

ORIGINAL ARTICLE

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Circumbilical pyloromyotomy: larger pyloric tumours need an extended incision

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Abstract Circumbilical pyloromyotomy has been used widely to offer an optimum cosmetic approach. On occasion, there are difficulties in delivering the large pyloric tumour through a relatively small incision. The authors prospectively collected a series of 39 consecutive pyloromyotomies performed over a period of 3 years in three teaching hospitals. Patients were aged 13 to 90 days (average 35) and the male-female ratio was 5:1. The initial operative approach was a right upper quadrant (RUQ) incision ($n = 6$) and later a circumbilical incision (CUI), with or without lateral extension, combined with transverse division of the linea alba and part of both rectus muscles ($n = 33$). Two infants (1 RUQ and 1 CUI) developed wound infections, which were treated with antibiotics. There were no other peri- or postoperative complications. It was necessary to extend the incision in one-third of CUI cases ($n = 12$) in order to facilitate the delivery of a large pyloric tumour through the incision. Both omega-shaped ($n = 3$) and a new modified extension ($n = 9$) have been used with good cosmetic results.

Key words Infantile hypertrophic pyloric stenosis · Circumbilical incision · Pyloromyotomy

Introduction

Ramstedt's pyloromyotomy (RP) can be performed through a number of different approaches. Tan and Bianchi first described this circumbilical incision (CUI) with supra-umbilical midline division of the linea alba in 1986 [21] (Fig. 1). However, some authors have described difficulty in delivering the pyloric tumour through the relatively small incision, so that different

modifications have been evaluated [4, 12, 20]. We reviewed our experience of RP and describe a new modified extension of the CUI for large-sized pyloric tumours.

Materials and methods

During 3-year period October 94–October 97, 39 consecutive infants underwent RP in three teaching hospitals, 6 via a classic trans-rectus right upper quadrant (RUQ) incision and 33 by CUI (22 without lateral extension, 3 with omega-shaped incisions, and 9 with a new modified incision). All data collected prospectively included age, sex, gestation, weight at birth, time of operation, and follow-up, blood gases, electrolytes and mode of diagnosis (test feeding, ultrasonography [US], and contrast meal).

All operations were performed by the author (ARK) with or without supervision of a consultant. After adequate fluid and electrolyte resuscitation, the umbilicus was cleaned with povidone-iodine solution on the ward. Preoperatively, one dose of antibiotic (amoxicillin/clavulanic acid, flucloxacillin, or cefuroxime) was given. A supraumbilical incision was made around two-thirds of the circumference of the umbilicus. The subcutaneous tissue and linea alba were divided transversely [3, 10]. The peritoneal cavity was opened and the greater curvature of the stomach was pulled up until delivery of the pyloric tumour. Partial division of both rectus muscles was performed in cases of large pyloric tumours. If there were still problems with delivery of the tumour, the skin incision was modified. Initially, an omega-shaped incision was made, and later a new modification was used by making bilateral (0.5–1 cm) skin incisions 0.5 cm above the two ends of the semicircular incision and the RP was then performed in all cases. The stomach was insufflated via a nasogastric tube (NGT) to check for mucosal leakage. The fascia and muscle were closed by interrupted 3-0 or 4-0 Vicryl sutures. The skin was now sutured such that the entire lateral extensions were incorporated in the semicircular umbilical wound. A wedge of skin (shaded area in Fig. 2) was excised on both sides of the cephalic skin edge, leaving a disparity between the cephalic and caudal wound edges. These were then approximated by pulling them farther apart from the cephalic edges using 6-0 Vicryl subcuticular sutures.

Postoperative analgesia was accomplished by local infiltration of 0.25% bupivacaine and rectal paracetamol. Operating times were noted. All infants commenced feeding within 6–12 h. The infants were discharged home when they could tolerate ad libitum feeds, usually on the 2nd postoperative day. Postoperative data collected included number of episodes of vomiting, time of fasting, complications, and duration of stay in hospital. All patients were seen in the clinic 8 weeks after the operation; their weights and wounds were observed.

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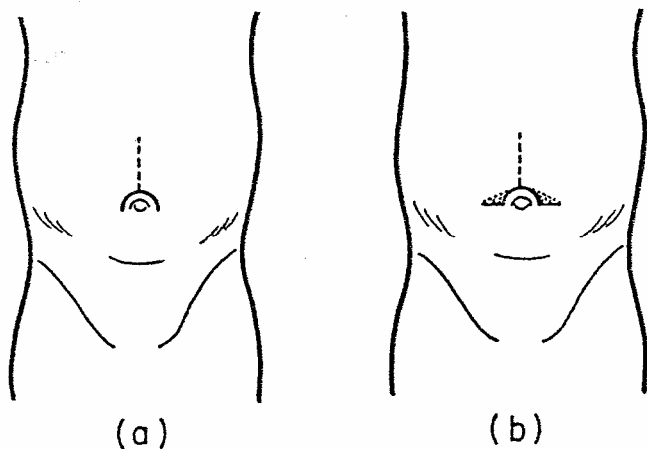


Fig. 1 a Circumbilical incision with midline deep fascial incision. b Omega-shaped extension. Shaded areas are excised to give semicircular skin closure

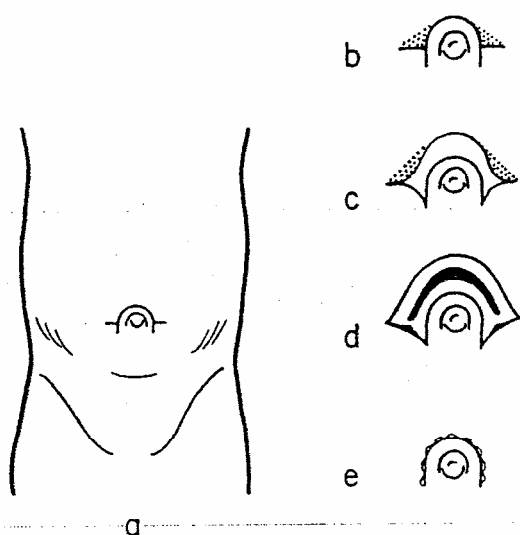


Fig. 2 a New modification of circumumbilical incision. b, c Excision of stippled area before skin closure. d Cephalic skin edge longer than caudal skin edge. e Final appearance of the wound after subcuticular skin closure by taking bites farther apart on cephalic skin edge

Results

During the 3-year period, 39 infants underwent RP in the three teaching hospitals (Table 1). The male:female ratio was 5.4:1, mean age at presentation was 35 days, and mean weight was 3.56 kg. All infants were diagnosed by test feeding and/or US and a contrast meal. Sixteen operations were done under the supervision of consultants. The mean operating time in all cases was 28 min (20–66). Initially, RP was done using Randolph's transverse RUQ incision ($n = 6$); CUI was then adopted ($n = 33$) due to the good cosmetic result. It was difficult to deliver large pyloric tumours through the relatively small incision: one-third of cases ($n = 12$) needed extension of the incision (Table 2). Three omega-shaped

Table 1 Teaching hospitals participating in study

	No. of cases
University Hospital of Wales, Cardiff, UK	20
St. James University Hospital and General Infirmary, Leeds, UK	14
King Khalid University Hospital, Riyadh, Saudi Arabia	5

Table 2 Incisions used for pyloromyotomy

Right upper abdominal	$n = 6$
Circumbilical	$n = 33$
Without extension	$n = 21$
Omega-shaped	$n = 3$
New modification	$n = 9$

incisions were done, and then a new modification was adopted for better cosmetic results ($n = 9$). There were no mucosal perforations. No infant required conversion to a RUQ incision or reoperation due to inadequate exposure. Six had postoperative vomiting for 1–6 days; 3 had gastro-oesophageal reflux on contrast meal and were treated medically. Wound infections occurred in 2 infants, 1 with a RUQ incision and 1 with a CUI; both were treated with antibiotics. On 8-week follow-up, all infants had gained considerable weight. The resulting wound had a "ruffled up" appearance initially, which settled in a few weeks. The scar here was barely visible at 8 weeks, while the cases done with omega-shaped incisions had small, visible scars at the umbilicus.

Discussion

Since Ramstedt introduced the extramucosal pyloromyotomy in 1911, few changes in the operative technique have been made. However, approaches to the pyloric tumour have changed, and attention to the details of perioperative care with a meticulous surgical approach are likely to have a great impact on reducing morbidity [4, 11, 12, 16, 19]. Open approaches include the median longitudinal incision, Robertson's muscle-splitting [18] and Randolph's transverse RUQ incision [17], and Tan and Bianchi's CUI [21]. Recently, laparoscopic pyloromyotomy (LPM) was described in the literature to have good cosmetic results and minimal complications [1, 2, 5, 13, 20].

In a collective United Kingdom review ($n = 1430$), common complications of the RUQ incision were wound infection (0.7%–14%), mucosal perforation (0.7%–11.5%), and wound dehiscence (0%–3.8%) [19]. Randolph's transverse RUQ incision remained the most commonly employed method, however, CUI has better cosmetic results as reported in previous series [6, 15, 16]. We have no experience of LPM. The problems associated with CUI may include difficult tumour delivery, which increases operative time, more gastric manipulation, and a higher wound-infection rate. Prophylactic antibiotics and adequate preoperative cleansing with antiseptic so-

lution were done in all our cases. Some authors have suggested that preoperative cleansing of the umbilicus is necessary, but it may also be a source of infection [3, 4, 7, 10, 15]. It is difficult to prove whether preoperative cleansing affects the rate of infection; we do, however, strongly believe that it is essential prior to CUI.

The use of prophylactic antibiotics has also been advocated in RP with any approach. Nour et al. reported that in RP via classic RUQ incisions the difference between groups with and without antibiotics was not statistically significant, however, there was an overall reduction in wound infections (6.5%) in the antibiotic group (12%) [14]. Huddart et al. reported that the overall rate of wound infection was 16% for CUI compared to 5.5% for RUQ incisions despite a higher use of prophylactic antibiotics (64% vs 13%). However, it is not clear from this study whether the 16% wound infections occurred in patients who did not receive prophylactic antibiotics [10]. Fitzgerald et al. reported that one infant with a CUI who developed a wound infection had received prophylactic antibiotics [7]. Podevin et al. [15], Horwitz and Lally [9], and Franchella and Sicilia [8] did not use prophylactic antibiotics in RP via CUI.

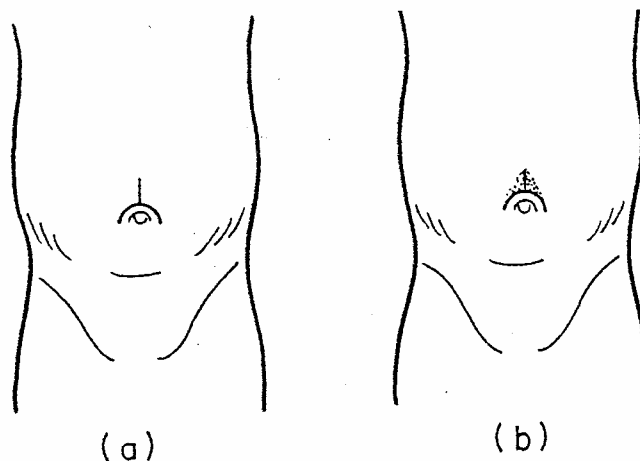


Fig. 3 a Circumumbilical incision and extended longitudinal upper umbilical skin incision. b Extension masked by Y-V plasty

Because of the low incidence of wound infections after RP using either incision in most series, it would require a large number of patients in each group to study this issue in a controlled trial. Apart from the umbilicus

Table 3 Literature review (NM not mentioned in series, RUQ right upper quadrant, CUI circumumbilical incision)

Authors, journal and year of publication	No. of cases	Wound infections	Mucosal perforation	Wound dehiscence/incisional hernia	Comments
Huddart, Bianchi [10], Pediatr Surg Int, 1993	138	16%	NM	Incisional hernia 0.7%	Compared with 182 cases of RUQ incision, more incisional hernias (2.7%) in RUQ incision. No difference in hospital stay between two groups. Antiseptic preoperative cleansing of umbilicus and antibiotic prophylaxis
Ali, Amari et al. [3], J R Coll Surg Edinb, 1992	22	13%	4%	Wound dehiscence 4%	Initially, postoperative wound drainage used. All patients had antibiotic prophylaxis
Besson et al. [4] Pediatr Surg Int, 1997	32	18%	9%	NM	One-third (11) of cases had modified CUI. One patient RUQ incision due to large tumour before use of modification of CUI. Antiseptic umbilical cleansing done but no mention of antibiotic prophylaxis
Podevin et al. [15] Eur J Pediatr Surg, 1997	118	4%	3%	None	Compared with 121 RUQ incisions, shorter hospital stay after CUI but statistically not significant. Antiseptic umbilical cleansing done but no antibiotic prophylaxis
Poli-Mero et al. [16] Eur J Pediatr Surg, 1996	40	None	2.5%	Wound dehiscence 2.5%	Compared with 40 RUQ incisions. Y-V plasty modified CUI with longitudinal fascial incision used. Antiseptic umbilical cleaning done but no mention of antibiotic prophylaxis
Horwitz JR, Lally [9] Am J Surg, 1996	18	None	None	None	Classic CUI with longitudinal fascial incision. Antiseptic umbilical cleaning done but no antibiotic prophylaxis
Fitzgerald et al. [7] J Pediatr Surg, 1990	50	10%(n=5)	4%(n=2)	None	Compared with 50 RUQ incisions. Omega-shaped incision with longitudinal or transverse fascial incision in all CUI. Antiseptic umbilical cleansing and antibiotic prophylaxis used in the beginning. One wound infection despite antibiotic
Franchella, Sicilia [8] Minerva Pediatr, 1997	33	None	None	None	One pyloromyotomy performed inside the peritoneal cavity. No prophylactic antibiotics, average hospital stay 4 days

as the source of infection, additional factors might contribute to wound infections. Opening the abdomen through a CUI may require strong traction in cases of large pyloric tumours. This can cause muscle ischaemia and subcutaneous haematoma formation, leading to wound infection and abscess formation. This problem has been observed by other authors as well [4, 16]. Besson et al. reported one case of muscle trauma leading to abscess formation [4].

The mean operating time in all cases was 28 min (20–66). As the patients with an RUQ approach were few in our series, it would require a large number of patients in each group to give any significant comparison. In one large series, mean operative times were significantly longer in CUI in comparison to RUQ incisions (52 vs 38 min) [15]. Fitzgerald et al. (CUI = 35, RUQ = 33 min) and Poli-Merol et al. (28 min in each group) reported no significant differences in mean operative time between the two groups [7, 16]. Extending the incision in cases of large pyloric tumours may avoid excessive time consumption. In our last 20 CUI cases, there were no wound infections and shorter mean operative times (<20 min) compared to the beginning of our series.

One-third ($n = 12$) of our cases required extension of the CUI. This was also reported in previous series (11 of 32 and 10 of 29 cases) [4, 15]. Omega-shaped incisions (Fig. 1), V-Y plasty (Fig. 3), and right-sided lateral extension for a modified CUI have been described in the literature [4, 12, 16, 21]. Tan and Bianchi first described the omega-shaped extension [21]. Fitzgerald et al. compared 50 cases of omega-shaped CUI with RUQ incisions and they found no difference in operative time or intra- and postoperative complications [7]. V-Y plasty was described by two French surgeons [4, 16]. One of their patients with a CUI needed a RUQ incision because delivery of the very large tumour had not been possible through the CUI and 2 patients had incidental mucosal perforations before the use of the modified V-Y plasty [4].

There are also reports of RP via CUI done inside the peritoneal cavity [8] or done inadequately. There is a recent report of 29 of 122 cases of RP performed intra-abdominally through a CUI [6]. Right-sided lateral extension was reported by Misra and Mushtaq in 30 consecutive cases [12]. We observed that not all patients with pyloric stenosis require a modified incision since our modification was needed in only 12 cases. Tumour sizes can be judged by palpation with the patient under general anaesthesia just prior to incision. The most common complications of CUI from previous reports are reviewed in Table 3.

The common complications of CUI are difficult delivery of a large tumour and wound infection. Difficult tumour delivery may increase the operative time and damage the serosa of the stomach or duodenum. These factors can be overcome by the extending the incision to avoid excessive traction on the retractors of the rectus muscles. Preoperative cleansing of the umbilicus and prophylactic antibiotics did not prove to decrease wound infections in this study. We believe that all large

pyloric tumours require a modified CUI which leaves an almost undetectable scar in most cases.

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