

Can the modified Tan–Bianchi circumumbilical approach be used for treating older children?

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Background and aim Since Tan and Bianchi reported umbilical incision as an access for pyloromyotomy in infantile hypertrophic pyloric stenosis, many pediatric surgeons have used this approach for a number of other procedures. Most of these studies focused on the usefulness of such an approach in neonates. This study aims at assessing the usefulness of the circumumbilical approach for exploring the abdominal cavity of infants and older children for treating a variety of surgical intra-abdominal diseases to achieve minimally invasive surgery with excellent cosmetic results.

Patients and methods All patients who underwent a circumumbilical skin incision for an exploratory laparotomy during the period June 2009 to October 2010 were reviewed. Age, operative procedure, conversions to standard laparotomy, complications, and follow-up data were recorded.

Results A total of 27 infants and children with ages ranging from 3 months to 8 years underwent circumumbilical incision for abdominal exploration. The indications were as follows: nonrotational malrotation of the midgut ($n=2$), intussusception ($n=13$), complicated V–P shunts ($n=4$), acute abdomen that proved to be due to Meckel's diverticulitis ($n=2$), gastrotomy for removal of an impacted foreign body from the stomach ($n=1$), pyloroplasty for caustic injury of the pylorus ($n=1$),

lymphatic mesenteric cyst ($n=1$), and complicated appendicitis ($n=3$). Conversion to a standard midline incision was necessary in one case. The complications encountered included wound infection ($n=5$), burst abdomen ($n=1$), and incisional hernia ($n=2$). Subsequent follow-up revealed that all incisions had healed and the scars were almost imperceptible as affirmed by parental satisfaction during outpatient clinic consultation.

Conclusion The circumumbilical approach appears to be safe, flexible, and easily reproducible, providing adequate exposure for some abdominal surgeries even in older infants and children as it has been tried successfully in neonates. The low-complication rate and pleasing aesthetic outcome are well-appreciated by parents and operators alike. *Ann Pediatr Surg* 7:126–129 © 2011 Annals of Pediatric Surgery.

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Introduction

The use of the transumbilical approach using a circumumbilical incision to perform a pyloromyotomy was first reported by Tan and Bianchi in 1986 [1]. This transumbilical technique has since then been adopted by many pediatric surgeons as a feasible, safe, inexpensive, and virtually scarless approach for hypertrophic pyloric stenosis. Several studies using modifications of this technique for the treatment of a variety of surgical intra-abdominal diseases in neonates and infants have been published [2–5].

However, recent studies including one from the Manchester group have focused on the usefulness of this approach in exploring the abdominal cavity and in treating most of the spectrum of surgical diseases in neonates [6–8]. In this study, we assessed the usefulness of the transumbilical approach in infants, toddlers, and children suffering from a variety of surgical intra-abdominal diseases to achieve minimally invasive surgery with excellent cosmetic results.

Patients and methods

All infants, toddlers, and children who underwent a circumumbilical skin incision for an exploratory laparotomy during the period June 2009 to October 2010 were

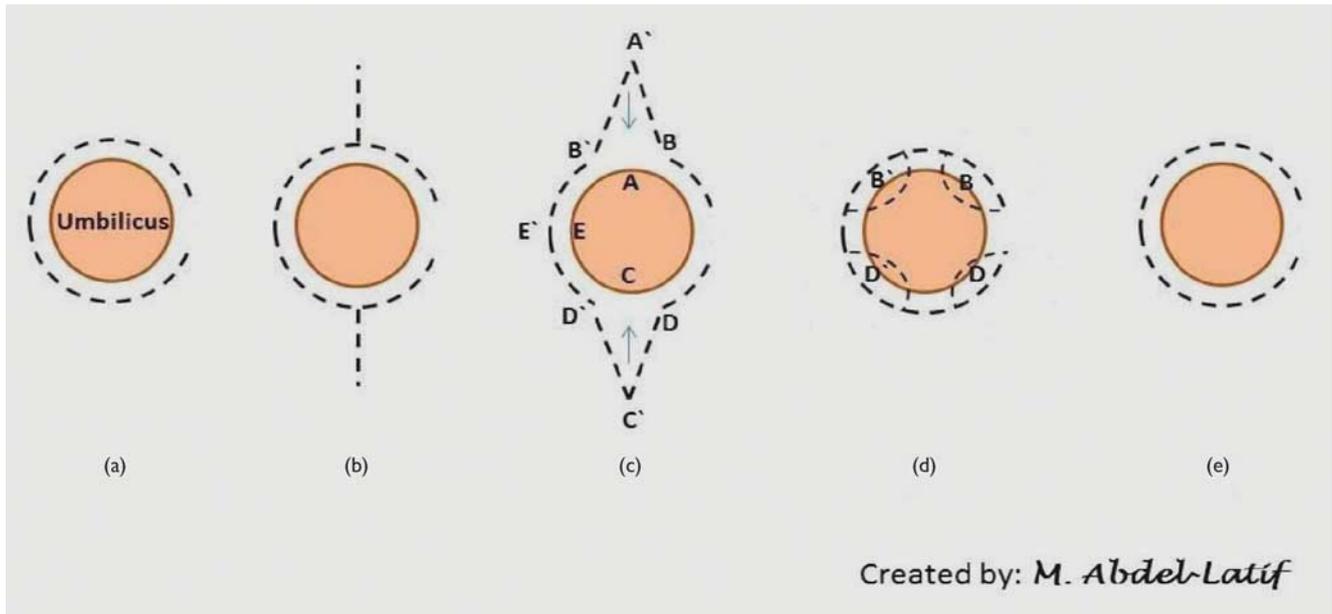
reviewed in this study. Neonates were excluded from the study. Age, sex, operative procedure, operative time, conversions to standard laparotomy, complications, and follow-up data were recorded. All parents were counseled, and an informed consent was taken in all cases. All patients were treated under general anesthesia in the operating room and were given antibiotic prophylaxis.

Surgical technique

The umbilicus was thoroughly cleansed with chlorhexidine after standard skin preparation. The umbilicus was incised 350° on its outermost circumference, leaving a 10° skin bridge on the left side of the umbilicus. A subcutaneous plane was developed for approximately 5 cm both cranially and caudally, and then the fascia and peritoneum were opened in the midline. To provide increased exposure, the skin was stretched in all directions with vein retractors together with relaxing midline skin incisions along the lineanigra both above and below the umbilicus, as the skin represented the limiting factor in extracting the abdominal contents (Fig. 1).

The bowel was then brought through the wound onto the abdominal surface, and the standard surgical procedure was completed under full vision. The wound was closed by closing the fascia in the midline. Approximation of the

Fig. 1



(a) Circumbilical incision. (b, c) The relaxing midline incisions (dotted lines). (d, e) Umbilicoplasty with excision of the four dog ears B, B', D, D', making the umbilicus a whole circle.

subcutaneous tissue and umbilicoplasty were performed by approximating points A–A', C–C', and E–E' at the three corners of the umbilical circle with excision of the excess dog ears at the four quarters of the circle with interrupted subcuticular nonabsorbable sutures, making it a complete circle again.

Results

During the period between June 2009 and October 2010, a total of 27 infants, toddlers, and children comprising 17 boys and 10 girls with ages ranging from 3 months to 8 years underwent treatment using the circumumbilical skin incision procedure (Table 1).

The indications for surgery are summarized in Table 2. The most frequent indication for exploration was intussusception mostly in infants below the age of 1 year.

All 27 wounds except one healed with excellent aesthetic appearance, which was well appreciated by the parents (Fig. 2).

Wound infection developed in five patients, representing a total incidence of 18.5% (Table 3). One of these five patients was further complicated by a burst abdomen treated by conversion to formal midline laparotomy for better closure of the abdominal muscles. Two patients developed incisional herniae. (Table 3). The two patients with incisional herniae are still awaiting treatment. There were no incidences of missed diagnoses or misdiagnoses in this series.

Discussion

The principle of applying a transumbilical approach to periumbilical surgical disease in infants and children is not new. Abdominal wall defects such as gastroschisis, omphalocele, and umbilical hernia are of course

Table 1 Patient's distribution according to age group

Age group	Number of patients
3 months–1 year	11
1–2 years	5
2–8 years	11

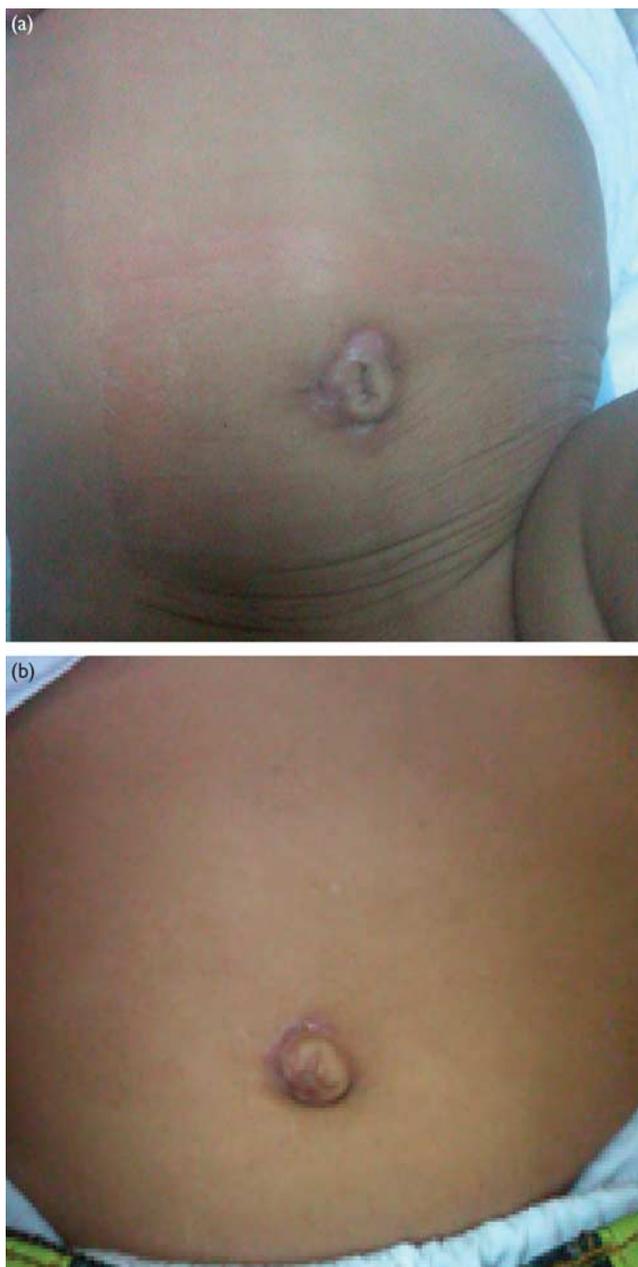
Table 2 Indication for surgery and operative procedure

Indication	Number of cases	Operative procedure
Intussusception	13	Resection and anastomosis (n=7) Open reduction (n=6)
Complicated V-P shunt	4	Repositioning of shunt (n=2) Drainage of infected cyst (n=2)
Complicated appendix	3	Appendectomy + drainage
Malrotation of midgut	2	Ladd's procedure
Acute abdomen (Mickel's diverticulitis)	2	Resection and anastomosis
Pyloric stricture due to caustic ingestion	1	Pyloroplasty
Impacted foreign body in stomach	1	Extraction through gastrotomy
Lymphatic mesenteric cyst	1	Resection and anastomosis

approached through the umbilicus. Similarly, epigastric hernias, urachal pathology, and omphalomesenteric duct remnants are often managed transumbilically.

The 1986 report by Tan and Bianchi [1] introduced the concept of approaching, through the umbilicus, surgical pathology elsewhere in the abdomen (i.e. pyloric stenosis). This approach has been widely adopted for pyloromyotomy. Several modifications of the original description of circumumbilical incision such as ω-shaped extension, V-Y plasty, and right-sided lateral extension have been adopted, all to address the extraction of a larger pyloric tumor [9–11].

Fig. 2



Postoperative picture of a 6-month-old baby who underwent right hemicolectomy for intussusception. (a) After 1 month; (b) after 6 months.

In 2003, Soutter and Askew [2] reported on the use of transumbilical laparotomy in infants for a wide variety of surgical problems, such as malrotation, intussusception, intestinal atresia, and some other conditions. In their study they described the transumbilical approach in 13 infants (ages ranging from 1 to 9 months) and three toddlers (age ranging from 13 to 24 months), opening the door for the use of this approach in older children.

In 2005, Sauer *et al.* [3] described the versatility of umbilical incision in the management of Hirschsprung's disease. However, several recent studies have described the use of such an approach in neonates and concluded that virtually most surgical indications in neonates could

Table 3 Postoperative complications

Primary pathology	Age	Complication
Intussusception	10 months	Wound infection, burst abdomen, conversion to midline incision, incisional hernia
Intussusception	1.5 years	Wound infection
Complicated appendix	4 years	Wound infection and incisional hernia
Complicated appendix	4.5 years	Wound infection
Complicated appendix	8 years	Wound infection

be treated through exploring the abdominal cavity using this approach [6–8].

In this study, we were primarily concerned with the assessment of the use of the same approach with suggested modifications in infants, toddlers, and children (who passed the neonatal period) as its effectiveness in neonatal surgery has been tested and proved in previous studies.

In this study, we described 27 patients who underwent surgery using the transumbilical approach by a circumumbilical incision. The type of disease among this cohort of patients showed a wide range.

It is our belief that stretching the skin and creating relaxing vertical midline skin incisions can yield an operative field of adequate size for performing a wide variety of reductions, resections, and anastomosis. We also believe that the type of umbilicoplasty suggested in this study can well camouflage the scar within the periumbilical skin, making it barely visible after a few weeks, and becomes almost imperceptible as the child grows and gains weight, 'folding in' the umbilical cicatrix.

Postoperative complications were comparable to those of conventional approaches for similar operations as most of our indications for explorations were for septic or potentially septic operations [12–14]. We had two incisional herniae in our series. We believe that incisional herniae can be avoided if there is good closure of the abdominal wall with particular attention to ensuring that there is no tension and no strangulation of tissues by the sutures.

Soutter and Askew [2] used a 'transumbilical' approach and had a complication rate of 6.8%. In the series from Toronto, including children with Hirschsprung's disease, Sauer *et al.* [3] reported a 24% complication rate, whereas the Bianchi group from Manchester [6] reported a 7.2% complication rate in 55 neonates who were subjected to the circumumbilical approach.

Although laparoscopic surgery has many advantages such as reduced postoperative pain, improved cosmesis, early mobilization and discharge with a resultant reduction in hospital costs [15–17], it could be associated with complications. In 1995, Chen *et al.* [13] reported a complication rate of 4% for thoracic and abdominal minimal access surgery. Laparoscopy requires considerable skill, has a prolonged learning curve, and has significant cost implications.

The circumumbilical open approach is an alternative to laparoscopy, combining safety with minimally disruptive

surgery. It requires no additional equipment or particular skills and leads to an aesthetic scar. Operative time did not constitute an issue in our series. We had five cases of wound infection, which was comparable with other studies.

The infant abdomen may be uniquely suited to this approach because of its limited longitudinal axis, its relatively thin and elastic abdominal wall, and its proportionately larger umbilicus. However, our success in infants, toddlers, and older children suggests that this technique may also be suitable for this age group with a variety of intra-abdominal surgical conditions.

Acknowledgements

Conflicts of interest

There are no conflicts of interest.

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