

Transumbilical approach for neonatal surgical diseases: woundless operation

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Abstract

Purpose The transumbilical approach by means of a circumumbilical incision has up until recently been the main method for performing a pyloromyotomy. This study aims to assess the clinical usefulness of the transumbilical approach for neonates with a variety of surgical intraabdominal diseases in order to achieve minimally invasive surgery with excellent cosmetic results.

Methods In 14 neonates with surgical diseases (3 hypertrophic pyloric stenoses, 3 ileal atresias, 2 jejunal atresias, 1 duodenal stenosis, 1 duodenal atresia, 2 ovarian cysts, 1 malrotation, and 1 segmental dilatation of ileum), treatment using a transumbilical approach by means of a half circumumbilical incision was performed at our institution. The clinical features of 14 cases were evaluated.

Results Eight cases except for three patients with hypertrophic pyloric stenosis, two with ovarian cysts and one with intestinal malrotation underwent the operation within 4 days of birth. In 10 of 14 cases, the umbilicus was incised on its upper half circumference, while the umbilicus of 4 cases was incised on its lower half circumference. In one ileal atresia patient with a remarkable degree of oral intestinal dilatation, a slight additional transverse incision was added. In four cases (1 case with ileal atresia, 2 cases of an ovarian cyst, and 1 case with a segmental dilatation of the ileum), laparoscopy-assisted transumbilical surgery was performed. In all cases, no operative complications were encountered. Postoperatively, there was no wound in appearance and the umbilicus appeared to be normal.

Conclusion The transumbilical approach with or without laparoscopic assistance is considered to be a feasible, safe, and cosmetically excellent surgical procedure in neonates with a wide variety of surgical intraabdominal diseases.

Keywords Umbilicus · Neonate · Surgery · Laparoscopy

Introduction

In 1986, the technique of transumbilical approach using a circumumbilical incision to perform a pyloromyotomy was first reported by Tan and Bianchi [1]. This technique has since been adopted by many pediatric surgeons as a feasible, safe, inexpensive, and virtually scarless approach to hypertrophic pyloric stenosis [2]. Recently, several case reports using a modification of this technique for infants and toddlers for the treatment of a variety of surgical intraabdominal diseases have been published [3–5]. In the present study, we assessed the clinical usefulness of the transumbilical approach for neonates with a variety of surgical intraabdominal diseases to achieve minimally invasive surgery with excellent cosmetic results.

Materials and methods

From 2005 to 2007, transumbilical approaches using a half circumumbilical incision were performed in the 14 neonates with surgical diseases in Department of Pediatric Surgery of Kyushu University Hospital. The umbilicus was incised on either its upper or lower half circumference. A subcutaneous plane was then made in a circular fashion, and the fascia and peritoneum were opened in the midline. In some cases, the right rectus muscle was cut transversely

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and the hepatic round ligament was cut, to obtain a sufficiently large operative field. The lesion was grasped with an atraumatic instrument and exteriorized through the umbilicus, and the treatment of the disease was then performed extracorporeally. In several cases who underwent anastomosis of intestine, the drain was inserted from the umbilical wound. The cut fascia was closed tightly, and the umbilical cord remained without treatment. The clinical features of these 14 cases are herein evaluated.

Results

A summary of 14 neonates with surgical diseases who underwent transumbilical approach is shown in Table 1. The diagnosis of 14 patients included 3 hypertrophic pyloric stenoses, 3 ileal atresias, 2 jejunal atresias, 1 duodenal stenosis, 1 duodenal atresia, 2 ovarian cysts, 1 malrotation, and 1 segmental dilatation of ileum. In eight cases (2 with jejunal atresia, 1 with ileal atresia, 1 with duodenal stenosis, 1 with duodenal atresia, 2 with ovarian cysts, and 1 with segmental dilatation of ileum), some abnormalities were detected prenatally. Eight cases, except for the three patients with hypertrophic pyloric stenosis, one with malrotation and two with ovarian cysts, underwent the operation within 4 days of birth.

In 10 of 14 cases, the umbilicus was incised on its upper half circumference, while the umbilicus of 4 cases (1 ileal atresia, 2 ovarian cysts, and 1 segmental dilatation of ileum) was incised on its lower half circumference. In one case with ileal atresia with a remarkable degree of oral intestinal dilatation, a slight additional transverse skin incision was added. A wound retractor XS (Applied

Medical Resources Corp, USA) was inserted from umbilical wound in other cases, to spread the wound and maintain the size of wound (Fig. 1). In all cases who used the wound retractor, no additional skin incisions were required. In patients with either duodenal stenosis (case 9) or duodenal atresia (case 10), the lesion was fixed in the retroperitoneum. However, after the whole intestine was pulled out through the umbilical wound, the lesion could be exteriorized through the umbilicus, and the treatment of the disease could be successfully performed extracorporeally (Fig. 2). In addition, regarding the patient with a malrotation, the whole intestine was pulled out through the umbilical wound, and then both a resection of Ladd's band and Bill's fixation were performed.

In four cases (1 case of ileal atresia, 2 cases of ovarian cyst, and 1 case of segmental dilatation of ileum), laparoscopy-assisted transumbilical surgery was performed. In four all cases, the laparoscope was first inserted from the umbilical wound, and then the site and condition of the disease were confirmed. Thereafter, the site of disease was pulled out through the umbilical wound, and then the disease could thus be easily treated. In all cases, no operative complications were encountered. The length of hospital stay was almost the same between the presented 14 cases who underwent the transumbilical approach and the other cases with the same disease who underwent an usual abdominal transverse incision approach. The outcome of 14 patients is excellent except for case 7 with jejunal atresia. Case 7 had multiple intestinal atresia and the cardiac anomaly (large VSD). After a radical operation of jejunal atresia, the length of the residual intestine was 30 cm. Unfortunately, the patient died of heart failure as a

Table 1 Summary of 14 neonatal cases with surgical diseases who underwent transumbilical approach

Case	Disease	Prenatal diagnosis	Time of operation	Operation	Incision of half circumference against the umbilicus	Additional skin incision	Laparoscopic assist
1	Hypertrophic pyloric stenosis	No	27th day	Pyloromyotomy	Upper	No	No
2	Hypertrophic pyloric stenosis	No	30th day	Pyloromyotomy	Upper	No	No
3	Hypertrophic pyloric stenosis	No	18th day	Pyloromyotomy	Upper	No	No
4	Ileal atresia	No	2nd day	Primary anastomosis	Lower	No	Yes
5	Ileal atresia	No	1st day	Primary anastomosis	Upper	Yes	No
6	Ileal atresia	Yes	0 day	Primary anastomosis	Upper	No	No
7	Jejunal atresia	Yes	0 day	Primary anastomosis	Upper	No	No
8	Jejunal atresia	Yes	0 day	Primary anastomosis	Upper	No	No
9	Duodenal stenosis	Yes	4th day	Resection of membranous tissue	Upper	No	No
10	Duodenal atresia	Yes	2nd day	Diamond's anastomosis	Upper	No	No
11	Ovarian cyst	Yes	30th day	Cystectomy	Lower	No	Yes
12	Ovarian cyst	Yes	8th day	Cystectomy	Lower	No	Yes
13	Malrotation	No	28th day	Radical operation	Upper	No	No
14	Segmental dilatation of ileum	Yes	7th day	Resction of dilatated ileim	Lower	No	Yes

Fig. 1 Case 8: Jejunal atresia (apple peel type). **a** The lesion was pulled out through the umbilical wound which was supported by the wound retractor XS. **b** The proximal dilated jejunum, 14 cm in the length, was tapered by GIA. **c** End to end anastomosis of the jejunum was performed

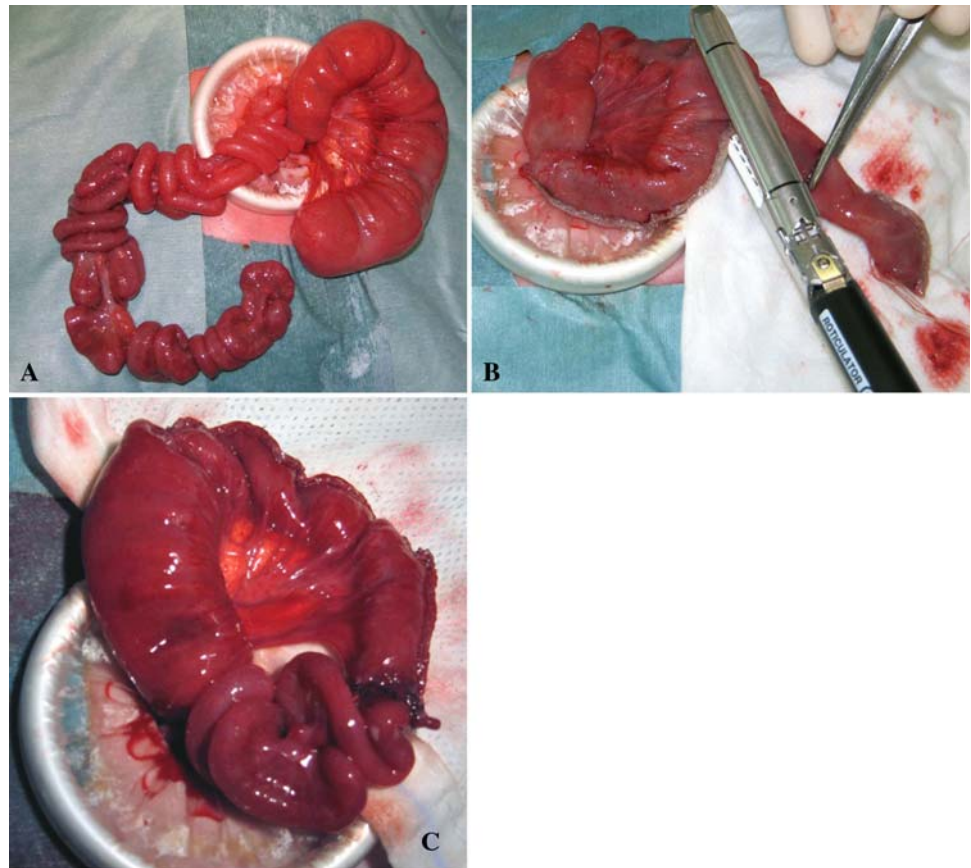
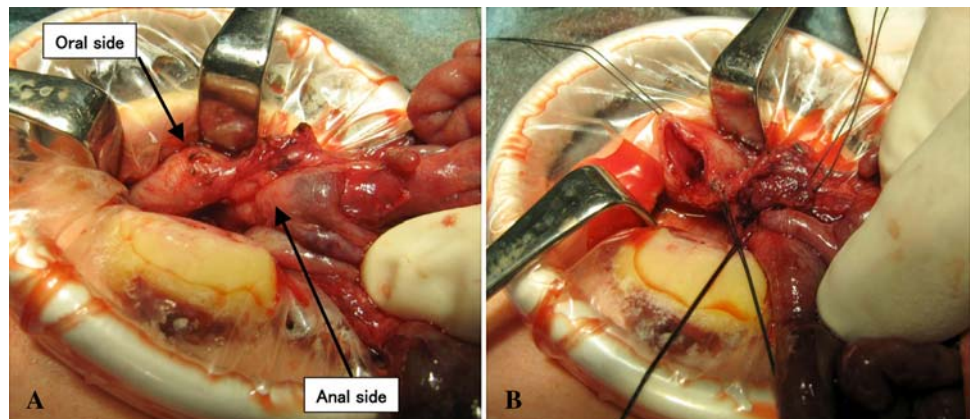


Fig. 2 Case 10: Duodenal atresia. **a** After the whole intestine was pulled out, the lesion could be exteriorized through the umbilical wound. **b** Diamond-shaped duodenoduodenostomy was performed extracorporeally



result of the large VSD and liver failure due to short bowel syndrome at 5 months of age.

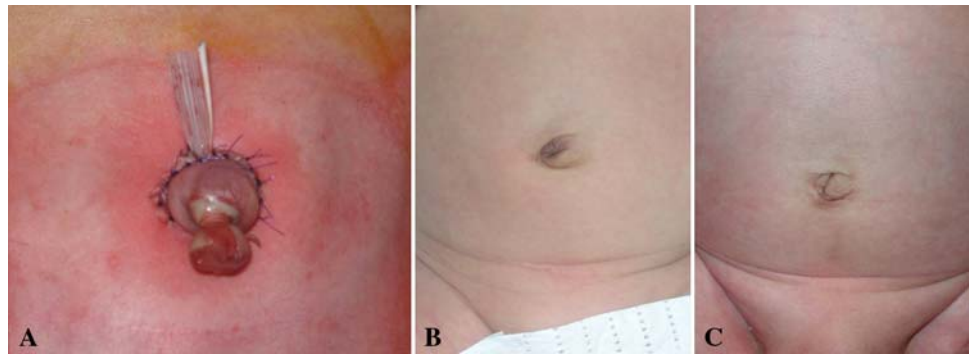
The appearance of an umbilical wound after the operation was excellent (Fig. 3). Postoperatively, no wound was visible and the umbilicus appeared to be normal.

Discussion

A transumbilical laparotomy incorporates the features commonly used in the external phase of laparoscopic

procedures such as Meckel’s diverticulectomy [6]. In 1986, the transumbilical approach using a circumumbilical incision for a pyloromyotomy was reported by Tan and Bianchi [1]. In 2003, Soutter and Askew [3] reported a modified Bianchi technique which was used as a new approach for a wide variety of infantile surgical diseases, including diseases for neonates. In 2004, Yamataka [4] reported three neonates who underwent laparoscopy-assisted surgery for prenatally diagnosed small bowel atresia. In 2007, Lin [5] reported six neonates who underwent transumbilical surgery for the treatment of ovarian cysts.

Fig. 3 Case 9: **a** 0 day after operation, **b** 1 month after operation, **c** 3 months after operation



In the present study, we described 14 neonates who underwent surgery using the transumbilical approach by a half circumumbilical incision. The type of disease among the 14 neonates showed a wide range. Furthermore, we also performed surgery using the transumbilical approach for an infant with ileo–ileo type intussusception at 31 days after birth. There are several reasons for using this approach, but the most important reason is that it is easy to perform for neonates, in comparison to older infants. One reason is that the skin of the neonate is soft and easy to stretch in all directions. Another reason is that the length to the site of disease is short, and the site of disease can thus be easily pulled out through the umbilical wound. In fact, the transumbilical approach for neonates with hypertrophic pyloric stenosis is easier to perform than for older infants with the same disease. To obtain a large operative field, opening the fascia upward in the midline, a slight transverse cut of the right rectus muscle and a cut of the hepatic round ligament in some cases with a incision on its upper half circumference are very important maneuvers. The retractor XS device (Applied Medical Resources Corp, USA) was inserted from umbilical wound in ten present cases, to spread the wound and limit the size of the wound, and thus allow the disease to be treated both easily and safely. In cases with either duodenal atresia or malrotation, pulling out whole intestine through the umbilicus allowed us to obtain a clear operative field, while also making it possible to perform both diamond-shaped duodenoduodenostomy and a resection of Ladd's band. In 11 of the 14 present cases, the umbilicus was incised on its upper half circumference, while the umbilicus of 4 cases was incised on its lower half circumference. Regarding the ability to safely and easily treat the disease, no difference between an incision on the upper half circumference or on the lower

half circumference was found. Regarding the laparoscopic-assisted transumbilical approach for neonates with surgical disease, Yamataka [4] reported surgery in three neonates with prenatally diagnosed small bowel atresia in 2004, and Prasad [6] reported surgery for a neonate with an ovarian cyst in 2007. In both reports, several ports in addition to the umbilical site were used. In the present study, laparoscopy-assisted transumbilical surgery was done in four cases. In all four cases, the role of laparoscopy was to observe and confirm disease through umbilical wound.

In the 14 present neonates who underwent surgery using the transumbilical approach, no operative complications were encountered. Postoperatively, no wound could be observed and the umbilicus appeared to be normal. In neonates with a wide variety of surgical intraabdominal diseases, the transumbilical approach either with or without laparoscopic assist is therefore considered to be feasible, safe, and cosmetically excellent.

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