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Original Article

Does ambulatory surgery work for open appendectomy?: A review of paediatric cases with appendicitis treated in a single institution

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Abstract

Ambulatory surgery for acute appendicitis operated on by open technique has not been yet mentioned before. The authors reviewed a preliminary result of children treated with open appendectomy. The records of 33 consecutive children with acute appendicitis between 2017 and 2018 were retrospectively reviewed. Of them, 25 who underwent appendectomy were either inflammatory or suppurative. Mean age was 115.92 ± 33.82 months. Wound averaged 2.02 ± 0.48 centimetres in length. The average operative time was 37 ± 18.6 minutes. Mean length of hospital stay (LOS) was 21.84 ± 16.2 hours. There were 4 and 16 patients who had a LOS of less than 12 and between 12 and 24, respectively. A small proportion of the patients could meet ambulatory surgery's criteria. The time at which patients presented to the surgeon causing the operation completed at night and a prolonged duration prior to consultation were the major hurdles in the study.

Keywords: ambulatory surgery, appendicitis, appendectomy

1. Introduction

Laparoscopic appendectomy is associated with good surgical outcomes and has become a more widely accepted treatment for acute non-perforated appendicitis. The length of hospital stay (LOS) for this approach takes increasingly less time from a mean postoperative hospitalization of 2 days (Guller *et al.*, 2004) to within the same day, questioning the need for inpatient care (Frazee *et al.*, 2016; Genser & Vons, 2015; Lefrancois *et al.*, 2015). Likewise, for appendectomies in children, the laparoscopic procedures are currently associated with results comparable to the open technique (Ali, Anwar, & Akhtar, 2017; Ikeda *et al.*, 2004). They can be performed with shortened LOS, and also they are able to be performed on the basis of ambulatory surgery (Akkoyun, 2013; Alkhoury *et al.*, 2012; Grewal, Sweat, & Vazquez, 2004; Jimbo *et al.*, 2017).

However, to date, an open technique is still considered as a standard treatment for acute appendicitis. Although the concept of ambulatory surgery for acute appendicitis treated by laparoscopic technique is currently widely reported, this approach for those operated on by open technique has not yet been mentioned. The authors reviewed a preliminary experience of treating children, in which the acute appendicitis is treated by open appendectomy with a short hospital stay, thereby evaluating the possibility of the open technique on an ambulatory basis.

2. Material and Methods

In 2017, we adopted a concept of short hospital stay for the treatment of acute appendicitis at our institution. As the author (PS) has experience of treating these patients with a minimal incision technique in over 2,000 cases, and the first case of paediatric patient who underwent open appendectomy and was clinically observed 3 hours postoperatively before discharge was recorded in June, we have continued this concept since then. Twelve months after that time, all paediatric patients who were diagnosed with acute appendicitis by three standard approaches, including clinical presentations, complete blood count and urinalysis were retrospectively reviewed. The institutional review board (IRB) granted permission to review data for this study (IRBID, 12/2561). All parents or patients were asked before reviewing

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their medical records by registered postal mail. There was an absence of declined response and "no response" implied no negative feedback in the study.

2.1 Preoperation

As, in our country, the Ministry of Public Health's policy demands step of admission for all patients diagnosed with acute appendicitis, all patients were registered twice at visit and admission time, respectively. Meanwhile, the patients could be transferred directly to operation room should the diagnosis to determined, or brought to observe at the ward should the diagnosis be indefinite. At times, some patients were admitted by a pediatrician and consulted to us later. When diagnosis of acute appendicitis was made, single dose of 10 mg/kg metronidazole and 5 mg/kg gentamicin was given intravenously to all patients.

2.2 Surgical technique

The technique for acute non-perforated appendicitis is still the same as mentioned in our previous report (Sookpotarom, Khampiwmar, & Termwattanaphakdee, 2010). Briefly, the patient undergoes general anaesthesia and the operation site is scrubbed and painted with povidone-iodine solution without shaving. Sterile cloth towels are utilized as usual. A 1.5 to 2.5 cm transverse skin crease incision, up to the patient's fat thickness, at McBurney point is made with scalpel No.15. With this scalpel, Metzenbaum scissor, Zen retractors and mosquito clamps, we are able to pass through Scarpa's fascia, aponeurosis and abdominal muscle and enter the peritoneum in all cases without electrocautery. According to the small opening, the only instrument that can help find the appendix or caecum are non-toothed thumb forceps and Babcock forceps. At this point, the technique requires high skill since the caecum or sometimes appendix will be grasped blindly. Occasionally, the instance is not simple and the author's digit will help find them and break any soft adhesion surrounding the appendix. The 4x4 gauzes are unfolded, longitudinally rolled and grasped with an arterial clamp for swabbing purpose instead of conventional sponge - holding forceps with gauzes.

When the appendix is identified, it is lifted outside and doubly ligated with 1-0 or 2-0 silk suture and appendectomy is done with scalpel No.11. The appendiceal stump is cleaned with cotton bud soaked with pure phenol and then 70% alcohol solution respectively. The stump is taken down without inversion. Special care must be taken to avoid wound contamination by the appendiceal stump. Peritonization and muscular sheath approximation with 3-0 polyglactin suture and 1-2 mg/kg Lidocaine injection at level of sheath and subcutaneous fat are performed, respectively. Finally, skin is closed by subcuticular suture with 5-0 polyglactin suture.

2.3 Postoperation

As we have mentioned regarding the policy earlier, counselling for out-patient management given at anaesthetic recovery room (ARR) is not possible in our country (Frazee *et al.*, 2016). Following approximately 1 hour of observation and monitoring for any postoperative complications at ARR, the patients were transferred back to their own ward and evaluated for eligibility to recover and resume their diet at home. The criteria for discharge, reviewed and modified from previous publications, are as follows (Hussain, Singh, Singh Ahi, & Singh 2014; Scott *et al.*, 2017);

1. Clinical improvement which includes
   - Stable vital signs for 60 min (with body temperature <38 degrees Celsius)
   - Full reversal of anaesthetic paralysis and consciousness
   - Presence of mild to moderate pain
   - Absence of bleeding or oozing
   - Minimal nausea/vomiting and
   - Ability to walk to void
2. Absence of difficulty in operation (operative time < 60 min)
3. The counselling time is daytime (before 6 p.m.), and
4. Agreement from both patient and parent

All patients are counselled for instruction regarding diet and unwanted symptoms. A printed instruction including contact information and follow-up appointments is given to them before discharge. Since the surgical wounds are closed with water-proof dressing, they are left in place without further dressing until the time of follow-up unless there is any problem. Only paracetamol is given for take-home medication.

2.4 Follow-up

Besides any patients' complications detected at wards, all patients will be re-evaluated again at the time of follow-up (approximately 2 weeks after discharge). The wound size measured with ruler and photographed with camera are our routine practice.

2.5 Term definition

Time to operating room (TTO) is defined as the time from visiting time to the time recorded when a patient comes to the operating room.

Operating room time (ORT) is defined as the time recorded when a patient comes in to the time recorded when a patient comes out of the operating room.

Time to discharge (TTD) is defined as the time recorded when a patient comes out of the operating room to the time the author signs an order to discharge the patient.

LOS is defined as the sum of TTO, ORT, and TTD.

Data are expressed as range and mean ± SD.

3. Results

Of 33 appendectomies, 2 patients were excluded because of their underlying disorders, i.e., one had a history of treatment of gastroschisis and another had nonrotation of midgut, which needed midline incision in lieu of right lower quadrant incision, and 6 patients whose appendices were necrotized (1) or perforated (5) were also excluded. The remaining 25 patients who underwent appendectomy were either inflammatory or suppurative. Mean age was 115.92 ± 33.82 months (range, 42 to 171 months). Wound measurements averaged 2.02 ± 0.48 centimetres (range, 1.3 to 3.4 centimetres) in length and 1.86 ± 1.02 centimetres (range, 0.5 to 4 centimetres) in depth. The correlation between the incision length and the wound depth (fat thickness) is

demonstrated in Figure 1. The average operative time was 37 ± 18.6 minutes (range, 20 to 110 minutes). The mean TTO, ORT and TTD were 9.8 ± 13.6 hours (range, 1.02 to 65.28 hours), 1.03 ± 0.34 hours (range, 0.5 to 2.25 hours), and 11.04 ± 6.69 hours (range, 1 to 33.58 hours), respectively. Mean length of hospital stay (LOS) was 21.84 ± 16.2 hours (range, 4.43 to 86.78 hours).

In an analysis of 25 patients to categorize them based on their length of stay and to explore the reasons why they could not be discharged at that time is shown in Table 1. We could classify all patients into 3 groups: A, including 4 patients, whose LOS was less than 12 hours; B, including 16 patients, in whom the LOS was between 12 and 24 hours; and C, including 5 patients, in which their LOS was over 24 hours. Time presentation (hospital visit time) of all 4 patients in group A, in order of time, were 4:47 a.m., 5:34 a.m., 0:59 p.m., and 10:51 p.m., with an average LOS of 6.64 ± 1.98 hours (range, 4.43 to 9.22 hours). In group B, there were 9 patients in who came to ward at night or when it was raining and were eligible for discharge without other reasons. Moreover, there were 2 patients in group B who, although the operation was completed at day time and their TTD was less than 12 hours, their TTO was over 12 hours, thereby resulting in increased total time of LOS beyond a 12-hour time limit. They both were initially admitted at paediatric ward and later were consulted for surgical evaluation. There were 10 patients in group B and C who could not meet our criteria because of difficulty in surgery, drowsiness, high fever, wound pain, or preference for VIP room. There was no complication at either early post-operation or 2 week-follow up time.

4. Discussion

Over the past 10 years, our surgical techniques for the treatment of appendicitis have improve as described earlier, while the lengths of hospital stay were gradually reduced. Many years before 2016, almost all of the uncomplicated appendectomies were hospitalized postoperatively without any specific care or treatment. And also, there was no specific diet programme. The patients were asked to wait a night stay for observing the possibility of postoperative complications. As the author (PS) has increasingly gained experience of treating these patients and adopted a concept of short hospital stay in 2017, we successfully treated our first case with a few-hour hospital stay (from visit time to discharge time). We developed criteria for the safe discharge as shown in the material and methods. The difficulty in our practice, the same as discussed in a study by Frazee and colleagues (Frazee *et al.*, 2016), is to counsel to their parents or families. Although the concept of our practice is not new for laparoscopic technique, it had not been implemented before for the open technique in our country. As a result, the parents or family were always surprised, and additional time was spent to explain the rationale and benefits of this approach. We developed a patient instruction in case they were eligible and advised to stay at their home. The instruction includes wound care, some activity limitations, and emergency contact numbers.

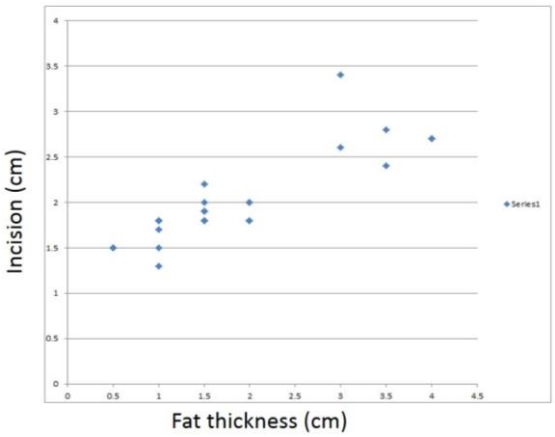

Figure 1. Correlation between incision and fat thickness (R^2 = 0.5324 and $p<0.0001$)

An accepted definition of ambulatory surgery defines this term as any surgical interventions that include a length of hospital stay of less than 12 hours without an overnight stay (International Association for Ambulatory Surgery [DSHIA], 2014). In the latest preliminary experience with 25 appendectomies, although there were only 4 patients who met these criteria, there were 11 patients in group B who could also have potential. That had the timing of surgery or the climate been appropriate in 9 patients, or the long-time observation been the case in 2 patients (not shown in the table), they would have been discharged sooner shifting these patients to an ambulatory basis. Various factors, e.g., child care, caregiver's work, transfer process, and transportation, influencing the hospital arrival time, and inevitably the time of presentation. Like our findings, most of the patients (63%) arrived and presented their symptoms between noon and midnight (Drake *et al.*, 2017). However, one of our drawbacks is that when the operation was completed at night time, they had never been asked for discharge regardless of other reasons. As a result, we could not know the actual number of patients whose parents would like their child to stay in hospital regardless of the patient is considering. According to our findings, although there was no specific treatment except oral paracetamol and there was only one family that required post-operative admission, the belief that post-operative hospital stay is necessary for the patients still exists. In addition, to make a diagnosis of appendicitis in children, particularly in young children is challenging (Mallick, 2008; Marzuillo, Germani, Krauss, & Barbi, 2015). They are

Table 1. The reasons for which the patients could not meet our discharge criteria

	Night time at ward or raining	Difficulty in operation	Drowsiness	High fever	Wound pain	Patient's preference
Group A (n=4)	0	0	0	0	0	0
Group B (n=16)	12	1	1	3	0	0
Group C (n=5)	3	1	0	2	1	1

frequently misdiagnosed as acute gastroenteritis and later transferred to us when clinically not improved, prolonging the pre-operative time.

Although there were 5 patients who had body temperature over 38 degrees, the patients had TTD, in order of duration of, 5.08, 12.16, 13.83, 16 and 33.58 hours, respectively. The longest duration occurred in a patient whose parent desired 2-night stay in a VIP room. Probably, in the next study the criteria would be adjusted to be "body temperature <38.5 degrees Celsius". Also, the 2 patients who experienced operative time of 110 and 60 minutes had TTD of 12.58 and 20 hours, respectively. An intraoperative event would be considered as surgical difficulty in lieu of operative time. According to the small numbers of our patients, we cannot reasonably conclude any factors in this study; however, it seemed that the time of presentation of a patient to the surgeon and time taken prior to consultation are both important factors influencing a total time in LOS.

Some factors enhancing recovery in our patients may be an intraoperative local anesthesia prior to abdominal wound closure and a minimal incision technique. The absence of opioid use in the study might be explained by our routine use of this local anesthetic infiltration. However, according to our thought, the minimal Minimal trauma to the abdominal wall is probably athe most plausible explanation for the results observed in this study. In adult, the mini-incision technique could be safely performed and intriguingly comparable to a laparoscopic group, should an appropriate group of patients be selected (Özsan, Karabuğa, Yoldaş, Alpdoğan, & Aydın, 2014; Çiftçi, 2015). We could perform mini-incision with a range of 1.3-3.4 centimeters (Figure 2). However, the same small incision length, cannot be made in every patient The size of a patient's incision depends roughly upon the size of the patient, namely the wound would be larger in a patient whose fat had more thickness in order for it to be easier to perform a procedure through a deeper hole. Although, for that reason, the minimal trauma could have the benefit over conventional open incision, the mini-incision is not without some events. Occasionally, with a retrocecal position or an appendix in which the mesoappendix was too short or distorted due to adhesions following previous inflammation, when we had found the base, it required some unique (our own) techniques. In such cases, sequential traction sutures (without needle), approximately 0.5-1 cm apart, was needed retrograde from appendiceal base to a point at which we could deliver the entire appendix onto the wound and meanwhile ligatures of mesoappendix were performed together (Figure 3). Another obstacle that we encountered when we faced a procedural difficulty was pressure from people on duty around us, e.g., assistants, scrub nurses, or anesthetic nurses, that convinced us to extend the incision. With our experience, in only one case, a long time ago, were the extension of incision needed. We thought that it was because too much volume of cecum was delivered out and long enough to make it swell causing it impossible to return into the abdomen. That was our learning curve. Actually, when we retracted the incision with greater force, slightly additional surgical space was achieved.

There were concerns with respect to the parents' feeling or their satisfaction. Although we had not collected doses of postoperative anesthesia and constructed a form to document this aspect as done in other studies (Ali *et al.*, 2017; Anderson, Abernathy, Jupiter, & Frazee, 2016), we had found

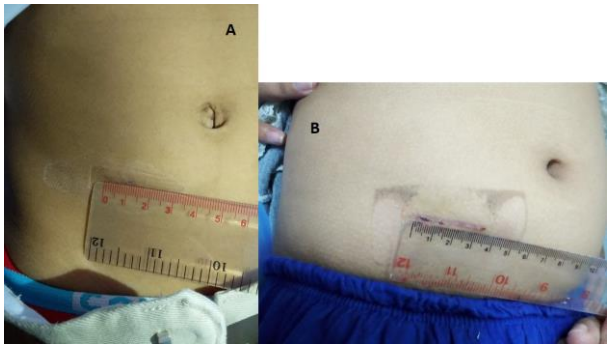

Figure 2. Incision size from smallest (A) to biggest (B)

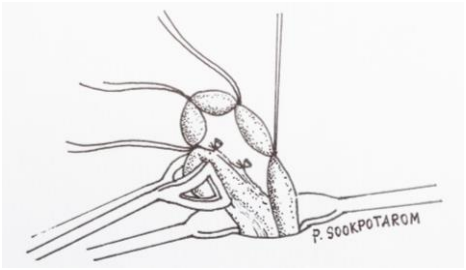

Figure 3. Sequential traction sutures retrograde from appendiceal base to a point at which the whole appendix can be delivered

that all parents in the group A felt satisfied particularly in a single-dad family. According to the pediatric ward's rule that the father as male adult could not stay with his son, he was quite happy to go back home following an hour post-operation.

In our opinion, a drawback will occur when this concept of treating pediatric patients with simple appendicitis as an ambulatory basis is applied to general practice. Although our success was not one-surgeon (P.S) experience and can also generalised into other surgeons practice, there is a paramount obstacle, i.e., the proposed technique requires repeated practices and time to achieve skill proficiency. Maybe, they will experience some pressures from people around them, as in the author's experience. As a result, we think that firstly we would like to propose the possibility of this concept rather than expecting a generalization into the other surgeons' practice. Consequently, the acceptance on this basis may result in general practice. However, we have tried to emphasize our surgical techniques in details expecting to help generalization of this techniques. Most importantly, we have to emphasize that this concept is only applied for pediatric patients with simple appendicitis, not complicated appendicitis.

With the natural history of the disease, presentation time at a hospital mean that most of the operation are completed at a time when the instant discharge is not possible. As we have shown, only a minority of cases, 4/25 (16%) in our series, could meet the ambulatory criteria. Probably, the treatment course of appendicitis is likely to be based on an early discharge in lieu of ambulatory surgery. However, some possible ways might help reducing time taken in the process including the Ministry's policy quits demanding this disease item to admission (maybe it is conditional) and there are better

ambulatory cases, either by laparoscopy or open techniques, to change the attitude of the people with respect to the disease that post-operative hospital stay is not needed for their offspring. In conclusion, it seems that the major hurdles to perform open appendectomy on the basis of ambulatory surgery include the time at which patients presented to surgeon that will render the operation completed at night and the duration the patients admission prior to consultation that will prolong the pre-operative hospital stay.

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References

Akkoyun, I. (2013). Outpatient laparoscopic appendectomy in children: A single center experience with 92 cases. *Surgical Laparoscopy, Endoscopy and Percutaneous Techniques*, *23*(1), 49-50. doi:10.1097/SLE.0b013e31826e4450

Ali, R., Anwar, M., & Akhtar, J. (2017). Laparoscopic versus open appendectomy in children: a randomized controlled trial from a developing country. *Journal of Pediatric Surgery*, *53*(2), 247-249. doi:10.1016/j.jpedsurg.2017.11.022

Alkhoury, F., Burnweit, C., Malvezzi, L., Knight, C., Diana, J., Pasaron, R., . . . Stylianos, S. (2012). A prospective study of safety and satisfaction with same-day discharge after laparoscopic appendectomy for acute appendicitis. *Journal of Pediatric Surgery*, *47*(2), 313-316. doi:10.1016/j.jpedsurg.2011.11.024

Anderson, K. A., Abernathy, S. W., Jupiter, D., & Frazee, R. C. (2016). Patient satisfaction after outpatient appendectomy. *Journal of Laparoendoscopic and Advanced Surgical Techniques - Part A*, *26*(12), 954-957. doi:10.1089/lap.2015.0488

Çiftçi, F. (2015). Laparoscopic vs mini-incision open appendectomy. *World Journal of Gastrointestinal Surgery*, *7*(10), 267-272. doi:10.4240/wjgs.v7.i10.267

Drake, F. T., Mottey, N. E., Castelli, A. A., Florence, M. G., Johnson, M. G., Steele, S. R., … Flum, D. R. (2017). Time-of-day and appendicitis: Impact on management and outcomes. *Surgery*, *161*(2), 405-414. doi:10.1016/j.surg.2016.06.052

Frazee, R. C., Abernathy, S. W., Isbell, C. L., Isbell, T., Regner, J. L., & Smith, R. D. (2016). Outpatient laparoscopic appendectomy: Is it time to end the discussion? *Journal of the American College of Surgeons*, *222*(4), 473-477. doi:10.1016/j.jamcollsurg.2015.12.053

Genser, L., & Vons, C. (2015). Can abdominal surgical emergencies be treated in an ambulatory setting? *Journal of Visceral Surgery*, *152*(Supplemental 6), S81-89. doi:10.1016/j.jviscsurg.2015.09.015

Grewal, H., Sweat, J., & Vazquez, W. D. (2004). Laparoscopic appendectomy in children can be done as a fast-track or same-day surgery. *Journal of the Society of Laparoscopic and Robotic Surgeons*, *8*(2), 151-154.

Guller, U., Hervey, S., Purves, H., Muhlbaier, L. H., Peterson, E. D., . . . Pietrobon, R. (2004). Laparoscopic versus open appendectomy: outcomes comparison based on a large administrative database. *Annals of Surgery*, *239*(1), 43-52. doi:10.1097/01.sla.0000103071.35986.c1

Hussain, A., Singh, S., Singh Ahi, K., & Singh, M. (2014). Status of day care laparoscopic appendectomy in developing countries. *International Scholarly* Research Notices, *2014*, 502786. doi:10.1155/2014/502786

Ikeda, H., Ishimaru, Y., Takayasu, H., Okamura, K., Kisaki, Y., & Fujino, J. (2004). Laparoscopic versus open appendectomy in children with uncomplicated and complicated appendicitis. *Journal of Pediatric Surgery*, *39*(11), 1680-1685. doi:10.1016/j.jpedsurg.2004.07.018

International Association for Ambulatory Surgery. (2014). Ambulatory surgery handbook (2nd ed.). Brussels, Belgium: Author.

Jimbo, T., Masumoto, K., Takayasu, H., Shinkai, T., Urita, Y., Uesugi, T., … Sasaki, T. (2017). Outcome of early discharge protocol after appendectomy for pediatric acute appendicitis. *Pediatrics International*, *59*(7), 803-806. doi:10.1111/ped.13290

Lefrancois, M., Lefevre, J. H., Chafai, N., Pitel, S., Kerger, L., Agostini, J., … Tiret, E. (2015). Management of acute appendicitis in ambulatory surgery: Is it possible? How to select patients? *Annals of Surgery*, *261*(6), 1167-1172. doi:10.1097/SLA.0000000000000795

Mallick, M. S. (2008). Appendicitis in pre-school children: A continuing clinical challenge. A retrospective study. *International Journal of Surgery*, *6*(5), 371-373. doi: 10.1016/j.ijsu.2008.06.003

Marzuillo, P., Germani, C., Krauss, B. S., & Barbi, E. (2015). Appendicitis in children less than five years old: A challenge for the general practitioner. *World Journal of Clinical Pediatrics*, *4*(2), 19-24. doi:10.5409/wjcp.v4.i2.19

Özsan, İ., Karabuğa, T., Yoldaş, Ö., Alpdoğan, Ö., & Aydın, Ü. (2014). Laparoscopic appendectomy versus mini-incision appendectomy in patients with lower body mass index and noncomplicated appendicitis. *Gastroenterology Research and Practice*, *2014*, 138648. doi:10.1155/2014/138648

Scott, A., Shekherdimian, S., Rouch, J. D., Sacks, G. D., Dawes, A. J., Lui, W. Y., … Aboulian, A. (2017). Same-day discharge in laparoscopic acute non-perforated appendectomy. *Journal of the American College of Surgeons*, *224*(1), 43-48. doi:10.1016/j.jamcollsurg.2016.10.026

Sookpotarom, P., Khampiwmar, W., & Termwattanaphakdee, T. (2010). Vigorous wound irrigation followed by subcuticular skin closure in children with perforated appendicitis. *Journal of the Medical Association of Thailand*, *93*(3), 318-23.