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## Original Research

# Our Experience with Laparoscopic Pyloromyotomy in Patients with Infantile Hypertrophic Pyloric Stenosis

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### Abstract

**Objectives:** In this study, we aim to discuss our experience with laparoscopic pyloromyotomy in patients with infantile hypertrophic pyloric stenosis (IHPS) and skills development throughout our learning curve.

**Methods:** We retrospectively collected data from 15 patients with IHPS who underwent laparoscopic pyloromyotomy between 2016 and 2019 in our clinic. Evolution in operation techniques, peroperative and postoperative surgical complications were analysed.

**Results:** In this research, 15 patients (male-to-female ratio:2.7/1) were studied. The median age at presentation was 36.5 days (25–100 days). Non-bilious projectile vomiting was seen in all of the patients, and in eight cases, marked failure to thrive was seen. Situs inversus totalis was seen in one of the cases as an associated anomaly, no other anomalies were noted. A palpable olive-shaped mass was found in only 33% of infants (five cases). A patient was detected to have no IHPS peroperatively. One of the cases was converted to open technique due to peroperative technical difficulties. A patient underwent 2nd operation due to incomplete pyloromyotomy. The duration of the first and last cases was 110 mins and 35 mins, respectively.

**Conclusion:** The laparoscopic approach in patients with infantile hypertrophic pyloric stenosis can result in good postoperative outcomes and satisfying surgery in the hands of surgeons who perform minimally invasive surgery routinely.

**Keywords:** Infantile hypertrophic pyloric stenosis; laparoscopy; minimal invasive surgery; pyloromyotomy.

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Muscle hypertrophy in the pyloric canal causes projectile non-bilious vomiting in infants of three weeks and three months-age. Infantile hypertrophic pyloric stenosis (IHPS) is a disease seen in approximately two out of 1000 live births, the cause of which has not been fully revealed.<sup>[1]</sup> In addition to the history of the patient, palpation of the hypertrophic pyloric muscle, which is called olive-shaped mass in the epigastric region on physical examination, is sufficient for diagnosis. The presence of pyloric muscle thickness of more than 4 mm (3 mm in premature

babies) and of the pyloric canal longer than 17 mm on ultrasound supports the presence of the disease.<sup>[2]</sup> Patients may experience dehydration, weight loss, hypokalemic and hypochloremic metabolic alkalosis and electrolyte disturbances.

To prevent operative and postoperative metabolic complications that may occur, dehydration and electrolyte imbalances that may sometimes be severe should be corrected before surgery and the patients should be operated after sufficient urine output is observed.

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Extramucosal pyloromyotomy, which has been used for a long time and remains unchanged in the treatment of IHPS, was first described by Fredet (1907) and Ramsted (1912).<sup>[3]</sup> The circumumbilical incision described by Tan and Bianchi in 1986 became a new alternative to the standard right upper quadrant incision.<sup>[4]</sup> Laparoscopic pyloromyotomy was first described by Alain in 1990.<sup>[5]</sup>

Although minimally invasive surgical techniques have been widely used in our clinic for more than 12 years, laparoscopic IHPS has only been performed for the last two years. We aimed to transfer the experiences to the reader and review our technique by explaining the history of laparoscopic surgery of IHPS, the difficulties experienced and the solutions produced, in our clinic.

## Methods

The demographic characteristics, physical examination and laboratory findings of 15 patients with IHPS who underwent laparoscopic pyloromyotomy between April 2016 and April 2018 in our clinic were retrospectively evaluated in this study. Surgery videos of the patients were watched in chronological order. The operation times were obtained based on the surgery videos of the patients. The problems we encountered during the laparoscopic technique we applied and the development process were evaluated. Our experience was conveyed to the reader by presenting our technique that we are currently applying and want to standardize in the treatment of IHPS in our clinic.

In this technique, the patient is placed perpendicular to the long axis of the operating table. Surgeon stands on the patient's left foot, the assistant and nurse on the patient's right foot, and the monitor is placed on the patient's head side.

A 3 mm short port is inserted via the umbilicus to enter the abdomen, and a 3 mm short optic cable is used. The abdominal cavity is inflated with carbon dioxide with a flow rate of 1-2 lt/min and with a pressure of 8 mmHg. The other two instruments are used to enter the abdomen directly from the incision without ports. One of these is an atraumatic "grasper" used to hold and fix the duodenum through the right hypochondrium. The second entry incision is used for the incision and separation of the pyloric muscles through the left epigastrium. 0.5-1 ml of 0.25% bupivacaine and adrenaline is injected into all of the incision sites. Pylorus muscles and canal length can be felt by distal and proximal compression of lumens with both tools. The duodenum, which is held with an atraumatic grasper with the left hand, is fixed by leaning towards the liver. Even partial fixing of the pylorus significantly increases ergonomics. An incision line is marked on the surface of the serosa along the pylorus front wall starting from the preduodenal vein to-

wards the stomach, with the burning function of the hook cautery. This line is useful both as a guide to the incision line and in reducing bleeding. Then, the incision is made into the pyloric muscles by using the cutter function of the 3 mm hook cautery and without over pressing the wall. When the cutting process is finished, the hook on the right hand is removed and the muscles are separated with the Benson clamp as in the classical method so that sufficient mucosal curvature is formed. For the adequacy and perforation control of myotomy, 100 ml of air is given from the nasogastric probe to the stomach, and no leakage and a comfortable transition of air to the duodenum is expected to be observed.

At the 6th hour after laparoscopy, the patient was fed orally with 5 ml of 5% Dextrose and gradually increased milk regimen was continued in tolerating patients.

## Results

The male-female ratio of 15 patients who underwent laparoscopic pyloromyotomy in our clinic was 2.7: 1, and the age at the admission of the patients was 36.5 (25-110) days. Severe non-bilious projectile vomiting was seen in all patients and marked failure to thrive was detected in eight patients. Olive mass finding was detected in the preoperative examination in only six of the patients. An additional note was not made for olive mass finding in the examination under general anesthesia peroperatively. All patients had hypochloremic hypokalemic metabolic alkalosis except for two patients. In one of the patients with normal biochemical parameters, it was observed that the patient did not actually have IHPS during surgery. The operation of this patient was terminated with diagnostic laparoscopy and this patient was followed up with the diagnosis of gastroesophageal reflux. Abdominal ultrasonography of the patient was reported to be compatible with pyloric stenosis. No additional medical condition was detected in patients in the series, except that one of the patients had situs inversus totalis. One patient was re-operated with a diagnosis of inadequate pyloromyotomy. In one patient, the surgeons converted to an open procedure due to peroperative technical difficulty. One of our patients could start receiving feeding late due to prolonged vomiting postoperatively. Wound infection and incisional hernia were not observed in our patients. While the operation time of the first laparoscopic pyloromyotomy was 110 minutes, the last operation in the series was recorded as 35 minutes.

## Conclusion

The male-female ratio of 15 patients who underwent laparoscopic pyloromyotomy in our clinic was 2.7:1, and the

admission age was 36.5 (25-110) days. In the literature, the prevalence of IHPS is given as an average of 1 in 300-900 live births in the white race.<sup>[6]</sup> Considering that the annual number of cases in our clinic is approximately 3000, our number of IHPS cases seems to be roughly small. The reason for this situation could not be explained. While minimally invasive surgery in pediatric surgery started to become widespread in the 1990s and in our country in the 2000s, the first laparoscopic case in our clinic was performed in 2006. Although we are a clinic with an annual laparoscopic case number of 680 (2017) and minimally invasive surgery is prioritized, switching to the laparoscopic technique in IHPS cases was late. This is due to the lack of equipment required for neonatal minimally invasive surgery, as well as the fact that the circumumbilical incision is partially at the acceptable small size compared to our other open incisions and the pyloromyotomy was technically too sensitive to be performed without palpation sensation. The initiating factor for pyloromyotomy using laparoscopic technique in our clinic is that it is often difficult to deliver the pyloric mass through a circumumbilical incision and serosal injuries occur during this time. Concerning duration of operation, it was seen that even surgeons with more than 10 years of experience in laparoscopy have a learning curve and the operation time of the first surgery is extended due to difficulties in fixing the duodenum and incision of the pylorus. With increasing experience in subsequent surgeries, overcoming the problems experienced at these stages shortened the duration from 110 minutes to 32 minutes. In the literature, different techniques are described for laparoscopic pyloromyotomy and arthroscopic blades are used more frequently to cut the pyloric muscles.<sup>[7]</sup> Since there was no arthroscopic blade in our operating room, hook cautery was used for the pyloric canal incision during the first laparoscopic pyloromyotomy in our clinic. When the video of the first operation was watched, it was observed that adhesions to the tissue were experienced during the use of the burning function of the hook cautery and that the action was taken with hesitation because of the possibility of perforation and this resulted in inadequate pyloromyotomy. Due to the vomiting lasting more than two days postoperatively, this patient was re-operated with an open method. In the second case, for the pyloric incision, an ophthalmic blade was preferred, but the blade had a thick but short body and was difficult to maneuver, so it was not successful in making a proper incision over a single line on the pylorus, and the operation time lasted as long as 105 minutes. It was seen that the incision made exactly parallel to the pylorus canal and at least 2 mm deep was important in the effective separation of the muscles. In the publications, it was reported that during the learning curve period,

laparoscopic pyloromyotomy lasts longer than open operations, but this period is shortened with increasing experience.<sup>[8,9]</sup> When laparoscopic exploration was performed, in the patient, in whom the pylorus was observed normally, two 3 mm working ports were inserted, all intestinal loops and abdomen were examined and no additional pathology that could explain vomiting was encountered. The patient's laparoscopy was terminated and gastroesophageal reflux was detected on the gastroduodenal x-ray taken postoperatively. The patient benefited from medical antireflux therapy. In our laparoscopic pyloromyotomy of our patient with situs inversus totalis, there was no need for an additional change in our surgical technique. In the third case of our series, while the pyloric canal was cut with an ophthalmic knife, there were a few lines and the muscle fibers could be obliquely separated and open surgery was performed with a circumumbilical incision since the sufficiency of pyloromyotomy was not certain.

There are different protocols regarding postoperative feeding time.<sup>[10]</sup> The course of postoperative feeding and the frequency of vomiting were similar for both operations in various publications.<sup>[11]</sup> In our patients, no application was applied other than in the open method in the nutrition protocol after laparoscopic surgery. At the 6<sup>th</sup> hour after laparoscopy, the patient was fed orally with 5 ml of 5% Dextrose and gradually increased milk regimen was continued in tolerating patients. Except our patient whose vomiting continued after insufficient pyloromyotomy, we had a patient with a delay in the regimen in 14 other patients and this patient was able to tolerate feeding 18 hours after surgery. Postoperative prolonged vomiting was thought to be due to the keeping of the duodenum long in this patient, whose operation time was 105 minutes.

The most prominent aspect of laparoscopic pyloromyotomy is that the incision is cosmetically better.<sup>[12]</sup> It is reported that the rate of wound infection and postoperative pain are also lower in the laparoscopic method.<sup>[12]</sup> In our series, no wound infection was experienced and pain control was achieved with a postoperative single dose of paracetamol suppository.

Laparoscopic exploration provides good imaging, good determination of the pyloric borders and detailed evaluation of vascular structures. In laparoscopy, manipulation of the stomach, pylorus and duodenum is less; less surgical trauma occurs with appropriate material and experience.

Laparoscopic pyloromyotomy is a technically easier, less traumatic method, which gives surgical satisfaction and high motivation in experienced hands for minimally invasive surgery, compared to pyloromyotomy with a circumumbilical incision.

## Disclosures

**Ethics Committee Approval:** Retrospective study.

**Peer-review:** Externally peer-reviewed.

**Conflict of Interest:** None declared.

**Authorship Contributions:** Concept – M.K.; Design – M.K., M.D.; Supervision – M.A.; Materials – N.S.; Data collection &/or processing – M.K., A.U.; Analysis and/or interpretation – M.K., A.I.D.; Literature search – C.A.K.; Writing – M.K., C.A.K.; Critical review – A.I.D.

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