

Laparoscopic surgery of congenital paraesophageal hernia in newborns and infants

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ABSTRACT

Introduction. Congenital paraesophageal hernia (CPH) is a rare pathology in pediatric patients. Clinical signs may occur as early as in newborns, which means it requires early surgical repair.

Clinical cases. This is a series of three patients under 1 year of age diagnosed with type IV CPH – with symptoms occurring since they were newborns – who underwent laparoscopic surgical repair. One patient had been diagnosed prenatally. Age at surgery was 6 days, 36 days, and 9 months, respectively. Weight at surgery was 3.60 kg, 3.79 kg, and 8.20 kg, respectively. The patients underwent laparoscopy, with removal of the hernia sac, closure of the diaphragmatic pillars, placement of a reinforcement absorbable mesh, and Nissen fundoplication. Mean operating time was 130 minutes. No intraoperative complications were recorded. One patient developed a sliding hernia, which was subsequently repaired without complications. Mean follow-up time was 24 months.

KEY WORDS: Hiatal hernia; Paraesophageal hernia; Children; Absorbable mesh.

CIRUGÍA LAPAROSCÓPICA DE LA HERNIA PARAESOFÁGICA CONGÉNITA EN NEONATOS Y LACTANTES

RESUMEN

Introducción. Las hernias paraesofágicas congénitas (HPC) son una patología poco frecuente en la edad pediátrica. Pueden presentar clínica desde la época neonatal precisando una reparación quirúrgica temprana.

Casos clínicos. Presentamos 3 casos diagnosticados de HPC tipo IV en pacientes menores de 1 año, que presentaron síntomas desde la época neonatal, en los que se ha realizado reparación quirúrgica laparoscópica. Un paciente presentaba diagnóstico prenatal. La edad en el momento de la cirugía fue 6 días, 36 días y 9 meses. El peso en el momento de la cirugía fue de 3,60 kg, 3,79 kg y 8,20 kg. Los pacientes fueron intervenidos por laparoscopia realizando excisión del saco herniario, cierre de pilares diafragmáticos, colocación de malla reabsorbible de refuerzo y una funduplicatura Nissen. El tiempo medio de cirugía fue de 130 minutos. No hubo

complicaciones intraoperatorias. Un paciente presentó una hernia de deslizamiento que se reparó posteriormente sin complicaciones. El tiempo medio de seguimiento es de 24 meses.

PALABRAS CLAVE: Hernia de hiato; Hernia paraesofágica; Niños; Malla reabsorbible.

INTRODUCTION

Hiatal hernias are rare in children. Most of them are secondary to gastroesophageal surgeries, with congenital hernias accounting for 3.5-5% of the total⁽¹⁾. They have been classified into four types: in type I (sliding hernia), the gastroesophageal junction is in an intrathoracic position; in type II, the gastric fundus is in an ascended position up the thorax; type III is a mixed hernia (types I and II), with both the gastric fundus and the gastroesophageal junction in an intrathoracic position; and in type IV, the stomach and another organ (the colon, the small bowel, or the spleen) are in an intrathoracic position. Hiatal hernia types II to IV are also known as paraesophageal hernias. They are called giant when the herniated stomach represents more than 30% of the total⁽²⁾.

Type IV congenital paraesophageal hernia (CPH) is the least frequent presentation^(1,3-5).

CLINICAL CASES

Clinical characteristics are featured in Table 1.

Case 1: Full-term newborn (FTN) prenatally diagnosed with type IV CPH at MRI. At birth, diagnosis was confirmed by means of a contrast study (Fig. 1). Once feeding had been initiated, significant gastroesophageal reflux (GER) occurred. It impaired the growing process as it could not be controlled with oral medication.

Case 2: FTN referred to our institution as a result of suspected intestinal obstruction. A thoracoabdominal X-ray

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Table 1. Clinical characteristics of the type IV paraesophageal hernia cases diagnosed in 2017-2018.

	<i>Patient 1</i>	<i>Patient 2</i>	<i>Patient 3</i>
Age at surgery	34 days	6 days	9 months
Weight	3.600 kg	3.790 kg	8.200 kg
Sex	Female	Male	Male
Associated abnormalities	No	No	No
Prenatally diagnosed	Yes	No	No
Diagnostic technique	Contrast study	Contrast study	CT-scan Contrast study
Digestive symptoms	Vomit Regurgitation	Vomit	Vomit Hematemesis
Respiratory symptoms	No	No	Bronchospasm Apnea
Delayed growth	Yes	No	Yes
Long-term follow-up	No symptoms	Laparoscopically repaired sliding hernia with signs occurring 7 months later	Mild GER signs treated with omeprazole



Figure 1. Esophagogastric contrast study and opaque enema demonstrating a type IV CPH.

was performed, which demonstrated the presence of a chest mass. The esophagogastric contrast study confirmed a type IV CPH with suspicion of organoaxial gastric volvulus.

Case 3: FTN with severe, poorly controlled GER since he was 1 month old. At 8 months of age, in the context of a respiratory infection, a chest X-ray was carried out (Fig. 2),

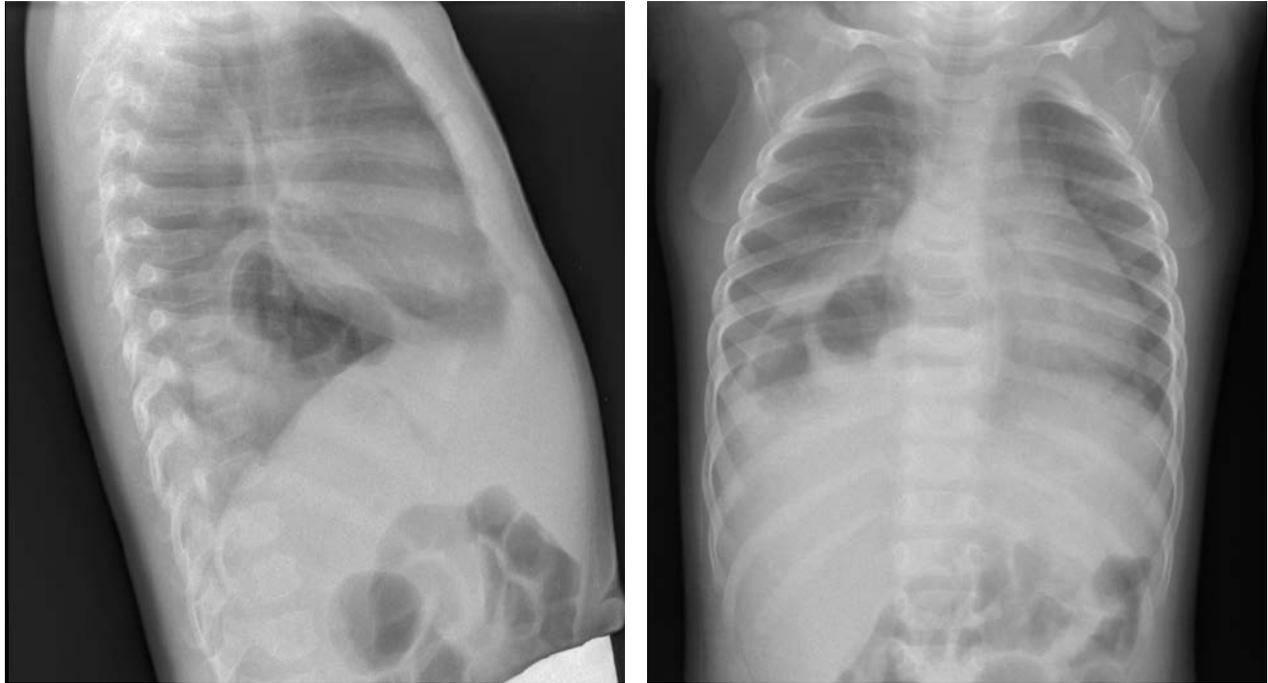


Figure 2. Lateral and anteroposterior X-ray demonstrating a thoracic hydroaerial mass.

which revealed the presence of a chest mass, so the patient was referred to our institution. An esophagogastric study and an opaque enema were performed, which confirmed type IV CPH.

In the three patients, laparoscopic surgical repair was carried out using a 5mm scope and four 3mm and 5mm instrument ports. Herniation of more than 30% of the stomach and the small bowel was observed in all cases. None of the patients had ischemic compromise of the abdominal organs. The latter were reduced, the hernia sac was removed, and the diaphragmatic pillars were sutured using Ti-Cron™ interrupted stitches. A Nissen fundoplication was also conducted. A Vicryl® absorbable mesh was placed above the suture of the pillars in the shape of a “U” and anchored with a ProTack™ fixation device. Mean surgical time was 130 minutes. No intraoperative complications were recorded.

Oral feeding was resumed the following day. In case 2, during follow-up, the fundoplication wrap was found to have slipped, with clinical repercussion. This was laparoscopically repaired. At surgery, the fundoplication wrap was found to have ascended, so the hiatus was repaired and reinforced with a GoreTex® patch. Case 3 required medical treatment of GER as compatible signs persisted. Mean follow-up time was 24 months.

DISCUSSION

Congenital hiatal hernia is a rare pathology of unknown incidence⁽²⁾, with type IV being the least frequent one⁽¹⁻⁴⁾.

Various embryological hypotheses have been formulated to explain the development of this pathology, including persisting right pneumoenteric recess during diaphragmatic development⁽⁶⁾, gastric ligament laxity, impaired esophageal hiatus, and flawed development of the diaphragmatic lumbar component^(1,2). Imamoglu et al. suggest the absence of pulmonary hypoplasia means the hiatal defect occurs during embryonic development, while content herniation takes places postnatally as a result of the combination of intra-abdominal and thoracic pressure⁽⁵⁾. Improved follow-up during pregnancy has allowed CPH to be diagnosed prenatally⁽²⁾. Our study featured one case of prenatal diagnosis where prenatal MRI showed the presence of herniated content within the thorax, which does not support the hypothesis of postnatal herniation.

CPH symptoms are multiple. Up to 68% of patients have GER⁽²⁾, and CPH is present in up to 20.7% of patients undergoing GER assessment⁽⁷⁾. Type I and type II hiatal hernias are more frequently associated with vomit, whereas types III and IV typically cause respiratory symptoms. Some authors suggest this is a result of superinfected persisting atelectasis secondary to the herniated content occupying the intrathoracic space⁽¹⁾. Various cases of intrathoracic gastric volvulus requiring emergency surgery have been reported⁽⁵⁾. In our series, all patients had GER and significant vomit, and organoaxial volvulus was suspected in one of them. The presence of symptoms since birth is most likely secondary to the type of hernia and the large volume of herniated gastric content, causing severe GER and significant feeding difficulty, which required an early defect repair.

Table 2. Comparison of the various anti-reflux techniques reported in the literature.

<i>Authors</i>	<i>Year</i>	<i>Anti-reflux technique</i>	<i>Patients</i>	<i>Types of CPH</i>	<i>Remarks</i>
Imamoglu et al.	2005	Thal	5	II: 1 III: 4	
Bettolli et al.	2006	Nissen	4	II: 4	
Karpelowsky et al.	2006	Nissen	20	Non-described	They compared patients with and without anti-reflux technique
		Boix Ochoa	13		
		Belsey	6		
		None	20		
Yousef et al.	2015	Nissen	7	II: 4	
		Toupet	3	III: 8	
		Thal	1	IV: 2	
		Dor	2		
		None	1		
Miyake et al.	2016	Toupet	2	I: 6	All patients had associated asplenia syndrome
		Plication of the angle of Hiss	6	II: 3	
		None	1	III: 1	
Petrosyan et al.	2018	Nissen	25	II: 6	
		Dor	1	III: 16	
		None	2	IV: 6	
Cheng et al.	2019	Nissen-Rossetti	90	I: 56	
		Thal		II: 19	
			13	III: 6	
				IV: 20	
Jiménez et al.	2020	Nissen	1	IV: 1	

CPH laparoscopic repair is rapidly gaining traction⁽⁴⁾. Cheng et al. describe a series of 103 patients with CPH undergoing laparoscopy with a mean weight of 7.34 ± 3.33 kg, 10 of whom had recurrence in the first 3 years⁽⁸⁾. Yousef et al. recommend laparoscopy in schoolchildren, but they advise against its use in newborns and infants owing to the small size of the surgical field⁽¹⁾. In our series, all patients were under 9 months old, and they all weighed less than 8 kg, but minimally invasive early repair was the first surgical option. In our view, the advances made in terms of laparoscopic scopes and 3 mm and 5 mm instruments allow minimally invasive CPH surgical repair to be carried out in a safe and effective manner in newborns and infants.

Surgical steps in this pathology include hernia sac dissection and removal, closure of the diaphragmatic pillars with or without the use of a reinforcing mesh, and an anti-reflux technique.

Even though hernia sac removal is the most complex step, especially in younger patients, it is associated with decreased recurrence^(1,5). It allows herniated organs to be fully reduced, the esophagus to be adequately mobilized, and the hiatal defect to be correctly exposed⁽¹⁾.

While closure of the diaphragmatic pillars is a widely accepted step, the use of meshes in CPH repair remains controversial. According to Imamoglu et al., hernia sac resection along with adequate esophageal mobilization should suffice to avoid recurrences⁽⁵⁾, whereas Bettolli et al.

believe routinely using meshes reduces recurrence rates⁽⁹⁾. Cheng et al. suggest meshes are used in recurrent cases⁽⁸⁾. In a meta-analysis of adult patients comparing cruroplasty with and without mesh, they found hernia recurrence risk is 58% lower in mesh patients than in non-mesh patients (OR: 0.51; 95% CI: 0.30-0.87; $p=0.014$). However, owing to the lack of follow-up, they conclude there are insufficient data to support routine use⁽¹⁰⁾. The most frequent complications associated with the use of meshes in adult patients are esophageal erosion and dysphagia⁽¹¹⁾. Sporadic cases of complications, such as polytetrafluoroethylene (PTFE) mesh erosion and migration, have been described in pediatric patients⁽¹²⁾, but according to more recent studies, PTFE + Goretex® meshes are safe. Hizuru et al. described the use of PTFE + Goretex® meshes in 13 pediatric patients with neurological impairment as a hiatal reinforcement during Nissen fundoplication⁽¹³⁾. Absorbable meshes, which are aimed at reducing complications⁽¹⁴⁾, can be either synthetic (Vycril®, Bio-A®) or biological (Surgisis®, Alorderm®); both of them have demonstrated to be safe^(15,16). In our series, synthetic absorbable meshes were routinely used, while non-absorbable ones were applied to recurrent cases only. Even though there is insufficient scientific evidence supporting routine use, current studies seem to demonstrate they are safe.

Karpelowsky et al. described a 60% frequency of GER signs in CPH patients not undergoing anti-reflux technique,

whereas incidence was as low as 15% in patients who did undergo it⁽⁶⁾. Anti-reflux technique associated with hernia repair is widely accepted due to the alteration of physiological mechanisms⁽²⁾. However, the surgery of choice differs according to the studies^(1,3-6,8,17) (Table 2). There are no comparative studies between techniques, and not all articles describe the method used, which means the anti-reflux technique is to be chosen by each surgeon. In our series, Nissen fundoplication was used, since it is the most common technique at our institution and it offers good results.

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