

Periumbilical Multiport Laparoscopic Appendectomy: A Preliminary Experience Using a Novel Technique

Ibrahim Akkoyun^{1,*}

¹Department of Pediatric Surgery, Dr. Faruk Sukan Maternity and Children Hospital, Konya, Turkey

*Corresponding author: Ibrahim Akkoyun, Department of Pediatric Surgery, Dr. Faruk Sukan Maternity and Children Hospital, Konya, Turkey. Tel: +90-5324742886, Fax: +90-3323236723, E-mail: ibrahimakkoyun@yahoo.com

Received: September 22, 2013; **Revised:** November 11, 2013; **Accepted:** November 18, 2013

Background: Single incision laparoscopic surgery (SILS) is especially developed to achieve better cosmetic results. Using the umbilicus for ports access is widely accepted in this approach.

Objectives: The aim of this study was to evaluate our initial experience with a new port access technique applied for laparoscopic appendectomy: Periumbilical Multiport Laparoscopic Appendectomy (PUMLA).

Patients and Methods: Between January 2011 and March 2013, a total of 14 appendectomies were performed using a new port access technique. Patients were selected randomly. Thirteen of these cases had acute appendicitis, and one patient had familial Mediterranean fever (FMF). During these operations, three separate curvilinear incisions were created in the periumbilical skin folds and ports were placed in these ways. The five millimeter port was used for a zero degree telescope. The other two were used to manipulate the laparoscopic instruments. The appendectomy was performed intracorporeally in six cases; however, in eight cases, the appendix was taken out via a trocar after dissecting the mesoappendix, then the appendectomy was performed extracorporeally. Reconstruction was not needed to the umbilicus as there was no anatomical distortion.

Results: Five patients were female, and nine were male. Age range was 5 to 15 years (mean 9.7 years). Operation time was between 20 and 82 minutes (mean 43 minutes). We did not need to convert to standard laparoscopic appendectomy or place an additional port in any of these patients. The average postoperative hospitalization was 14.1 hours (5-33 h). No complications such as wound infection, trocar site hernia, adhesive small-bowel obstruction, or abscess were observed in the early and late postoperative period. Good cosmetic results were obtained after the separate periumbilical curvilinear incision technique.

Conclusions: We found that this new port access technique is feasible, safe, and associated with good cosmetic results.

Keywords: Laparoscopy; Appendectomy; Child; Surgical Procedures, Minimally Invasive

1. Background

Today, laparoscopic surgery is widely accepted and practiced for the treatment of many surgical diseases, including appendicitis. Conventional laparoscopic appendectomy is performed with surgical instruments and telescopes by inserting ports through incisions made at different abdominal locations. Advancements in the laparoscopic technique and new instrumentation have resulted in minimally invasive surgeries with less, or no, scar tissue. Recently there have been reports of many techniques such as single incision laparoscopic surgery, single site surgery, etc. (1-3). We know that in all of these reported techniques, a 20-30 mm incision is needed below or on the umbilicus with or without using a multiport access device. Moreover, it is well known that in these reported studies, appendectomy was achieved with the

aid of intracorporeal or extracorporeal slings for retraction, specialized ports for manipulation of instruments, or dedicated multitip or curved laparoscopic tools (4-7).

2. Objectives

The aim of this study was to evaluate our initial experience with a new port access technique used for laparoscopic appendectomy: Periumbilical Multiport Laparoscopic Appendectomy (PUMLA).

3. Patients and Methods

Between January 2011 and March 2013, 14 PUMLA procedures were performed on 14 patients at the Dr. Faruk Sukan Maternity and Children Hospital, Department of Pediatric Surgery, Konya, Turkey. One elective appendectomy for familial Mediterranean fever (FMF) and eleven

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

This study was conducted by a single pediatric surgeon in a maternity and children hospital. Technique detailed in this article is the first study in laparoscopic surgical field. This technique can be performed and adopted to other laparoscopic surgical procedures. Moreover, I think that it is very attractive and would be cited in other literatures.

Copyright © 2013, Colorectal Research Center and Health Policy Research Center of Shiraz University of Medical Sciences. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

immediate appendectomies were performed for acute appendicitis. The incisions for the port access sites were created in the periumbilical skin folds in a separate and curvilinear manner (Figure 1). Prior to the implementation of this technique, we measured the diameter of supposedly round-shaped umbilicus of 24 children aged between five to fifteen years. The diameter (R) of these children's umbilicus varied from nine to twenty-one mm. Based on the $2\pi r$ formula, the circumference of these umbilici was measured to be between 28 and 66 mm. As a result, this enabled us to make curvilinear and separate incisions periumbilically as we needed an 18 mm (10+5+3) space; the total area of three trocars, for the operation.



Figure 1. Separate Curvilinear Incisions for the Port Access

As the directions of the ports should be pointing towards the right lower quadrant during the appendectomy, the port for the five mm telescope was placed between 1 and 3 O'clock; the five mm trocar, to be manipulated by the right hand, was placed between 9 and 11 O'clock, and the 3 mm port was placed between 5 and 6 O'clock (the most superior part of the umbilicus was accepted as 12 O'clock). Trocars were introduced into the abdominal wall not from the fascia directly below the incision, but from a more lateral location. This was due to less expected collision of the instruments intrabdominally when an adequate triangulation was achieved between them. After the Veress needle was placed through

the 0.5 cm incision into the peritoneal cavity and pneumoperitoneum was created by the required pressure, the first five mm trocar was introduced into the peritoneal cavity and the abdominal cavity was observed by a five mm zero degree telescope. Then, the other five mm port was introduced into the peritoneal space. The appendix was to be explored by a laparoscopic dissector. Finally, a three mm trocar was introduced. The Laparoscopic Babcock instrument was used to manipulate the appendix through the three mm port. During the procedure, the outside portion of the ports was left at different lengths to prevent the port heads from rubbing against each other. The mesoappendix was dissected by a bipolar or monopolar cautery. The stump of the appendix was ligated in four patients and the appendix was extracted from the abdominal cavity via the trocar after the appendectomy (intracorporeal). This was due to the fact that the appendix could be ruptured during extraction as it was fragile in those cases. In the other eight cases in which the appendix was not fragile, it was extracted through the trocar site after being separated from its mesentery, following which the appendiceal stump was doubly ligated and the appendectomy was completed (extracorporeal). A five mm port enabled us to extract the appendix from a patient with FMF and another patient who was 5 years old; however, in the other patients, the five mm port was replaced by the 10 mm trocar by widening the incision site when we realized the impossibility of extracting the appendix in those patients. Reconstruction was not needed for the umbilicus as there was no anatomical distortion. Therefore, we propose periumbilical rather than intraumbilical port access, and recommend transumbilical access only in children who have an umbilical hernia. The fascia of the three mm and five mm incisions were not closed, and only the fascia of the 10 mm incision was closed. Skin incisions were infiltrated by a local anesthetic agent and closed subcuticularly. During all of these operations, 5 and 10 mm disposable ports (Covidien, Mansfield, MA, The USA), a three mm reusable port (Karl Storz GmbH, Tuttlingen, Germany), a five mm zero degree telescope (Karl Storz GmbH, Tuttlingen, Germany), and simple laparoscopic instruments were used (Figure 2).

4. Results

Our patients were aged between five and fifteen years old (mean 9.7). The operation time was, on average, 36 minutes (20-82 m). There was no need to convert to conventional laparoscopic appendectomy or placement of an additional port in any of these patients. None needed narcotic analgesic for postoperative pain. In the age-based follow-up of patients (Visual Analog Scale for below seven years old, and Virtual Analog Scale for seven years old and above), two patients needed one dose of an analgesic agent each, and intravenous Paracetamol was helpful in those cases who suffered from pain to relieve

shoulder or umbilical pain. All patients were mobilized in the first two hours, and were fed orally by the 4th hour postoperatively. All patients were discharged in less than 24 hours. The average postoperative hospitalization was 10.2 hours (5-22). There was no extra cost as there was no need for use of articulating instruments or a multiport device. No postoperative complications were observed, including wound infection or trocar-site herniation. Our cosmetic results were satisfactory as there was no anatomical distortion of the umbilicus and no visible scar.



Figure 2. Triangulation of the Straight Laparoscopic Instruments During Appendectomy

5. Discussion

Many surgical diseases can be currently treated by laparoscopic surgery. Compared to other open surgical procedures, laparoscopic surgery has many advantages, such as less postoperative pain, shorter hospital stays, earlier recovery periods, and better cosmetic results (1). Recently, there have been reports of single-incision multiport techniques (SILS) or efforts to lessen the number of ports to achieve scarless surgery. The SILS approach is also known as embryonic natural orifice transumbilical endoscopic surgery (4). It primarily uses standard laparoscopic instruments through a familiar visual approach and is thus more easily adopted than other developing approaches, such as natural orifice transluminal endoscopic surgery (NOTES). The NOTES approach uses natural orifices such as the mouth, stomach, rectum, or vagina. Although this approach provides a scarless surgery, it is not considered to be appropriate according to ethical or surgical principles, as it requires perforation of the stomach, vagina, or rectum; therefore, the umbilicus is more widely accepted as a natural orifice for port access (5). In the SILS approach, a 20-30 mm transverse, vertical, or yin-yang symbol-shaped incision is created on the umbilicus, then the umbilical skin is raised as a flap, and then a 20-30 mm fascial incision is made, through

which access devices with 3 ports named SILS port (Covidien, Mansfield, MA, The USA), R-port (Advanced Surgical Concepts, Wicklow, Ireland) Gelport (Applied Medical, Rancho Santa Margarita, CA, The USA), and etc. are inserted into the peritoneal cavity (4, 8). This disadvantage of SILS causes an increased risk for developing a fascial defect (9). A camera is placed in one of those ports, and the other two ports are used for one of straight, curved, or articulating procedural instruments, depending on the type of surgical procedure required.

Single-port access devices can be often considered reasonable for adults; however, it is argued that a 20-30 mm incision could be considered for laparotomy in children. Pediatric sizes of these devices have not been manufactured yet. Such a long skin incision along with a same-length fascial incision requires the closure of the fascia. Another disadvantage of SILS is the increased potential for developing a fascial defect (9). Moreover, after a single incision is made inside the umbilicus, the umbilical skin is raised as a flap tissue, which would eventually lead to the distortion of the umbilicus anatomy. This would require a reconstruction of the umbilicus in the last part of the operation. It is also a fact that these port access systems raise the cost of the operation which is especially a problem for developing countries. Ergun et al. (10) showed that the cost of SILS is 560 euros, which is more than conventional laparoscopy.

There have been reports of single-incision multiport techniques without using a multiport access device. In this approach, after a 20-30 mm incision is made, it is possible to place 3 trocars through separate-stab fascial incisions (7, 11). However, because the incision is made, infraumbilical curvilinear or intraumbilical ports would be extremely close to each other, and triangulation of the ports would be very limited. Furthermore, if defects occur on the fascia due to the ports merging together, either the pneumoperitoneum cannot be achieved sufficiently or gas flow would need to stay at the maximum level (1). Because the diameter of the umbilicus is shorter in children than adults, this long incision may extend outside the umbilicus and may lead to visible scar formation. As a matter of fact, for the umbilicus of the oldest child we measured, the umbilical diameter was 21 mm. If again, the procedure is being performed on the umbilicus, then a reconstruction of the umbilicus would be needed. Moreover, the intraumbilical approach was reported to cause umbilical granuloma or omphalitis (12, 13). The only advantage of a long incision is that it enables the operator to take a large and solid specimen. Besides, there is no need to obtain a large and solid specimen in procedures such as appendectomy, inguinal hernia repair, orchiopey, varicocele, cholecystectomy, In Nissen fundoplication single-port access technique could be used.

Because the circular umbilical cord enters the umbilicus, the umbilicus is also shaped as a circular structure. Theoretically, one expects such shape to continue all over

human life. Based on the studies, the umbilical shape can either be circular or ellipsoidal (14, 15). This circular structure is even more obvious in slim children. In overweight children, the umbilicus looks ellipsoidal due to fatty tissue bulging bilaterally, or superiorly and inferiorly around it. One can put a finger in those with the ellipsoidal shape and make them look more circular. With this in mind, we measured the umbilical diameters of 24 children aged five to fifteen years, and determined it to be 9-21 mm. Even though the umbilicus is thought to be a natural orifice, we do not favor integrity distortion of the umbilicus as it was closed and shaped into its final anatomy during the newborn period. This was evidenced by the feedback of contentment from the patients and their parents, especially by adolescent girls highly concerned about their umbilical image. Therefore, we propose periumbilical rather than intraumbilical port access and recommend transumbilical access only in children who have an umbilical hernia.

This novel technique (PUMLA):

Does not need single-port access systems, therefore it keeps costs down.

Has less incisional-hernia risk, due to the fact that 3-10 mm incisions are made through periumbilical skin folds, unlike the single-port access systems, which cause a fascial defect due to 20-30 mm incisions. There is no need for the closure of three-five mm defects in children older than 5 years, as no reports of trocar site hernia are present to date (16). This enables both intracorporeal and extracorporeal appendectomy.



Figure 3. Cosmetic Appearance 5 Months Following Surgery

The original shape of the umbilicus is protected as there is no distortion of the natural shape of the umbilicus.

Complications such as umbilical granuloma or omphalitis would not be seen as the site of access is not intraumbilical.

Good cosmetic results are obtained because incisions are made through periumbilical skin folds, and the natural shape of the umbilicus is preserved (Figure 3).

Also, I believe that this approach provides a scarless surgery, and is considered appropriate regarding ethical or surgical principles, because it is performed with a laparoscope, and is considered as a minimally invasive surgery for the treatment of children with appendicitis.

In conclusion, we found that this novel port access technique is feasible, safe, and associated with good cosmetic results. We also think that it can be performed not only for appendectomy, but also for other operations that can be performed laparoscopically requiring three-port access. A wide variety of port access combinations would be possible to point towards different parts of the abdomen by separate curvilinear incisions created on the periumbilical skin folds.

Acknowledgements

None declared.

Financial Disclosure

None Declared.

Funding/Support

None Declared.

References

1. Garey CL, Laituri CA, Ostlie DJ, Snyder CL, Andrews WS, Holcomb GW, 3rd, et al. Single-incision laparoscopic surgery in children: initial single-center experience. *J Pediatr Surg.* 2011;**46**(5):904-7.
2. Ostlie DJ. Single-site umbilical laparoscopic appendectomy. *Semin Pediatr Surg.* 2011;**20**(4):196-200.
3. Tam YH, Lee KH, Sihoe JD, Chan KW, Cheung ST, Pang KK. Initial experience in children using conventional laparoscopic instruments in single-incision laparoscopic surgery. *J Pediatr Surg.* 2010;**45**(12):2381-5.
4. Ahmed I, Paraskeva P. A clinical review of single-incision laparoscopic surgery. *Surgeon.* 2011;**9**(6):341-51.
5. Ahmed K, Wang TT, Patel VM, Nagpal K, Clark J, Ali M, et al. The role of single-incision laparoscopic surgery in abdominal and pelvic surgery: a systematic review. *Surg Endosc.* 2011;**25**(2):378-96.
6. Ates O, Hakguder G, Olguner M, Akgur FM. Single-port laparoscopic appendectomy conducted intracorporeally with the aid of a trans-abdominal sling suture. *J Pediatr Surg.* 2007;**42**(6):1071-4.
7. Chiu CG, Nguyen NH, Bloom SW. Single-incision laparoscopic appendectomy using conventional instruments: an initial experience using a novel technique. *Surg Endosc.* 2011;**25**(4):1153-9.
8. Irwin BH, Rao PP, Stein RJ, Desai MM. Laparoendoscopic single site surgery in urology. *Urol Clin North Am.* 2009;**36**(2):223-35.
9. Chamberlain RS, Sakpal SV. A comprehensive review of single-incision laparoscopic surgery (SILS) and natural orifice transluminal endoscopic surgery (NOTES) techniques for cholecystectomy. *J Gastrointest Surg.* 2009;**13**(9):1733-40.

10. Ergun O, Tiryaki S, Celik A. Single center experience in single-incision laparoscopic surgery in children in Turkey. *J Pediatr Surg*. 2011;**46**(4):704-7.
11. Dutta S. Early experience with single incision laparoscopic surgery: eliminating the scar from abdominal operations. *J Pediatr Surg*. 2009;**44**(9):1741-5.
12. Hong TH, Kim HL, Lee YS, Kim JJ, Lee KH, You YK, et al. Transumbilical single-port laparoscopic appendectomy (TUSPLA): scarless intracorporeal appendectomy. *J Laparoendosc Adv Surg Tech A*. 2009;**19**(1):75-8.
13. Mlyncek M, Truska A, Garay J. Laparoscopy Without Use of the Veress Needle: Results in a Series of 1,600 Procedures. *Mayo Clinic proceedings. Mayo Clinic*. 1994;**69**(12):1146-8.
14. Ahn HJ, Kim SW, Hwang SM, Choi EH, Ahn SK. Umbilical shape and diseases related to age and sex. *Korean J Dermatol*. 2000;**38**(3):322-8.
15. Sinkkonen A. Umbilicus as a fitness signal in humans. *FASEB J*. 2009;**23**(1):10-2.
16. Paya K, Wurm J, Fakhari M, Felder-Puig R, Puig S. Trocar-site hernia as a typical postoperative complication of minimally invasive surgery among preschool children. *Surg Endosc*. 2008;**22**(12):2724-7.