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Port exteriorization appendectomy in children: an alternative to conventional laparoscopic technique?

Abstract

Laparoscopic appendectomy is usually performed with an intra-corporeal approach. The conventional procedure uses three ports. The port exteriorization appendectomy [PEA] uses two trocars to perform the whole procedure and can be considered as an efficient alternative to the conventional approach especially in case of non-availability of adequate material. We Report our experience using the port exteriorization appendectomy with the aim to evaluate this technique and appreciate its feasibility for all grades of appendicitis and to compare the results of this technique with conventional laparoscopic appendectomy

Methods: Between May 2013 and January 2014, 193 appendectomies were performed in our department, in 50 cases [26%] a port exteriorization appendectomy was performed Technical challenges, complications, and postoperative recovery were collected and analyzed.

Results: 50 Children with a mean age of 10.5 years old [4-14 years] underwent laparoscopic appendectomy using the port exteriorization of the appendix. In 24 % of the cases laparoscopic appendectomy concerned complicated appendicitis [gangrenous, located peritonitis]. The mean Operative time was 39 min [12-90 min]. The mean operative time for conventional laparoscopic appendectomy was 53 min. There was a statistically significant difference with the PEA appendectomy where the operative time was shorter [p=0,025] No major complications were reported. Postoperative recovery and cosmetic results were excellent in all cases.

Conclusion: Port exteriorization appendectomy is a safe and economical approach to perform pediatric appendectomy, when conditions are favorable. It allows minimizing minimally invasive surgery even further, allowing a low level of invasiveness and post-operative pain and high improvement of cosmetic result.

Keywords: laparoscopy, appendectomy, port exteriorization, children

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Introduction

Appendectomy is one of the most common surgical procedures. The surgical techniques to perform appendectomy are various, ranging from the open technique, first described by Mac Burney in 1894 and which has been the gold standard for the management of acute appendicitis for more than a century, to the standard three ports laparoscopic approach described by Semm In 1983.[1] The Port exteriorization appendectomy offers advantages of both approaches, a good laparoscopic visualization and a safe extracorporeal appendectomy. First reported by Valla.[2] Then by others like Ohno.[3] This technique concerned at the beginning only cases of uncomplicated appendicitis. The aim of this prospective study was to evaluate the feasibility and efficiency of port exteriorization appendectomy for both complicated and uncomplicated appendicitis. Different variables were documented and collected: Mean operative time, conversion rate, hospital stay, complications and patients' satisfaction.

Patients and methods

Between May 2013 and January 2014, 193 appendectomies were performed in our Department. In 50 cases (26%), the surgery was performed using the port exteriorization technique. The choice of the technique was performed according to the surgeon predisposition to perform the laparoscopic appendectomy, only one surgeon practiced this approach during emergency shift through this period. All the patients admitted for appendicitis when this surgeon was on call were included; we excluded patients with pre-operative diagnostic of appendicular abscesses or appendicular plastron All the children's parents were informed preoperatively about the procedure, the possibility of adding a third trocar and the eventuality of conversion to an open surgery. All data were prospectively collected and compiled using Excel software (Microsoft, Redmond, WA, USA). Tests for statistical significance included the Chisquare and Fisher's exact tests, as well as logistic regression from the SPSS statistical program (SPSS, Chicago, IL, USA). Differences were considered significant at a p value less than 0.05.

Description of the procedure

Under general anesthesia, the patient was placed in supine position. The surgeon stands on the left side of the patient and the first assistant on the right one, with personal screens at the opposite side of the surgeon. A 5 mm, semicircular incision was made at the upper edge of the umbilicus. The fascia was exposed and incised. A 5 mm port for a laparoscopic camera was then introduced. After pneumperitoneum insufflation, 10 mm working port was introduced under laparoscopic visual control in the right lower quadrant of the abdomen. The appendix was isolated, grasped and mobilized allowing its extraction with the meso-appendix, outside the abdomen Figure 1. The rest of the surgery was similar to open appendectomy. Because it was impossible to pull out the appendix, a 5 mm working port was introduced under visual control at the left lower quadrant of the abdomen. The appendix was then mobilized by dividing inflammatory adhesions and the meso

appendix was coagulated using a monopolar hook, then the appendix, free of its mesoappendix; was extracted out of the abdomen through the 10mm port. After appendectomy, the caeco-appendicular junction was repositioned back into the Abdomen. Visual control of hemostasis and the length of the remaining appendicular stamp were made. After Extraction of trocars under a visual control, the fascia of the two ports incision and the skin were opposed with delayed absorbable sutures.

Figure 1 Exteriorization of the appendix through a 10 mm trocar.

Post-operative care

During the procedure, all the patients received a single dose of Cefotaxim (30 mg Kg). Imidazole (15 mg kg) and aminoside (5mg/Kg) were added once a complicated form of the appendicitis was found. Progressive feeding was started 4 hours after surgery. Post-operative antibiotherapy was performed according to a local protocol established after a prospective study in our hospital with the aim of identifying the microbiological profile of acute appendicitis in children in our area. In cases of non-complicated appendicitis (catarrhal or phlegmonous without perforation) no post operative antibiotherapy was necessary and the patient was discharged the day after. In cases of complicated appendicitis (gangrenous, local peritonitis) a 3 day intravenous antibiotherapy was administrated relayed by adapted oral antibiotics for 10 days.

Post operative follow up

The Patients were systematically controlled 2 weeks after surgery then 1 and 3 months later.

Results

During the study period, 30 boys and 20 girls were treated in our department using port exteriorisation technique. The surgery was performed by the same senior surgeon. A total of 193 appendectomies were performed at the same period. The different operative techniques used to treat these children are summarized in Table 1. All Pre-operative, per operative and post-operative data were prospectively collected. The mean age of the patients was 10.5 years the median age was 11 years with an average between 4 and 14 years. In 76 % of the cases (Group 1) the appendicitis was non complicated (38 cases), inflammatory in 8 cases, or phlegmonous in 30 cases. In 24 % of the cases (Group 2) the appendicitis was complicated (12 cases), gangrenous in 7 cases and local peritonitis in 5 cases Table 2.

Table 1 Summary of the appendectomy technique during the period of the study

Operative Technique	N	%
Mac Burney Appendectomy	128	66%
3 Port Intra Abdominal Laparoscopic Appendectomy	15	8%
Laparoscopic Assisted Appendectomy	50	26%
TOTAL	193	100

Table 2 Differences between cases of Uncomplicated and complicated appendicitis

	Uncomplicated Appendicitis	Complicated Appendicitis	p
Number of cases	38	12	
Start of Symptoms	1.44 days	2 days	0.3
Leucocytes	12.879 /mm3	17.792 /mm3	0.001
CRP	20.30 mg/l	46.62 mg/l	0.003
Mean Operative Time	34 min	55 min	0.002
Hospital Stay	1 day	3 days	0.004
Conversion to Laparotomy	0	0	
Wound Infection	0	0	
Intra-abdominal Abscess	0	0	
Re Admission	0	0	

Pre-operative features

Symptoms started 1.79 days before surgery at average in Group 1 and 2 days in Group 2. The mean value of blood leucocytes and C-reactive protein were significantly lower in the Group 1 patients than Group 2 (p=0,03 and p= 0,015) Table 2. All the patients had an abdominal ultrasound; the appendix was visualized in 90 % of the cases.

Operative features

The mean operative time was 39 min (10-95 min). In group 1 the mean operative time was 34 min: 25 min for inflammatory appendicitis and 37 min in phlegmonous cases. In group 2 the mean operative time was 55 min: 65 min for gangrenous appendicitis and 55 min for local peritonitis. The difference between the two groups was statistically significant (p=0,002). None of the patients needed a conversion to laparotomy during surgery. In three cases (6%) we needed to add a third 5 mm operative trocar. Two cases of local peritonitis with necrozing retro coecal appendix, and one case for under hepatic appendix.

Post-operative features

Liquid supply was started 4 hours after surgery. All the patients had an antalgic prescription of Paracetamol (60mg/kg/J) and bolus of Nalbuphine (0.2/mg/kg/j) when needed. There was no need for antibiotic prescription after surgery in group 1, but the patients of group 2 had an intravenous prescription of Cefotaxim 100 mg/kg/24h and Metronidazole (30mg/kg/25h) for 3 days and gentamicin 3mg/kg/24h for 48 hours. The patients were discharged the day after the surgery in group 1. The patients were discharged 3 days at average in group 2 with a prescription of oral antibiotic, according to the bacteriological results; to have a total of 10 days antibiotherapy.[4] The patients were reviewed after 2 weeks, 1 and 3 months after surgery. Pathologic examination revealed acute appendicitis in all cases. No cases of wound infection or post appendectomy intra-abdominal abscesses were reported. None of the patients was re admitted for occlusive syndrome. Patients and parents were totally satisfied by the cosmetic results.

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Discussion

Although criticized for technical difficulty and cost , the 3 ports "in" technique has been widely practiced and remains the gold standard, among techniques of laparoscopic appendectomy, due to its significant advantages.[3] However, it needs a complete surgical laparoscopy set in addition to a trained surgeon. It's clear that advantages of laparoscopic appendectomy over open approach include decreased pain, fewer postoperative complications, and decreased length of hospitalization, improved intra-abdominal visualization, and better cosmetic results. Studies support that laparoscopic procedures reduce the inflammatory cascade by reducing expression of pro inflammatory cytokines. Those cytokines can be responsible of an increase of systemic inflammatory response and perioperative morbidity and mortality. Three laparoscopic ports are traditionally required to complete a laparoscopic appendectomy. In the minimally invasive surgery area, pediatric surgeons continue to be concerned with alternative technical solutions to minimize scarring to the patient. The mini invasive approach offers a significant reduction in the post-operative cytokines and this approach causes less surgical trauma in children compared with the open surgery.[5] The non-availability of adequate material (endoloops) represents an obstacle to perform the laparoscopic appendectomy which encouraged us to look for an alternative technique combining the advantages of both open and laparoscopic appendectomy, which was in our practice the port exteriorization technique.

This technique, performed predominantly using two ports and occasionally three, gained popularity initially in pediatric practice[6,7] and later in adult surgeries as well.[8,9] Several studies report the trans umbilical one trocar laparoscopic appendectomy (TULA) as technique of value in the management of acute appendicitis. Ding and al,[10] reports in a systematic review and meta-analysis that trans umbilical one trocar laparoscopic appendectomy was associated with higher conversion rate and perhaps higher surgical difficulty and hospitalization costs than the conventional laparoscopic appendectomy. According to Carter et al.[11] TULA resulted in more pain and longer operative time without improving short term recovery or complications comparing to the three ports laparoscopic appendectomy, while in our study the PEA was associated with significantly shorter operative time and lower complication rate than the conventional laparoscopic appendectomy Table 3. In a precedent study performed in our department the mean operative time for conventional laparoscopic appendectomy was 53 min. Comparing to the Port exteriorization group, there was a statistically significant difference. The operative time was significantly shorter (p= 0.025) in the two-port technique for both uncomplicated and complicated appendicitis Table 3. This difference can be explained by the fact that in the two port technique appendectomy was performed outside the abdomen allowing an easier manipulation of the appendix. Compared to the trans umbilical one trocar laparoscopic appendectomy (TULA), The port exteriorization technique offers a better triangulation and avoids collisions between laparoscope and instruments, it can also be considered as a transition step before the TULA.[12] Few studies about the port exteriorization appendectomy are available.[6,9,12–16]

Table 3 Comparison between conventional laparoscopy and PEA

Mean Operative Time	Uncomplicated Case	Complicated Case	p
Conventional Laparoscopy			
53 min	50 min	72 min	0,025
PEA			
39 min	34 min	55 min	

Table 4 Summary of Pediatric similar studies

	Pediatric Cases	Uncomplicated Appendicitis	Complicated Appendicitis	Operative Time (Min)	Use of Third Trocar	Conversion Rate	Complication	Hospital Stay (Day)
Our Study	50	76%	24%	39	6%	0	0	2
GołębiewskiA 2013	27	63%	37%	39	-	-	11.10%	-
Valioulis.I 2001	38	81.5	15.8	19	23.60%	5.20%	5.20%	-
El-GoharyMA2001	13	46.2	53.8	34	-	0	0	2.4

Only three previous studies concerned pediatric population.[6,13,17] Our study has a double interesting point; interest represented by the concerned population (pediatric), and the fact that procedure concerned both uncomplicated and complicated appendicitis. The mean operative time in the published studies ranged from 19 min to 64 min, In the pediatric studies the operative time ranged from 19[6] to 39minute.[13] The complications rate ranged in pediatric studies from 5.2 % to 11.1 %,[7] In our study like EL-Gohary et al.[17] none of the patients developed local wound infection or intra-abdominal abscesses Table 4. All The patients and their parents were totally satisfied by the cosmetic result.

Conclusion

The PEA technique for children's acute appendicitis can be performed as safely and efficiently as the open technique, with a lower cost than the complete laparoscopic approach. This method can be recommended as an alternative to open appendectomy or the conventional laparoscopic technique, and can be considered as a transition step before the one trocar laparoscopic assisted appendectomy.

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Conflicts of interest

The authors declare that there are no conflicts of interest.

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