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Supra-transumbilical laparotomy (STL) approach for small bowel atresia repair: Our experience and review of the literature

Ernesto Leva, Filippo Parolini, Andrea Zanini, Anna Morandi, Giorgio Farris, Stefania Franzini[1], Maurzio Torricelli

ABSTRACT

Background: Supra-Transumbilical Laparotomy (STL) has been used in paediatric surgery for a broad spectrum of abdominal procedures. We report our experience with STL approach for small bowel atresia repair in newborns and review previous published series on the topic. **Patients and Methods:** Fourteen patients with small bowel atresia were treated via STL approach at our Institution over a 5-year period and their charts were retrospectively reviewed. **Results:** STL procedure was performed at mean age of 3.1 day. No malrotation disorders were detected with pre-operative contrast enema. Eight patients (54.1%) presented jejunal atresia, five (35.7%) ileal atresia, and one (7.1%) multiple ileal and jejunal atresias. Standard repair with primary end-to-back anastomosis was performed in all but one patient. In the newborn with multiple atresia, STL incision was converted in supra-umbilical transverse incision due to difficulty of exposition. After surgery, one patient developed anastomotic stricture, and another developed occlusion due to adhesions: Both infants required second laparotomy. No infections of the umbilical site were recorded, and cosmetic results were excellent in all patients. **Conclusions:** Increasing evidence suggests that STL approach for small bowel atresia is feasible, safe and provides adequate exposure for small bowel atresia surgery. When malrotation and colonic/multiple atresia are pre-operatively ruled out, STL procedure can be choosen as first approach.

Key words: Jejuno-ileal atresia, mini-invasive surgery, newborns

Departments of Pediatric Surgery, [1]Pediatric Anaesthesiology, Fondazione IRCCS Ca' Granda-Ospedale Maggiore Policlinico, Milano, Italy

Address for correspondence:
Dr. Ernesto Leva,
Department of Paediatric Surgery,
Fondazione IRCCS Ca' Granda, Ospedale Maggiore Policlinico,
Padiglione Alfieri (Chirurgia Pediatrica),
Via Commenda-10 20122 Milano, Italy.
E-mail: articles.chped@gmail.com

INTRODUCTION

Recent advancements in paediatric surgery technique and instrumentation have allowed significantly more complex and delicate procedures to be performed, even in small premature newborns.[1] Supra-Transumbilical Laparotomy (STL) has been described by Tan and Bianchi to perform pyloromyotomy since 1986.[2] Almost all the bowel can be managed through a minimal circumumbilical incision, and this approach has minimal complications and a superior cosmetic results compared to classical transverse laparotomy.[3] Several authors subsequently adopted and modified this approach for various major neonatal abdominal operations, such as small bowel atresia repair.[3-7] This study provides a cohort of patients with jejuno-ileal atresia repaired via STL laparotomy at our Institution, and a review of previous published series.

PATIENTS AND METHODS

From January 2008 to December 2012, 14 consecutive newborns with small bowel atresia were managed at our Institution and were included in this retrospective study. The characteristics of the population were collected from patients' charts and operative reports; data regarding early and late postoperative complications were noted. Type of jejuno-ileal atresia was noted according to Grosfeld's classification.[8,9] When clinically suspected small bowel atresia was confirmed by plain abdominal X-Ray, contrast enema was performed in all patients.[8,9] Newborns with findings suggesting intestinal ischaemia, perforation, necrosis, or haemodynamically instable were excluded from the study. All patients were repaired via STL approach: The umbilicus was prepared with a warm iodophor solution and suture ligated after resection of the clamped cord. STL procedure was accomplished through a semicircular incision above the umbilicus [Figure 1], and fascia and peritoneum were opened on

the midline. The entire bowel was gently eviscerated and carefully inspected, and location and type of obstruction noted [Figure 2]. Entero-entrosotomy with or without tapering of the proximal dilated pouch were carried out as per standard repair. The peri-umbilical wound was closed subcuticularly [Figure 3]. All procedures were performed by a senior paediatric surgeon. Data were compared with a composite reference series clearly stating newborns with small bowel atresia repaired through STL approach. We omitted reports in which titles or abstracts indicated that they were not human studies, they were not focussed on small bowel repair, and not clearly reported the method of treatment. We then evaluated the full text of the articles that passed the criteria. Titles and abstracts of identified publications were checked and reviewed against the predefined inclusion criteria, and afterward, the full text the articles were similarly assessed for eligibility.

RESULTS

Fourteen patients underwent STL approach for small bowel atresia repair over a 5-year period and were included in this study [Table 1]. During contrast enema, microcolon was detected in one patient. Eight patients (57.1%) presented jejunal atresia (four children type I, and four type IIIa), five patients (35.7%) presented ileal atresia (four type IIIa and one type IIIb were recorded) and one baby (7.1%) presented multiple jejunal and ileal atresias. No malrotation disorders or other associated abnormalities were detected. In all patients with jejunal atresia, resection of dilated proximal bowel was performed, and antimesenteric tapering of the proximal pouch was necessary in three patients (60.0%). Primary repair was then accomplished in all cases with double-layer end-to-back anastomosis. In patients with ileal atresia, tapering and primary end-to-back anastomosis were performed. Conversion to supraumbilical transverse incision was done in one patient, due to difficult exposition of the multiple atresic segments. In this newborn, multiple anastomoses were subsequently performed to preserve as much intestine as possible. Mean follow up was 1,232 days (SD 532, median 756). No mortality was noted. Twelve patients (85.7%) presented no complications at follow-up. One patient developed anastomotic stricture which was repaired through resection of the stenotic tract and re-anastomosis in post-operative day 34th; another patient underwent laparotomic exploration in post-operative day 12th due to persistent bilious stagnation. At laparotomy adhesions of the anastomotic site, determining occlusion were noted. No infection of the umbilical site was recorded, and cosmetic results were excellent in all patients. The initial PubMed search yielded 15 potentially relevant articles for the reference series. Finally, five eligible articles met the inclusion criteria and were selected, encompassing a



Figure 1: The site of supra-umbilical skin incision. It is also evident the abdominal distension with intestinal patterning, characterised by visible loops of bowel on the abdominal wall



Figure 2: Exteriorization of the entire small bowel and exposition of a massive dilated ileal loop. On the left is recognizable the appendix



Figure 3: Cosmetic final result

total of 59 newborns[3-7] [Table 2]. Three studies,[3,5,7] as in our series, adopted suvra-transumbilical approach, while Suri[6] and Tajiri[4] performed the circumumbilical incision either at the superior or inferior aspect of the umbilicus. One mortality was noted,[4] and all the studies considered umbilical approach to be feasible, safe and cosmetically excellent. The only study that compared circumumbilical incision to traditional transverse abdominal incision for various neonatal abdominal operations, including small bowel atresia repair, was performed by Suri and colleagues,[6] and stated that mini-invasive approach was equivalent to the transverse abdominal incision, with regard to all peri-operative and post-operative outcomes.

DISCUSSION

Jejuno-ileal atresia is traditionally corrected via supra-umbilical transverse incision;[3] although this approach allows excellent access to all endoperitoneal areas of the neonate and has excellent results with minimal morbidity and mortality, it results in more losses of temperature and need for fluid replacement during surgery due to major surgical exposure, and in poor cosmesis in adulthood. According to Tan and Bianchi,[2] all the small bowel can be investigated also through a mini-invasive trans-umbilical approach, and atresias can be repaired by exteriorization of the involved bowel.[3-5] The original approach was subsequently minimally modified. The rationale of STL approach is that small incision will decrease the trauma on the tissues and translate into reduced pain, shorter length of stay, and better cosmesis.[1] In our series, there were no problems in repairing the atresia, performing the anastomosis, repairing the mesenteric defect and replacing the bowel in the abdominal cavity. This approach is easier to perform in newborns than in older infants: The skin of the neonate is soft and easy to stretch in all directions, and the short-length bowel can be easily pulled out through a little umbilical incision.[4] In addition, in our experience, intraoperative fluid management resulted in a reduction of the volume of fluids infusion during surgery. In fact, the minor bowel exposure leads to lower third-space losses than in classical incision.[10] Concerning the aesthetical aspects, the presence of a permanent large scar remains a concerns for caregivers and children,[3] and STL incision leads to a virtually invisible scar within few months.[1,7,11] Suri and colleagues[6] reported a higher incidence of incisional hernia in circumumbilical incision group compared to transverse laparotomic one (38% vs. 6%). This is likely due to the relative weakness of the umbilical fascia in the newborn. One other limitation of this approach is incomplete exposition of the entire bowel, especially when colonic or multiple atresias are detected. In these cases, as stated by Murphy[7] and Suri,[6] it is possible to laterally extend the incision as an omega incision. In our experience, we suggest to perform contrast enema during pre-operative assessment to evaluate and to rule out associated pathologies of the large bowel and malrotation disorders, which can be unnoticed with STL approach.[10] When these conditions are ruled out, STL procedure could be safely performed. STL procedure

Table 1: Population

Gestational age, mean (SD), weeks	33.86 (1.18)
Weight at time of surgery, mean (SD), g	2650 (512)
Time of surgery, mean (SD), days	3.1 (0.59)
Jejunal atresia, *n* (%)	8 (57.1)
Ileal atresia, *n* (%)	5 (35.7)
Jejunal and ileal atresia, *n* (%)	1 (7.2)
Complications	2 (14.3)

SD: Standard deviation

Table 2: STL approach for jejuno-ileal atresia

	Patients, *n*	Time of surgery, Days (range)	Average operation time, min (range)	Incision	Conversion rate, *n* (%)	Complications, *n*	Mortality, *n* (%)
Murphy (97-07)	18	NA	NA	Supra-Umbilical	NA*	NA*	0 (0)
Soutter (98-03)	5	NA	NA	350° supra-Umbilical	NA*	0 (0)	0 (0)
Suri (99-09)	15	NA	NA	Supra or sub -Umbilical	NA*	NA*	0 (0)
Banieghbal (02-05)	16	1-8	75 (50-120)	Supra-Umbilical	1 (6.3)	Intestinal obstruction (2) Wound infections (1)	0 (0)
Tajiri (05-07)	5	1-3	NA	Supra or sub-Umbilical	1 (20)	0 (0)	1 (20)
Our series (08-12)	14	1-6	82 (45-150)	Supra-Umbilical	1 (7.1)	Stricture (1) Occlusion (1)	0 (0)

*These studies reported trans-umbilical approach for various neonatal abdominal procedures, including small bowel atresia repair. Conversion rate and complications for each disease were not reported; STL: Supra-transumbilical laparotomy; SD: Standard deviation

does not preclude the option to a formal laparotomy, which authors believe is indicated in case of "apple peel syndrome".[12,13] This condition could be very difficult to manage through a small incision, also related to the severe defect of the mesentery vessels supply, as confirmed in our series. Tajiri and colleagues[4] suggest performing laparoscopy-assisted trans-umbilical surgery to confirm the site and condition of disease through laparoscope. Our experience suggests that STL procedure is a feasible and safe procedure that provides adequate inspection of the entire small bowel, and is cosmetically superior to classical laparotomic incisions. This approach can also be considered an alternative to laparoscopy because it leads to excellent cosmetic results[6] and, as stated by Soutter *et al.*,[5] does not require any special training for surgeons, there is no complex or costly instrumentation to acquire, and there is no increase in complications associated with a learning curve. When pre-operative contrast enema is normal, STL procedure can be chosen as the first surgical approach.

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