Original Article

A Novel Scarless Laparoscopic Method for Morgagni Hernia Repair

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ABSTRACT

Background: Morgagni hernia (MH) is a rare congenital defect of the diaphragm. Although the various surgical method has been proposed, there is no surgical consensus. **Aim:** In this study, we aimed to report the outcome of the patients that underwent surgery which is completed using a single port laparoscopic-assisted transabdominal closure of MH. **Patients and Methods:** This is a retrospective analysis of 18 pediatric patients who underwent novel laparoscopic MH repair at a single tertiary pediatric hospital between March 2018 and December 2020. **Results:** Of the 18 patients, 72% (n = 13) were male and 28% (n = 5) were female. The symptoms at admission included repeated chest infection (39%), dyspnea (33%), vomiting (17%), and abdominal pain (22%). The colon (78%) was the most frequently herniated organ. Hernias were bilateral, on the left, and on the right in seven, four, and seven cases, respectively. All surgical interventions were completed within 25–50 min. All patients started enteral feeding within 24 hours. All patients were discharged within 1–3 days without any complications. The mean follow-up period was 27 months. **Conclusions:** In conclusion, our method is characterized by a shorter operation time, early return to feeding, early discharge, excellent cosmetic results, low cost, and low recurrence rate. Further prospective trials are needed to compare our novel scarless technique to other methods.

Keywords: *Laparoscopic, morgagni hernia, scarless*

Introduction

Morgagni hernia (MH), a defect in the anteromedial portion of diaphragm, was first described by Giovanni Morgagni.[1] MHs are rare compared to Bochdalek hernias,[2-4] occurring in 1 of every 4,800--5,000 live births and accounting for <4% of all diaphragmatic defects.[2-4] Although the colon is one of the most frequently herniated organs in the thoracic cavity, herniation also occurs in the omentum, stomach, liver, and small intestines.[5,6] Congenital heart disease, chest wall deformities, intestinal malrotation, omphalocele, chromosomal anomalies, and Down syndrome are associated with MH.[6,7] Patients with MH are typically asymptomatic but are sometimes referred to the pneumology department due to respiratory system complaints such as fever, cough, and wheezing.[8,9] Various surgical approaches to thoracic repair have been reported, via median sternotomy, thoracotomy, and thoracoscopy, as well as abdominal approaches via laparotomy and laparoscopy. However, there is no surgical consensus, and thoracoscopic repair outcomes among laparoscopic approaches are variable and controversial.[10] Both surgeons and patients have raised concerns over the surgical options for MH, including regarding cosmetic outcomes, surgery time, cost, and length of stay at the hospital. This study evaluated medium-term surgical and clinical outcomes in pediatric patients following application of a novel, minimally invasive approach for MH correction.

Material and Method

We retrospectively analyzed the records of 18 patients who underwent surgery for MH between March 2018 and December 2020 at Dicle University Medical

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School, Department of Pediatric Surgery. Demographic characteristics were evaluated, including age, gender, symptoms, associated anomalies, radiological studies, operation and hospitalization times, complication and recurrence rates, and side of herniation.

Evaluations of associated anomalies were based on physical examination, radiological imaging, surgical intervention, and, if necessary, echocardiography and chromosomal analysis.

All patients underwent surgical repair via laparoscopy using our novel scarless technique. The surgical intervention and postoperative follow-up were performed by the same surgeon.

Surgical technique

In this study, a novel scarless laparoscopic method for MH repair is described. This method is similar to the percutaneous internal ring suturing technique of inguinal hernia for children. General anesthesia is induced and the patient is stabilized in a supine reverse Trendelenburg position. The intervention is started by inserting only one port through the umbilicus via an open technique; no additional ports are inserted into the abdominal cavity. This port is used only for imaging the hernia sac. Although we usually find no herniated organs in the cavity during surgery due to the relaxing effect of the anesthesia and the position of the patient, herniated abdominal contents are sometimes seen. However, these organs can be easily cleared from the hernia sac by maneuvering the endoscope.

We entered the abdominal cavity around the xiphoid with a 20-gauge catheter needle and a nonabsorbable 2-0 prolene suture made into a loop [Figure 1]. The needle entered the abdominal cavity through the abdominal wall and preperitoneal tissue, and approached the rim of the diaphragm. The loop was pushed forward through the opening" of the needle. After creating a sufficiently large loop, the needle was withdrawn so that the loop remained in the abdominal cavity. Then, another needle with prolene suture was inserted through the previous needle point on the skin but passed through the subcut and anterior abdominal wall muscles away from the previous needle tract pushed forward through the first loop after reaching the rim of the diaphragm. The second needle was also removed, and the second Prolene suture was held while withdrawing the first loop. With this maneuver, the second Prolene suture was turned out of the abdominal cavity, forming a "U" suture in the abdomen [Figure 2]. Finally, the Prolene sutures were tied extracorporeally, leaving the knots under subcutaneous tissue [Figure 3]. Although the number of loops depends on the size of the defect, about one centimeter apart was preferred. We did not perform any skin incisions for the knots.

Results

Table 1 summarizes the patient demographic data. Of the 18 patients, 72% (n = 13) were male and 28% (n = 5) were female. The mean ages at diagnosis and at operation were 21 months (range: 4--43 months) and 22 months (range: 5--54 months), respectively. Eleven patients (61%) were older than 1 year of age. The symptoms at admission included repeated chest infection (RCI) (39%), dyspnea (33%), vomiting (17%), and abdominal pain (22%) there were no symptoms in 28% of cases.

Laboratory analyses and X-rays were performed in all patients, while computed tomography was performed in only two patients [Figure 4].

All patients underwent surgery using our novel scarless technique. In all cases, prolene sutures were used to repair the hernia defect without hernia sac excision. The colon (78%) was the most frequently herniated organ.

Hernias were bilateral, on the left, and on the right in seven, four, and seven cases, respectively. Nine patients

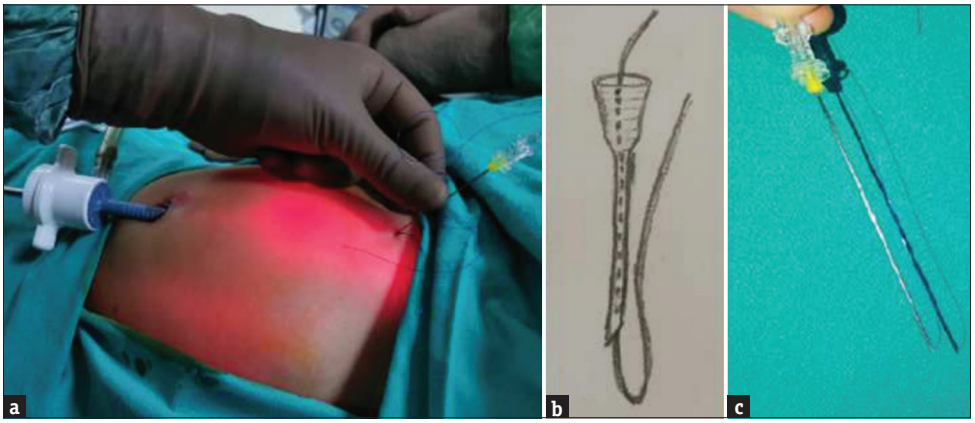

Figure 1: (a). Entrance of the Needle around the xiphoid (b). Needle drawing (c). 20-gauge catheter needle nonabsorbable 2-0 prolene suture.

Table 1: Clinical data of patients

Case	Gender	Clinical Presentation	laterality	Age at Diagnosis	Age at Surgery	Operative Time (min)	Diagnosis	Recurrence	Length of hospital stay (LOS)	Associated Anomalies
1	M	RCI, Abdominal pain	Left	31,5	31,8	35	CXR	No	2	Pectus carinatum, Down syndrome, Hydrocephali Craniosynostosis
2	M	Dyspnea	Left	36,5	37,7	35	CXR	No	2	Down syndrome, ASD, PDA
3	M	Dyspnea, vomiting	Bilateral	42,5	43,3	30	CXR	No	3	Gastroesophageal reflux, Prematurity
4	M	No symptoms	Right	15	15,4	25	CXR,	No	2	
5	F	RCI, abdominal pain	Right	9,8	9,9	25	CXR	No	2	
6	M	No symptoms	Left	34,3	35,1	50	CXR,	No	2	
7	M	RCI, dyspnea	Right	12,7	13,1	35	CXR	Yes	2	Down's syndrome, ASD, VSD, Right Arcus aorta, hypothyroidism, prematurity
8	F	Abdominal pain, vomiting	Right	26,6	27,7	43	CXR,	No	1	Epilepsia, PDA
9	M	Dyspnea, abdominal pain	Right	5,3	7,1	42	CXR	No	1	
10	M	RCI	Bilateral	43,2	43,4	46	CXR,	No	1	
11	M	No symptoms	Right	24,6	33	40	CXR	No	1	Down's Syndrome, ASD, VSD
12	M	No symptoms	Bilateral	50	53,5	40	CXR	No	2	
13	M	No symptoms	Right	5,5	5,5	50	CXR, CT	No	1	Situs solitus, Pectus carinatum
14	M	RCI	Bilateral	5,4	6	35	CXR	No	1	PFO,
15	F	RCI, dyspnea	Bilateral	6,6	7	40	CXR	No	1	PDA, ASD
16	F	Vomiting	Bilateral	10,8	10,8	30	CXR	No	2	
17	F	RCI, dyspnea	Left	13	13,1	35	CXR	No	1	
18	M	RCI	Bilateral	4,4	5	40	CXR, CT	No	2	

CXR: Chest radiogram, CT: Computed Tomography, RCI: Repeated Chest Infection

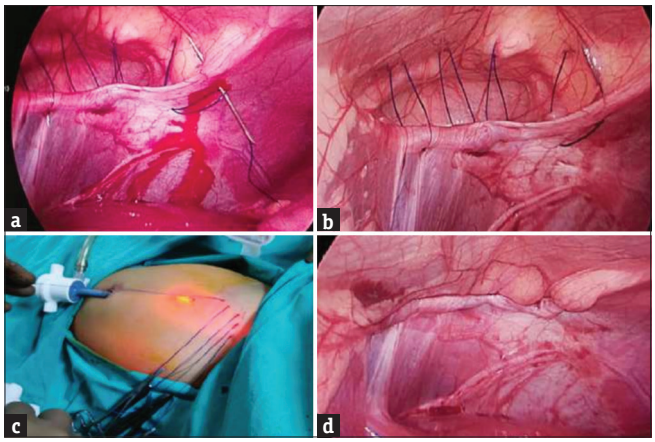

Figure 2: (a). Pushed needle, (b). Created loops (c). A View of the sutures extracorporeally (d). View intracorporeally after tied sutures.

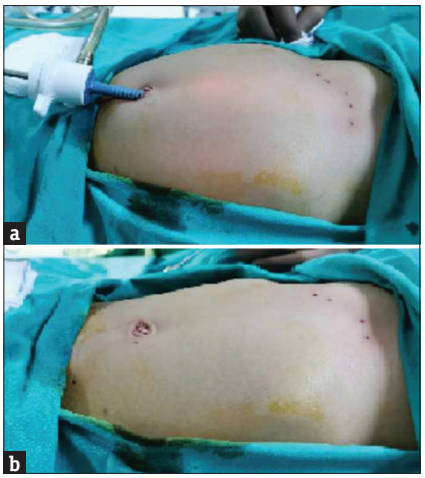

Figure 3: View of the abdominal wall (a). during surgery after tied sutures (b). The end of surgery.

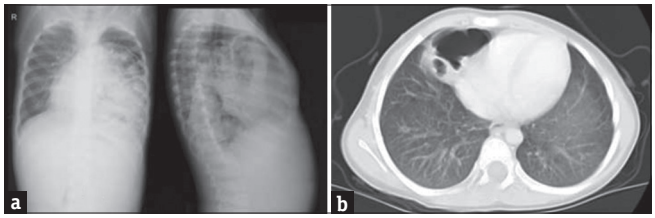

Figure 4: (a). Chest radiograph of a Morgagni hernia (paracardiac opacity), (b). Computed tomography image of a Morgagni hernia

had at least one associated congenital anomaly, and four had multiple associated anomalies. Down syndrome was found in four patients. Cardiac anomalies were found in eight patients, and three patients were operated on due to major cardiac anomaly.

All surgical interventions were completed within 25--50 min (mean, 37 min). All patients started enteral feeding within 24 hours (mean, 6 hours; range: 5--24 hours). All patients were discharged within 1--3 days (mean, 1.6 days) with no complications.

The follow-up period was 12--45 months (mean, 27 months), and all patients were asymptomatic, except one who experienced recurrence; this patient had multiple associated anomalies including Down syndrome, atrial septal defect (ASD), ventricular septal defect (VSD), right arcus aorta, hypothyroidism, and prematurity. The patient had also undergone laparoscopic MH repair and had been operated on due to major cardiac anomaly before admission to our institute.

Discussion

Although MH may be diagnosed incidentally in childhood, patients present with symptoms ranging from slight abdominal pain to severe respiratory symptoms.[11,12] Based on 15 years of experience with MH repair, Jetley *et al*.[8] reported that RCI was the most common presenting symptom, most admissions to our center were due to RCIs.

Previous studies have found genetic mutations associated with Bochdalek hernia.[13,14] Associations between MH and chromosomopathies, such as Down's syndrome, suggest that MH is an inheritable defect, but evidence is lacking.[13,14] However, four of our patients had Down syndrome. Further investigations should confirm this potential relationship.

Diagnosis of MH is made by physical examination, chest radiograph (CXR), or computed tomography (CT). Pinheiro *et al*.[15] performed CT in 69% of patients, while Jetley *et al*.[8] used CT in 36% of cases. Although CT is the gold standard for diagnosis, we used CXR for the initial radiological study due to concerns about radiation exposure and the stability of the patient; CT was performed in only two patients (11%). A careful assessment using CXR is sufficient in most cases.

Before 1990, thoracotomy and especially laparotomy were the standard surgical approaches for MH. After the first laparoscopic repair of MH in 1992 by Kuster *et al*.,[10] minimally invasive techniques became the gold standard in both children and adults.[9,10,16-18] Many laparoscopic techniques have been proposed but the optimal approach is still controversial. Laparoscopic-assisted repair of MH (LARMH) with extracorporeal knots under the subcutaneous tissue is widely used.[2,19] Ergun *et al*.[20] and Pinheiro *et al*.[15] used LARMH with three and four ports, respectively. We used only one port for imaging the hernia sac through the umbilical area and repaired the defect using prolene sutures without sac excision, resulting in fewer complications, a lower recurrence rate, shorter operative time, shorter length of stay, and excellent cosmetic results compared toother repair methods.

Garriboli *et al*.[21] suggested that the use of absorbable sutures may be associated with recurrence of MH. Pinheiro *et al*.[15] reported one recurrence in a case that had been repaired with an absorbable suture. Therefore, we used nonabsorbable sutures in all of our patients.

Although volvulus, obstruction, and perforation are serious, MH repair generally prevents these intestinal complications.[22]

Lamas-Pinheiro *et al*.[15] used a minimally invasive repair technique for MH and reported a mean operative time of 95 min. Ergun *et al*.[20] reported a mean of operative time of 40 min. Although 39% of our cases had bilateral MH, the mean operation time was only 37 min. The lower number of ports used and shorter operative time highlight how efficient and simple this method is.

The decision to excise the hernia sac remains controversial. Excision has been suggested to reduce the recurrence rate.[23,24] Ergun *et al*.[20] recently reported their experience with laparoscopic MH repair using a loop suture removal technique; they removed the hernia sac using two working trocars and reported no recurrence or complications. However, additional port usage increases the financial burden and cosmetic concerns. Pinheiro *et al*.[15] reported a recurrence rate of 18% when using three working trocars without excising the sac. Al-Salem *et al*.[7] reported an overall recurrence rate of 7%, and there were no recurrences in the LARMH group despite no excision of the sac. Although we did not excise the sac in the present study, there was only one recurrence during the follow-up period (mean, 27 months) in a patient with Down syndrome. Down syndrome is associated with muscular deficiency of the body wall and diaphragm[25] so may be a risk factor for recurrence.

Ergun *et al*.[20] reported a mean enteral feeding time of 7 hours (range: 6--24 hours), which is comparable to the mean feeding time of 6 hours (range: 5--24 hours) in the present study. Ergun *et al*.,[20] Pinheiro *et al*.,[15] and Al-Salem *et al*.[7] used three, four, and four ports, respectively, for imaging the hernia sac, whereas we used only one port. This enhances trust in patients due to the satisfactory cosmetic results compared to laparotomy, thoracotomy, and minimally invasive techniques with multiple ports. Although we used only one port for imaging and did not excise the hernia sac, we encountered no complications and the recurrence rate was superior to those reported in the literature.

In conclusion, our method is superior to techniques such as open repair and laparoscopic methods (i.e., methods using multiple ports and internal suturing) because it is characterized by a shorter operation time, early return to feeding, early discharge, excellent cosmetic results (i.e., it is scarless), low cost, and low recurrence rate. Further prospective trials are needed to compare our novel scarless technique to other methods.

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Type of Study: Retrospective, Clinical Study.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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