we have matured during these years.

PATIENTS AND METHODS

We conducted a retrospective review of 231 children treated by TULAA at our Institution in the period from November 2001 to September 2007 [Table 1]. We treated 126 females (54%) and 105 males (46%). Median age was 11.6 years (range 3-18 years). The chief complaint on admission was recurrent or acute abdominal pain in right lower quadrant. Diagnosis of appendicitis was based on clinical findings (tenderness upon palpation of the abdomen, resistance of right iliac region, fever), laboratory parameters and ultra-sound reports. Children with pre-operative evidence of perforated appendicitis were excluded from this study.

All children had a clinical diagnosis of acute appendicitis with right iliac fossa pain, 100 (43%) patients complained of rebound tenderness in the right iliac fossa. Leukocytosis > 13,5 x 10^9/ l was reported in 203

Table 1: Patients' clinical data

Data	Variables	n	Appendicitis	
			Group A (acute)	Group B (elective)
			68	163
Sex	F	126	21	105
	M	105	47	58
Age (year)	<7	81	18	63
	≥7	150	50	100
Weight (kg)	<26	86	32	54
	≥26	145	36	109
Fever (°C)	< 38	210	47	163
	≥ 38	21	21	0
Vomiting	not	212	49	163
	yes	19	19	0
Alvus	normal	163	43	120
	stipsis/diahrroea	68	25	43
Pain	diffuse/aspecific	160	6	154
	elective/muscle defense	71	65	9
Symptoms arise (hours)	<12 h	46	46	0
	≥12 h	185	22	163
White blood cell count (WBC×10^3/μL)	<13000	28	6	22
	≥13000	203	62	141
Neutrophil percentage (%)	<76	79	11	68
	≥76	152	57	95
ESR (mm/h)	<21	119	8	111
	≥21	112	60	52
CRP (mg/L)	<10	51	11	40
	≥10	180	57	123
Ultrasound aspect	negative	8	1	7
	positive	223	67	156
Interval hospit-operation	<12 h	16	16	0
	≥12 h	215	52	163
Technique	one-port	227	64	163
	2-3 ports	2	2	0
	laparotomy	2	2	0
ABT-postop	not	211	48	163
	yes	20	20	0
Complications	not	227	64	163
	yes	4	4	0
Postoperative hospitalization (day)	<6	230	67	163
	≥6	1	1	0

children (89%) and a C-reactive protein (CRP) > 10 mg / l was reported in 180 patients (78%).

A pre-operative ultrasonography was performed in all children: the appendix was visible in 223 patients (96%), the diameter of the appendix was increased to > 6 mm in 76 children (33%). Additional pathological findings were detected in 12 patients (5%) [e.g. ovarian cyst formation].

Our policy does not include prophylactic antibiosis, however, depending on the intra-operative findings we may decide to administer ceftazidime (100 mg / kg / day in three doses) postoperatively.

TULAA previews one umbilical access to position an optical connected to a camera with an operating channel in the abdomen. We began the procedure using one 11 mm Hasson port in which a 10 mm, 0 degree laparoscope with a 5 mm operative channel was inserted.

To prevent umbilical infections we recommend complete exteriorisation of the navel to correctly disinfect the area. In our experience, in fact, this is the only method to avoid postoperative onfalitis.

Pneumoperitoneum was achieved, maintaining pressure between 8 and 12 mm hg, according to

patient's weight. We introduced 5 mm instruments (atraumatic grasper and scissor) for the dissection. The appendix and a portion of the cecal cone was mobilised, grasped and exteriorised through the umbilical access; appendectomy was performed outside the abdominal cavity using the traditional open technique.

Thereafter, the mesentery was divided and a ligature was placed around the base of appendix. The caecum was re-inserted into the abdomen and, after re-insufflation, ileal exploration was completed laparoscopically (alternatively this evaluation can be performed at the beginning of the procedure, after having localized the appendix). The fascia was closed with "X" stiches, and fascial-infiltration with 6 to 8 ml ropivacaine 0.2% or levobupivacaine 0.5% injections based on patient's weight (inferior or superior to 20 kg) was performed; intradermal stiches were used for skin closure.

RESULTS

The appendix was identified in all patients. The location of the appendix was reported in the surgeon's note and listed as anterior intraperitoneal (140 cases, 61%), pelvic (16 cases, 7%), pericolic (31 cases, 13%), laterocecal (23 cases, 10%) or retrocecal (21 cases, 9%). The latter one position was regarded as the site in which the appendix could be partially (18 patients) or completely (three patients) hidden from the anterior parietal peritoneum (subsierous retrocecal appendixes). Forty two children (18%) needed laparoscopic intraperitoneal adhesiolysis.

We utilised one port in 227 children (98%), an additional trocar in one child (0.5%) and two additional ports in one (0.5%) child; conversion to open surgery was needed in two (1%) patients.

The umbilical incision was extensively enlarged (1.5 cm in cranial and caudal direction on fascial as well as cutaneous plan) in one patient due to subhepatic phlegmonous appendix.

Median operative time was 38 minutes (range 25-100) vs. 29.5 minutes of the laparotomic appendectomy. There were 163 semi-elective interventions (medium time 37,9 minutes), while 68 were emergency procedures (medium time 38.2 minutes). There was no statistical difference between the duration of emergency and programmed operations ($P > 0.05$). Median hospital stay was 3.5 days (range 3-7).

Median length of postoperative analgesia was 1 day (range 0-2).

Two suppurations of the umbilical wound, one case of peritonism on the second postoperative day and one granuloma of the navel without any major complications were described (1,7% of patients) in the follow-up period (50 months; range 15-85 months). A resident performed the surgery in 21 patients (9%), giving this intervention a relevant didactic role in approaching laparoscopic techniques.[4]

Histological work up of the appendectomy-specimens revealed 137 cases of acute (hyperemic) appendicitis (59%), 72 cases of phlegmonous (31%), 20 cases of empyematous (9%) and 2 cases of sclero-atrophic (1%). Associated pathologies treated: Two Meckel's diverticulum, one torsion of paraooforon cyst (left-sided), one ovarian cyst, one cyst of the mesosalphinx, two small cysts of the salphinx, four umbilical hernias, one adhesion bridle.

DISCUSSION

The advantages of the laparoscopic appendectomy in uncomplicated appendicitis have been widely documented. Exploration of the abdominal cavity is easy and exhaustive; it allows exclusion of other diseases involving the pelvic and the right iliac region. Further, it allows easy access to difficult appendixes or to those with an anomalous position. Most of the current techniques use at least three ports. In order to decrease both costs and port-related visceral or vascular injuries, techniques with one or two ports and laparoscopic-guided appendectomies with mini-laparotomy were described.[5]

The transumbilical one-port appendectomy evinced great interest among paediatric surgeons because it combines the advantages of laparoscopic surgery with those of open surgery. The technique we apply is the French approach first described by the equipe of professor Valla in 1994.

Great limits of the procedure remain subsierous appendicitis or strongly adherent appendixes that do not allow mobilisation with only one instrument. When appendix is gangrenous with a friable wall, the risk of laceration is too great to permit excessive tractions used with this technique.

However, in intraperitoneal appendixes the organ can be



Figure 1: The Spaghetti manoeuvre

easily grasped from its point and exteriorised through the umbilicus. This manoeuvre cannot be performed in the retrocecal position.

In these cases, our suggestion would be to grasp the appendix from its base (usually the only visible part) and produce a twisting of the organ, rotating circumferentially the laparoscopic grasper ("Spaghetti manoeuvre") [Figure 1].

This procedure is very useful in exposing the body and finally the point of the appendix, allowing, in the majority of cases, the division of the soft adhesions and its exteriorization from the navel. In the appendixes, partially or completely subsierous (retrocecal or not), one option is to enlarge only the umbilical fascia in a caudal or lateral direction (1 cm to 2 cm or more, and the umbilical skin if necessary) and, once having grasped the base of the appendix and having taken it to the navel, an extra-abdominal progressive section of the adhesions in a proximal to distal direction can be performed. This will be more easily performed in children less than six years of age.

If this step cannot be safely accomplished (in the completely subsierosus retrocecal appendixes, three cases in our series), is mandatory not to hesitate adding one or two additional ports, and eventually convert.

In our series, the conversion to laparotomy was needed twice; the first during the first year of application of the technique was due to a prudential scope. The second was due to a subsierous appendix.

The suppurations of the wound were described when we started using this new technique. At that point the incision included the superior margin of the navel, however we have modified the approach (complete exteriorisation of the umbilical scar and opening on the median line), and we did not observe any more postoperative suppurations thereafter. The only case of peritonism was caused by necrosis of the appendicular base, with subsequent filtration of internal content, provoked through coagulation of the mucosa to sterilizing scope. Navel granulomas were treated with point's removal and with AgNO3. Adopting these technical details our complication rate appears low, inferior to that reported in other works.[3]

CONCLUSION

The one-port procedure is a safe and feasible procedure and indicated to evaluate and treat painful abdominal syndromes involving the right iliac region and acute uncomplicated appendicitis.[6]

The main advantage of this technique is the reduced trauma due to a single large orifice for the laparoscope. In our experience, the one-port appendectomy represents a valid alternative to other laparoscopic and open appendectomy techniques in children. In some cases it is necessary to insert one or more ports to safely perform the appendectomy. Surgeon's experience remains the most relevant factor in safely accomplishing this procedure.

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