

# Non-laparoscopic minimal surgical approach to pyloromyotomy: An experience from a challenged resource setting

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## ABSTRACT

**Background:** The aim of the study is to review the experience with the classic Ramstedt's pyloromyotomy through the RUQ approach and the circumlinear supraumbilical fold approach (circumumbilical [CU]) pyloromyotomy (an approach that combines the ease and safety of the open pyloromyotomy with the advantages of minimal invasiveness). **Patients and Methods:** A single centre review in a period of 12 years from January 2001 to December 2013 with the institutional ethical committee's approval, evaluating 316 pyloromyotomies based on surgical approach: RUQ (171); and CU (145). Patients' demographics, acid-base/electrolyte status on presentation, mean operative time (MOT), postoperative length of stay (LOS) at hospital, and complications were recorded. **Results:** Patients demographics, acid – base/electrolyte status on presentation; and MOT were not significantly different. The median LOS was 33 and 30 minutes for CU and RUQ, respectively, with no statistical significant difference between the two groups. One patient in the CU group had a late adhesive bowel obstruction requiring laparotomy and bowel resection. Moreover, wound infection rates did not differ significantly between the two groups (CU 3; and RUQ; 3;  $P = 0.15$ ). **Conclusions:** Pyloromyotomy is associated with a low complication rate. Cosmetically, CU is superior to the RUQ approach. Its short learning curve and the feasibility to examine the integrity of the duodenal mucosa intraoperatively may make CU a safer alternative in case of surgeons who are still practicing the RUQ approach in countries with a challenged resource settings.

**Key words:** Pyloric stenosis, pyloromyotomy, umbilical incision, laparoscopy, minimal invasive pyloromyotomy

## INTRODUCTION

Infantile hypertrophic pyloric stenosis (IHPS) is one of the more common paediatric surgical problems with an incidence of 2–4 in 1000 infants.<sup>[1]</sup> IHPS is a condition in young infants marked by thickening of the pylorus muscle leading to gastric outlet obstruction. Oral administration of erythromycin in the first few weeks of life has been shown to increase the risk of developing IHPS.<sup>[2]</sup>

The traditional non-surgical treatment with the use of atropine for IHPS was suggested by some authors as an effective therapy that may be an alternative to pyloromyotomy if the length of the hospital stay and the necessity of continuing oral atropine medication are accepted. However, the cost-effectiveness of this manoeuvre may be high for resource-challenged and/or low-resource settings.<sup>[3]</sup>

Surgical management of IHPS has traditionally involved a Ramstedt's pyloromyotomy using a classical RUQ incision.<sup>[4]</sup> Although, effective at providing excellent exposure of the pylorus, this method results in an abdominal scar that grows with the patient, often becoming quite significant with time. In the interest of improved cosmesis, alternative procedures have evolved, which include both laparoscopic as well as umbilical approaches.<sup>[4-8]</sup>

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Nevertheless, few studies have investigated the cosmetic outcome of the current approaches to pyloromyotomy in infants with hypertrophic pyloric stenosis. We describe hereby our results of pyloromyotomy using two different techniques of RUQ and circumumbilical (CU).

### PATIENTS AND METHODS

All patients who underwent pyloromyotomy for IHPS during the period from January 2001 to December 2013 were included in the study. With the approval of the institutional ethical committee; the recorded data included the patient's age, sex, acid – base status and chloride levels. Patients were divided into two groups, depending on the surgical approach: RUQ approach and circumlinear supraumbilical fold approach (circumumbilical [CU]), [Figures 1 and 2]. In each group we looked at two variables: The mean operative time (MOT), the median postoperative length of stay (LOS), as well as the rate of complications. Complication rates were subdivided into major and minor complications. Where appropriate, data were presented as mean, standard deviation and 95% Confidence Interval as well as in the form of graphs (SPSS Statistics for Windows, Version 17.0. Chicago: SPSS Inc.). Chi-square test and Fisher's exact test were used for categorical data. To assess the statistical significance of these variables, with  $P \leq 0.05$  was considered significant. Patients who had complications were excluded from the MOT and LOS analysis.

### RESULTS

Collected data of the studied 316 patients [Graph 1] who underwent pyloromyotomy were recorded [Tables 1 and 2]. They were divided into two groups based on the surgical approach used: RUQ, 171 patients [Table 1] and CU, 145 patients [Table 2]. As shown in Tables 1 and 2 the demographic and preoperative laboratory data for the two groups were not significantly different [Figure 1]. The MOT

for RUQ was 36 min and 40 min for the CU. This difference of 4 minutes in the MOT is not clinically significant; therefore, statistical analysis was not applied to it.

A shorter LOS for the RUQ group was noted, but this was not statistically different from the CU group.



Figure 1: The CU incision

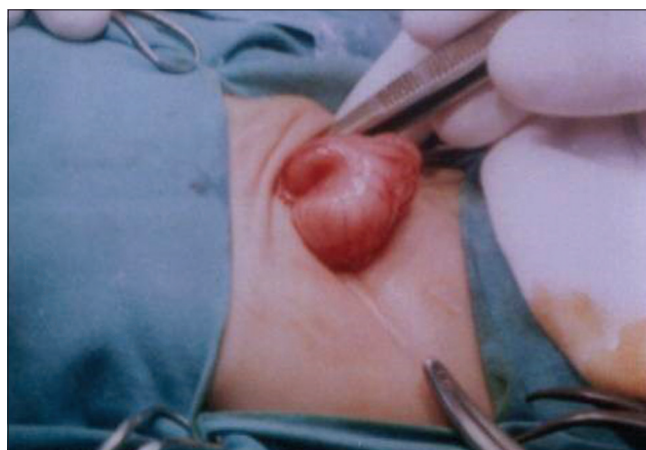
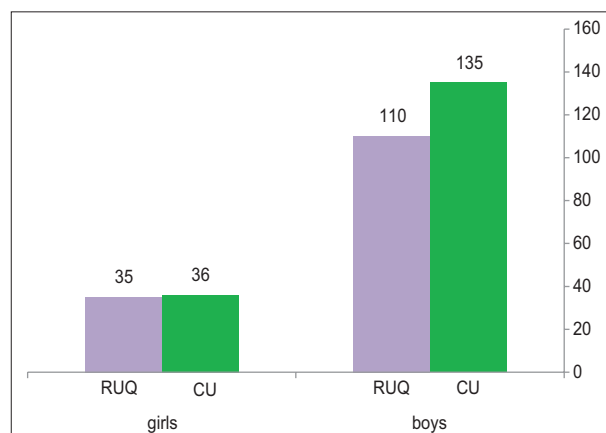


Figure 2: Delivery of pyloric tumor through the CU approach

**Table 1: Description of Data of patients who underwent right upper quadrant pyloromyotomy (GROUP 1)**

Variables	Surgical approach		
	RUQ	SD	95% CI
No. of Patients	171		
Mean age (week)	4.9	0.01	4.8985-4.9015
Mean pH level	7.41	0.3	7.3647-7.4553
Mean Chloride level	101.3	0.5	101.225-101.375
MOT (min)	36		35.940-36.060
Median LOS (hour)	30		29.909-30.091

CI=Confidence Interval



Graph 1: Comparison of Gender among the studied population

Major complications were noted in two cases of intestinal perforation occurred using the RUQ approach. One perforation was mucosal (within the pyloromyotomy incision and one was in the duodenum distal to the pyloromyotomy incision caused by a Babcock clamp used to hold the duodenum distal to the pyloric olive. There was one gastric perforation using the CU approach which was also caused by a Babcock clamp used to pull the olive out [Table 3].

All intestinal perforations in the RUQ and the CU groups were recognised intra operatively; the patients recovered well postoperatively with simply suturing the perforation and with holding the oral feeding for 24–48 hours. Patients were discharged home between 48 and 72 h later.

In the category of minor complications, the data revealed three instances of wound infection in the CU approach and three in the RUQ approach, again these figures are not statistically significant,  $P = 0.519$  as shown in Table 3.

The mean number of episodes of postoperative emesis with the RUQ and CU groups was 1.8 and 2, respectively, numbers that are clinically similar.

## DISCUSSION

Despite many theories, the aetiology of IHPS remains largely unknown.<sup>[10]</sup> Although, occasional publications suggest non-operative<sup>[11]</sup> endoscopic<sup>[12]</sup> or other non-traditional<sup>[3]</sup> managements as alternatives, longitudinal extramucosal myotomy is nearly

**Table 2: Description of Data of patients who underwent supraumbilical fold approach pyloromyotomy (GROUP 2)**

	CU	SD	95% CI
No. of Patients	N=145		
Mean age (week)	5.2	0.001	5.19984-5.20016
Mean pH level	7.42	0.02	7.4167-7.4233
Mean Chloride level	101.8	0.3	101.751-101.849
MOT (min)	40	0.2	39.967-40.033
Median LOS (h)*	33	0.3	32.951-33.049

**Table 3: Complications**

Complications	Surgical approach	
	RUQ (n=171)	CU (n=145)
Major:		
Duodenal/gastric perforation	2 (1.2%)	2 (1.3%)
Minor:		
Wound infection*	3 (1.8%)	3 (2%)
Mean postoperative emesis	1.8	2

\*  $P=0.519$

universally accepted for the correction of this condition.<sup>[9]</sup> Pyloromyotomy is a common surgical procedure, performed today both by pediatric surgeons and general surgeons.<sup>[14,15]</sup> Different approaches have been advocated over the years, from Robertson gridiron incision,<sup>[16]</sup> to the RUQ approach<sup>[15]</sup> with more emphasis recently on improving cosmetic results.

CU approach for pyloromyotomy was described to a certain a better cosmetic outcome. Because of its low complication rate, this approach was accepted by many surgeons from various schools.<sup>[13-20]</sup> However, in comparison with the RUQ approach, some studies observed that the CU approach led to an increase in the rate of wound infection and longer operative time.<sup>[21]</sup> This concept is contradicted with our data that showed no significant statistical difference among CU and RUQ groups regarding the MOT and the wound infection. The increased infectious risk has been shown to be definitively reduced by the use of preoperative antibiotic prophylaxis.<sup>[22]</sup>

Among the complications of pyloromyotomy (regardless of the approach), the most life-threatening is mucosal perforation, particularly if not recognized.<sup>[23,24]</sup> In our series mucosal perforation was seen in a total of four patients out of 316 patients (1.3%). However, some reported the incidence of perforation to be as high as 19% in the recent publications of open series.<sup>[25]</sup> Mucosal injury usually occurs when an incision is carried to deep or too far distally or when an instrument presses down on this delicate membrane. The intracavitary CU pyloromyotomy is an appealing alternative to the conventional open technique in which the olive, along with a small portion of the antrum and the duodenum, is exteriorised. Because the pylorus is below the incision, and the laparotomy can be shorter, trauma is minimised. This type of myotomy has been used with a RUQ incision,<sup>[26]</sup> as well as a CU incision.<sup>[27,28]</sup>

## CONCLUSIONS

Circumlinear supraumbilical fold approach to pyloromyotomy is a valuable operation that may produce an undetectable scar. This technique is safe, simple, and easily reproducible and not requiring special equipment or instrumentation providing an excellent exposure and operative space to the pylorus with no difference from the RUQ approach. Therefore, while awaiting final answers from further randomized controlled trials with regard to safety, efficacy, cost-effectiveness, and long-term cosmesis of the laparoscopic approach, we feel that second thoughts are still needed before entering

the laparoscopic era for pyloromyotomy especially in countries with a challenged resource settings like ours.

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### Conflicts of interest

There are no conflicts of interest.

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