Single port laparoscopic assisted pyloromyotomy
Our experience

A. Appignani M. Bertozzi

Table of Contents

1. ABSTRACT .................................................................................................. 1
2. INTRODUCTION ........................................................................................... 2
3. MATERIALS AND METHODS ........................................................................ 2
4. OPERATIVE TECHNIQUE .............................................................................. 2
5. DISCUSSION ................................................................................................ 3
6. CONCLUSIONS ............................................................................................. 4
7. REFERENCES ............................................................................................... 4
8. IMAGES ....................................................................................................... 6

1. ABSTRACT

Background Ramstedt pyloromyotomy is the procedure of choice for infantile hypertrophic pyloric stenosis; however, the best way to approach the pylorus is debated.

Recent literature reports many comparisons between various open and laparoscopic approaches. The purpose of this experience is to show a new approach to infantile hypertrophic pyloric stenosis: single-port, laparoscopic-assisted pyloromyotomy.

Methods: 31 infants underwent single-port laparoscopic-assisted pyloromyotomy. The approach to the abdominal cavity is performed through a right circumbilical incision, and then a 12-mm trocar is inserted. After the pneumoperitoneum is established, an operative telescope is introduced. Once the telescope is inserted, the pylorus is easily located, and then grasped and exteriorized via the umbilical incision. At this point, conventional Ramstedt pyloromyotomy is performed. Once the pylorus is reintroduced in the abdomen, a new pneumoperitoneum is created to control mucosal integrity and hemostasis.

Results. In all 31 cases operated on, an adequate pyloromyotomy was performed in a good ranging time without any intra- or post-operative complications, achieving also excellent cosmetic results.

Conclusions The feasibility of single-port laparoscopic assisted pyloromyotomy obtained in this small sample suggests that this procedure could be an excellent alternative to open or laparoscopic pyloromyotomy as long as it acts as intermediary between the two techniques.
2. INTRODUCTION

Infantile hypertrophic pyloric stenosis (IHPS) is a common surgical condition of early infancy with an incidence of approximately 1 to 3 per 1,000 live births (ref. 1).

Ramstedt pyloromyotomy was initially described in 1912 and remains the “gold standard” technique for IHPS (ref. 2). Several significant modifications to gain access to the pylorus have been introduced since the original publication. We describe our experience in performing Ramstedt’s pyloromyotomy with a single-port, laparoscopic assisted technique, (ref. 3) and we analyzed our results after the first years of implementation.

3. MATERIALS AND METHODS

From November 2008 to March 2013, 31 children (24 boys and 7 girls), mean age 36.6 days (20 -53 days), underwent single-port, laparoscopic-assisted pyloromyotomy (SPLAP). The medium body weight is 4,337 kg (2,8 – 5,3 kg). Characteristic of pylorus is about muscle thickness, the longitudinal and the transverse diameter. The average muscle thickness is 5.4 mm (3.5 – 6mm), the middle longitudinal diameter is 21.4 mm (15- 24 mm) and the average transverse diameter is 16.25 mm (12-18 mm).

We reintroduced feeding 6 h after the intervention following an increasing scheme, and we discharged the patients only 24 h later the first full meal. Information about age, operative approach, operating time, time to full feeding, complications, postoperative emesis, and postoperative discharge day were analyzed for all the patients.

4. OPERATIVE TECHNIQUE

A prophylactic dose of intravenous antibiotic (ceftriaxone, 50 mg/kg) is administered 30 min before surgery. A roll is positioned under the baby’s back to expose the high quadrants of the abdomen. Umbilical cleansing with povidone-iodine is provided before the surgical procedure.

The infant is placed in anti-Trendelenburg position. A right circumbilical incision is performed (4) Once the peritoneum is opened, a 12-mm Hasson trocar with pneumostatic anchorage is inserted. After establishing a pneumoperitoneum (to a pressure of 6 mmHg—flow 0.5 l/min), an operative telescope is introduced, and a complete exploration of the abdominal cavity is performed. After the pylorus is spotted, with atraumatic instrument the stomach is gently grasped laparoscopically proximal to the pyloric tumour and exteriorized through the right umbilical incision; the trocar is removed. With this simple manoeuver, often the tumor is exteriorized from the abdominal wall. In case of difficulty, taking the stomach in two fingers, a gentle traction is performed to pull out the hypertrophic pylorus from the umbilical incision; then a Ramstedt’s pyloromyotomy is performed (Fig. 1). Once conventional intervention is done, the pylorus is reintroduced in the abdomen. A reintroduction of the 12-mm trocar is performed and a pneumoperitoneum is again created. After the individuation of the pyloromyotomy, a minimal irrigation with a Nelaton catheter 14 ch introduced in the operative channel of the telescope is done and an air test by insufflating 50 ml of air through a previously placed nasogastric tube is performed to exclude any mucosal leakage (Fig. 2). If no perforation is detected, after a careful control of the hemostasis, the trocar is removed.

The wound is closed meticulously: 4–0 Vicryl interrupted fascia sutures are used and skin suture is performed using 2-octylecyanocrylate glue.
5. DISCUSSION

Since Ramstedt introduced in 1912 the longitudinal splitting of the seromuscular layer without suturing (2), the treatment of IHPS has remained essentially the same; what has changed, however, is the way in which the abdomen is opened (5,6). In 1986, Tan and Bianchi (7) described a new technique in which the pyloromyotomy was performed through a supra umbilical skin-fold incision, and in 1991, Alain et al. (8) introduced the laparoscopic approach.

During the past few years, many surgeons have preferred to perform laparoscopic pyloromyotomy (LP) but as many continue to perform open surgery by circumbilical incision or by other ways (4, 9-11) . The approach to the pylorus to perform pyloromyotomy is still debated and many authors in recent years have compared the various approaches looking for the best, considering the complications, postoperative hospital stay, cosmetic results, etc. Even if many manuscripts are available that compare laparoscopic and open pyloromyotomy (12-17), the results are different according to the authors and there is no definitive evidence in favor of LP or the open procedure. Although Ostlie et al. (18) reported an absence of complications in a large series of LP, other authors have demonstrated that this technique may expose patients to a higher risk of inadequate pyloromyotomy and duodenal perforation because of a longer learning curve (12,14,19)]. Leclair et al. (20) in a recent double-blinded, randomized, controlled trial compared the laparoscopic and circumbilical approaches, concluding that the open approach is their first choice for pyloromyotomy. Hall et al. (21) in 2004 performed a meta-analysis of studies comparing open and LP and concluded that the open approach is associated with fewer complications and higher efficacy but exalt the significantly shorter recovery time after LP.

The appearance of a higher complication rate in LP may be justified by the learning curve as much as if the operation is performed by a general surgery resident (22, 23).

Perger et al. (24) stated that if skill and experience to replicate good outcomes of laparoscopy are not available, open pyloromyotomy is a safer technique. They also report that if the umbilical approach is performed by experienced surgeons, it has comparable results to LP and may be the preferred technique.

Video-assisted surgery often offers the benefits of endoscopic exploration and mini-invasivity as much as the advantages of conventional surgery. The first authors to describe the single umbilical puncture to perform a laparoscopic appendectomy were Pelosi and Pelosi III in 1992 (25). Since this report, many others have applied this combined technique for the treatment of various pathologies even in children (26-28), but a laparoscopic-assisted procedure for IHPS has never been reported.

Traditionally, a right upper quadrant incision was used by our department to approach the IHPS. Recently, we decided to perform open pyloromyotomies with a right semicircular umbilical skin-fold incision to improve the cosmetic results in our patients. In the first cases, we had some difficulties detecting the pylorus in those patients who had distended bowel. This problem was probably due to the learning curve; therefore, the idea to perform a hybrid technique to approach the IHPS was born, and the introduction of the operative laparoscope eased a quick detection of the pylorus even in this condition.

Even if laparoscopic pyloromyotomy may be a good way for the entire surgical team to get training in neonatal laparoscopic surgery because it is quite frequent, an adequate learning curve is necessary; the Amsterdam experience indicates that the learning curve for LP involved 35 procedures [29]. Our high level of confidence and experience with laparoscopic-assisted procedures performed in neonatal surgery led us to prefer a laparoscopic-assisted approach instead of the laparoscopic one. In our 31 cases, we performed the SPLAP with a right
A. Appignani M. Bertozzi

Semicircular incision, which provides an almost invisible unique scar and a cosmetic outcome with a very high overall satisfaction[9]. (Fig. 3)

The exteriorization of the pylorus may be difficult through the circumbilical incision and some authors prefer to perform an extended incision [30-32], modifying the original technique [7] or performing an intra-abdominal pyloromyotomy [33-35]. In our series, using the right semicircular umbilical approach [4], there were no difficulties in extracting the pylorus. No serosal injury occurred and the extended sheath incision seems to be effective.

During the SPLAP, we perform an open Ramstedt’s procedure to avoid an inadequate pyloromyotomy, which is easy to perform even by residents of pediatric surgery. The integrity check of the mucosa, as much as the bleeding control, may be performed outside and inside the abdominal cavity through the air test, avoiding any unrecognized perforation or bleeding, which expose patients to a second operation or the risk of systemic sepsis [17].

SPLAP is performed for the most part as an open technique, and we use the pneumoperitoneum only for the identification of the pylorus and for the final mucosal and bleeding check, avoiding all the disadvantages of a prolonged pneumoperitoneum in infants. Finally, we want to emphasize that in 11 patients we performed the operation “gasless” thanks to the trocar with pneumostatic anchorage, which allows abdominal wall traction by the assistant surgeon. A further advantage of the SPLAP is the complete exploration of the abdominal cavity, which shows any other possible associated malformation.

6. CONCLUSIONS

Ramstedt’s pyloromyotomy remains the procedure of choice for IHPS. Our further experience with SPLAP confirm the previous report and it remains our procedure of choice for IHPS.

SPLAP for IHPS is safe and, in our experience, is an alternative approach that acts as intermediary between the laparoscopic procedure and the open one.

7. REFERENCES

Incidence of infantile hypertrophic pyloric stenosis
. Lancet 1:1177


8. IMAGES

Fig.1: Pyloromyotomy throught the umbilical excision

Fig.2: laparoscopic control of pyloromyotomy
Fig. 3: Excellent cosmetic result