Small lateral access—an alternative approach to appendicitis in paediatric patients: A randomised controlled trial

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KEYWORDS
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Abstract  Background: Conventionally the appendix is removed through a right lower quadrant transverse incision or a gridiron incision approximately 5 cm in length. In this modern era of minimally invasive surgery, there is a lot of emphasis on cosmesis and early recovery. We performed a prospective, double blind, randomised trial to evaluate a new incision for appendectomy to compare with conventional appendectomy.

Methods: One hundred and twenty patients, aged between 3 and 18 years, were randomized to receive either small access appendectomy (SAA) (n = 60, 53 acute appendicitis and 7 interval appendectomy) or conventional appendectomy (CAP) (n = 60, 55 acute appendicitis and 5 interval appendectomy). SAA was performed through an incision in the lateral 1/3 of the spino-umbilical line, lateral to McBurney’s point. The caecum along with the appendix could be delivered through this small incision easily as the ileal loops did not interfere with the delivery. All patients suspected of acute appendicitis were evaluated by the modified Alvarado’s system to reduce the rate of negative appendectomies. Patients with diffuse peritonitis were excluded.

Results: The demographic data for the two groups were similar. The SAA group required less analgesics (p < 0.001), had earlier ambulation and shorter hospital stay (p < 0.001), and better cosmetic score (p < 0.001), but the operation took longer (p < 0.001) compared to the CAP group.

Conclusion: We conclude that SAA can be done safely without the need for any special equipment, with definite advantages over conventional appendectomy.

Introduction

Conventionally the appendix is removed through a right lower quadrant transverse incision or a gridiron incision approximately 5 cm in length, and sometimes through a paramedian incision. The mortality rate following surgery for acute
non-perforated appendicitis has declined over the past 60 years to almost zero percent, but morbidity remains an issue. In this era of minimally invasive surgery, there has been a lot of enthusiasm to give surgical patients better comfort, better cosmesis and earlier recovery. Some studies on laparoscopic appendectomy reported less pain, shorter hospital stay and earlier return to school/work while others failed to demonstrate the advantages. This prospective, double blind, randomised trial was done to compare the new incision with conventional appendectomy in children.

Patients and method

From January to August 2004, 120 children with clinical signs and symptoms of acute appendicitis were randomly assigned to small access appendectomy (SAA) and to conventional appendectomy (CAP). The sample size was estimated by statistical calculations to be 120. Randomisation was done by using sealed envelopes with 60 patients assigned to each group, and it occurred in the preoperative bay after the patients/parents consented to participate in the study. Case record forms were used to record the data of the patients. The modified Alvarado system (MANTRELS) was used to reduce the negative appendectomy rate. Only patients with a short history with signs and symptoms of appendicitis were included. Patients with diffuse peritonitis suggestive of gangrene or perforation were excluded from the study. At the time of induction, a single dose of analgesic diclofenac was given to each patient. Postoperative analgesic requirement was recorded for analysis. Registrars or third year residents under the direct supervision of a registrar performed the procedures.

SAA group

A skin crease incision, 1.5–2 cm in length was made in the middle third of the lateral third of the spino-umbilical line, lateral to McBurney’s point (Figs. 1a and 2). External oblique fibres were cut and the internal oblique and the transverse muscle fibres were split in the direction of the fibres. Two smallest size Lagenbeck’s retractors were used to retract the fibres. Haemostasis was achieved at this point. The peritoneum was held with four artery forceps and was opened with artery forceps holding on to the peritoneum which lay in the depth of the wound, and thus helped in the delivery of the appendix (Fig. 1b). A taenia was recognised by pulling on to the caecum, and was held with a Babcock’s/bowel forcep (Fig. 1c). Two Babcock’s forceps were used to walk down the taenia to the base of the appendix at which point the appendix was pulled into the wound (Fig. 1d).

A window was made in the meso-appendix and ties were applied taking care not to cut the thread or the tissues as retraction of the vessel or the tissue into the wound meant conversion to conventional appendectomy due to the limited access. The ileum could be tracked to the last two feet by delivering only 1–2 inches at one time into the wound by Babcock’s forceps or bowel forceps. In females, when the appendix looked normal and pre-operative ultrasound was not available, the incision was extended to about 2 cm, to allow the introduction of a finger to palpate and hook the ovaries into the wound.

Conventional appendectomy (CAP)

Appendectomy was done via the Lanz or the gridiron incision 4–6 cm long (Fig. 2).

Figure 1 The important steps of small access appendectomy: (a) site of incision; (b) holding of peritoneum with four artery forceps before cutting peritoneum; (c) holding taenia of caecum leading to appendiceal base; (d) delivery of appendix in wound.
Results

There was no difference in the demographic data between the SAA and the CAP groups (Table 1). The mean age was around 11 years (range 3–18). The BMI of 95% of children was around the 50th percentile of the WHO growth chart for boys and girls. In the SAA group, 53 patients underwent the procedure for acute appendicitis while seven patients underwent interval appendectomy (Table 1). The appendices were normal in gross appearance in 11 patients out of whom 4 appendices were normal on histology (2M/2F). Four patients in the SAA group had perforated appendices, out of which only one patient had the procedure completed by small access appendectomy, without any post operative sequelae. Two patients had gangrenous appendices and were converted to conventional appendectomy. Overall, 11 patients (18.3%) had to be converted from SAA to CAP for the reasons shown in Table 2. In the CAP group, 55 and 5 children underwent the procedures for acute and interval appendectomy, respectively. There was no statistical difference between the pathologies in the two groups (Table 1).

The mean operating time for SAA was approximately 40% (15 min) longer than CAP \( (p < 0.001) \) (Table 1). As the surgeons’ experience increased, the operating time decreased. Post-operatively, the children in the SAA group had less pain, and required half the doses of analgesics \( (p < 0.001) \) (Table 1), and were ambulatory earlier than the CAP group. Early post-operative activities like mounting from bed, squatting, ability to walk to the toilet, and late activities like climbing stairs on the 8th day were much better in the SAA group. In the SAA group, hospital stay was shorter by approximately 25% \( (10 \, h) \) \( (p < 0.001) \) (Table 1). Wound infection occurred in one patient in the SAA group compared to three in the CAP group \( (p < 0.62) \) (Table 1). None of the patients developed intra-abdominal abscess in the study. There was no history of itching or numbness in the territory of the ilio-hypogastric nerve distribution in the SAA group while this was present in seven patients in the CAP group. The cosmesis score was better in the SAA than the CAP group \( (p < 0.001) \) (Table 1). Prolonged ileus occurred in one patient in the CAP group, while none in the SAA group, including those who were converted.

Discussion

The first appendectomy was done incidentally by Claudius Amyand in 1736 while Kronlein in 1886 published the first report of appendectomy. The term appendicitis was
Table 2  Conversions from SAA to CAP in 11 children

<table>
<thead>
<tr>
<th>Cause</th>
<th>Number of patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tie slipped from meso-appendix</td>
<td>1</td>
</tr>
<tr>
<td>Failure to reduce the gut back</td>
<td>1</td>
</tr>
<tr>
<td>Subserosal appendix</td>
<td>2</td>
</tr>
<tr>
<td>Gross inflammation with adhesions</td>
<td>1</td>
</tr>
<tr>
<td>of the tip</td>
<td></td>
</tr>
<tr>
<td>Adhesions (interlevel appendectomy)</td>
<td>1</td>
</tr>
<tr>
<td>Gangrenous</td>
<td>2</td>
</tr>
<tr>
<td>Perforated appendix</td>
<td>3</td>
</tr>
<tr>
<td>Total no.</td>
<td>11</td>
</tr>
</tbody>
</table>

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coined by Fitz in 1886.10 Traditionally appendectomy was performed through incisions like the right lower quadrant transverse incision (Rockey–Davis) or the classical incision which is centred over McBurney’s point at right angles to and two-thirds of the way along a line drawn from the umbilicus to the anterior superior iliac spine. Some surgeons use a vertical midline or a right paramedian (Battle) incision.1,11 Although 20 years have passed since the initial description of laparoscopic appendectomy by Semm,12 laparoscopic appendectomy has not become the treatment of choice for appendicitis in children for several reasons: (a) it is technically more challenging, (b) it has a potentially higher chance of complications such as intra-abdominal abscesses13,14 and complications relating to trocar placement, (c) the inability to perform laparoscopic surgery with the on call medical personnel, and (d) the high costs. There are potential benefits of laparoscopic appendectomy, such as (a) better exposure, (b) better cosmesis, (c) lower wound infection rates, and other controversial benefits like lower analgesic use, shorter hospital stay, and earlier return to normal activities.1,6,15,16

The advantage of the incision used in SAA over the conventional incision is that the caecum is directly underneath the incision at this site, and the ileal loops do not interfere with the recognition and delivery of the caecum and the appendix through this small incision (Fig. 2). Some studies used small incisions placed more medially for appendectomy at McBurney’s point, but used a laparoscope to locate the appendix behind the small bowel loops, thus, using a costly equipment to make the operation technically less difficult.17,18 The appendix has a free mesentery in the majority of cases and thus, it can be delivered into the wound. In 2% of cases, the appendix cannot be removed by this method as it lies retroperitoneally, and it is not possible to pull the appendix into the wound.1 We converted to conventional appendectomy in two of our cases due to adhesions (Table 2). The delivery of the caecum into the wound should be avoided, as it may be difficult to push the caecum back into the peritoneal cavity via this incision. Only 1–2 inches of ileum should be delivered into the wound at one time. If more ileum is delivered, it may not be possible to push it back into the peritoneal cavity, and conversion may be required, as happened in one of our patients. The chances of going into the retroperitoneum are high at this lateral distance from the midline. The incision can be extended medially and conventional appendectomy done if adhesion, perforation, or gangrenous appendix is found (Table 2). Due to these reasons, we converted 18% of our patients to conventional appendectomy.

Small access appendectomy can be performed by any general surgeon even in remote rural areas as a simple technique is used, and no new equipment is required. Learning to carry out SAA is easy, as it is performed under direct vision. Patients will benefit from less requirement for analgesics, early ambulation, shorter hospital stay and better cosmesis. The decrease in hospital stay also results in less social disturbance. Parents can resume their normal work early. Laparoscopic surgery is beneficial when the diagnosis is in doubt and in obese patients.19,20 There is around 30% increase in the cost of the operation when laparoscopic surgery is used compared to open procedures.21,22 SAA has the benefit of a single wound and scar compared to the three wounds (15 mm, 15/7 mm, 7 mm) and scars of laparoscopic appendectomy with less cost.

Conclusion

This study indicated that small access appendectomy is feasible for children with early appendicitis with the benefits of less analgesic requirement, shorter hospital stay, and better cosmesis.

References