

ORIGINAL

Could the percutaneous intracorporeal ring suturing method be the primary surgical option for the treatment of Morgagni hernia in children?

¿Podría el método de sutura intracorpórea percutánea en anillo ser la primera opción quirúrgica para el tratamiento de la hernia de Morgagni en niños?

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Abstract

Objective: This study presents our clinic's experience with using the percutaneous internal ring suturing (PIRS) technique during laparoscopic Morgagni hernia repair.

Materials and methods: The files of 23 cases operated in our clinic between 2012-2021 were evaluated retrospectively.

Results: Ages of 23 patients ranged from 1 month to 60 months (median 36 months). Nine were female and 14 were male. All cases were pre-diagnosed by chest X-ray, and at least one of the contrast-enhanced passage X-rays and abdominal tomography were taken before the surgery decision. Six cases were asymptomatic, 6 cases had intestinal obstruction, 11 cases had pulmonary symptoms. There were right hernias in 13 cases, left hernias in 5 cases, and bilateral hernias in 5 cases. All cases were operated on with the laparoscopic PIRS method. The diameters of the hernia defect ranged from 5 to 16 cm. The sac was completely removed in all cases. Median discharge was 4 days. The median follow-up period was 13 months. There was no mortality, morbidity, or conversion to open surgery. Late recurrence was not observed.

Conclusions: Laparoscopic PIRS method is an easily applicable, effective, and safe alternative surgical method for Morgagni hernia repair in children.

Keywords: Children, Morgagni Hernia, Laparoscopy.

Resumen

Objetivo: Este estudio presenta la experiencia de nuestra clínica con uso de técnica de sutura percutánea en anillo interno (PIRS) durante la reparación laparoscópica de la hernia de Morgagni.

Materiales y métodos: Se evaluaron retrospectivamente los expedientes de 23 casos operados en nuestra clínica entre 2012-2021.

Resultados: Edades de 23 pacientes oscilaron entre 1 mes-60 meses. Nueve eran mujeres y 14 eran hombres. Todos los casos fueron pre-diagnosticados mediante radiografía de tórax, y al menos una de las radiografías de pasaje con contraste y tomografía abdominal se tomaron antes de la decisión quirúrgica. Seis casos estaban asintomáticos, 6 casos tenían obstrucción intestinal, 11 casos tenían síntomas pulmonares. Hubo hernias derechas en 13 casos, hernias izquierdas en 5 casos y hernias bilaterales en 5 casos. Todos los casos fueron operados con el método laparoscópico PIRS. Diámetros del defecto herniario oscilaron entre 5-16 cm. Saco se eliminó por completo en todos los casos. Mediana de alta fue de 4 días. Mediana del periodo de seguimiento fue de 13 meses. No hubo mortalidad, morbilidad ni conversión a cirugía abierta.

Conclusiones: Método laparoscópico PIRS es un método quirúrgico alternativo de fácil aplicación, efectivo y seguro para reparación de la hernia de Morgagni en niños.

Palabras clave: Niños, Hernia de Morgagni, Laparoscopia.

Introduction

Morgagni hernia (MH) is an anterior retrosternal diaphragmatic hernia originally identified by Morgagni in 1769. The estimated incidence is 1/2000-5000 births. However, the true incidence rate remains unknown¹. A Morgagni hernia is located posterolaterally to the sternum and is caused by a failure of the pars tendinalis part of the costochondral arches to fuse with the pars sternalis²⁻⁴. Failure of fusion on the right side is a Morgagni hernia, while a failure of fusion on the left is often called a Larrey hernia. Although left-sided and bilateral hernias occur, 90% of Morgagni hernias occur on the right side due to the pericardial attachments to the diaphragm that provide protection and support to the left side^{5,6}. The defects originally are small, with over 90% of defects having a hernia sac, however, can grow over time due to increases in intra-abdominal pressure, causing weakness of the diaphragm. While open surgery is still considered the traditional approach for treatment, laparoscopic methods have become increasingly popular in recent years. Although the laparoscopic PIRS method is traditionally defined as an inguinal hernia repair technique in children, it has started to be used in Morgagni hernia repair. In this study, the experience of repair with PIRS method, which is a laparoscopic method in the repair of Morgagni hernia, is presented.

Materials and methods

The case files of 23 cases operated in our clinic between 2012-2021 were evaluated retrospectively. Age, gender, symptoms, diagnostic methods, additional anomalies, surgical findings, and postoperative follow-up information of the patients were evaluated (Table I). All cases were operated by the same surgeon. The findings were analyzed using the descriptive statistical method.

All cases were prediagnosed by chest X-ray (Figure 1), and at least one of the contrast-enhanced passage X-rays and abdominal tomography (Figure 2) were taken before the surgery decision.

Surgical technique: Under general anesthesia, while the patient was in the supine position with proper covering, the abdomen was inflated by insufflation from the umbilicus with the Hasson technique through a 10 mm trocar (10 mm pressure, flow rate at 0.5 lt/min). Two working trocars of 5mm were inserted from

Figure 1: Preoperative computed tomography view.

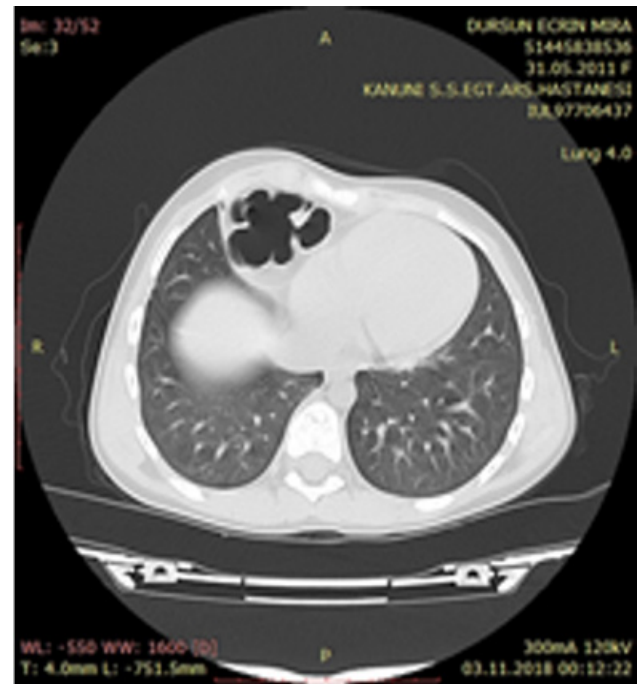


Figure 2: Preoperative view of the chest X-ray.



Table I: General findings.

Gender	9 cases female – 14 cases Male
Morgagni Hernia Side	13 case Right – 5 case Left - 5 case Bilateral
Symptoms	6 cases asymptomatic - 6 cases intestinal obstruction - 11 cases pulmonary symptoms
Additional Anomalies	3 cases down syndrome - 1 case Ehler Danlos – 1 case William Buren Syndrome

Figura 3: Intraoperative view -1.

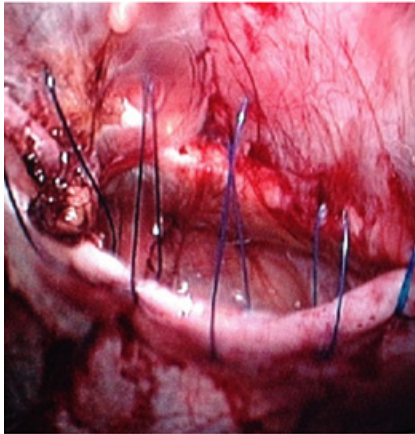


Figura 4: Intraoperative view-2.

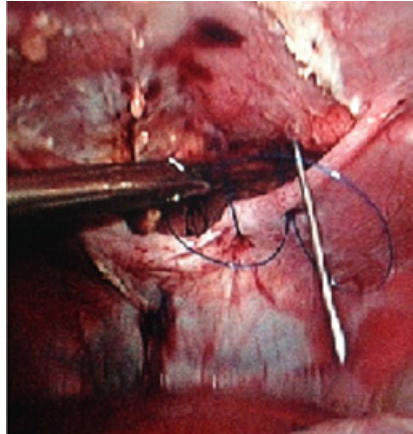


Figura 5: Intraoperative view-3.



the right and left lower quadrants. In bilateral cases, the falciform ligament was cut for proper vision. The hernia sac was identified and its contents were reduced into the abdomen, and the sac was partially or completely excised. Three or six incisions of 3 mm were made under the xiphoid depending on the size of the sac. A non-absorbable suture (2-0 prolene) was passed through the fascia and the edges of the hernia sac with an 18-gauge gray branule, leaving the ends out, and inserting it into a ring and the needle was removed. Then, another suture of the same kind was passed through the needle and this time it was entered through a different fascia point without forming a ring, and passed directly through the ring and the needle was removed. The ring was pulled out and the other suture was taken out and suspended. In this way, 4-5 sutures were placed along the edges of the hernia sac and were individually tied, leaving the knots subcutaneously. (**Figures 3, 4 and 5**).

Results

Of all 23 cases, 9 were female and 14 were male. Their ages ranged from 1 month to 60 months (with a median of 36 months). Chest X-rays were taken in all cases and the diagnosis study was started. At least one of the contrast-enhanced passage X-rays and abdominal tomography were taken preoperatively. Six cases were asymptomatic, 6 cases had vomiting, and 11 cases had pulmonary symptoms.

Thirteen patients had right hernia, 5 patients had left hernia, and 5 patients had bilateral hernia. Of the 23 cases, 16 had colon organs in the sac and 7 patients had organs including the small intestine, liver and stomach.

Three patients had Down, 1 case had Ehler Danlos syndrome, 1 case had William-Bauren syndrome. The diameters of the hernia defect ranged from 5 to 16 cm. All cases were operated with the laparoscopic PIRS method.

The hernia sac was partially or completely removed in all cases. Discharge time ranged between 3-6 days (median 4). Late follow-up was 10-16 (median 13) months. There was no mortality, morbidity or transition to open surgery. There was no recurrence in late follow-up.

Discussion

Morgagni hernia (MH) is caused by a deficiency in diaphragm fusion or muscle development. This leads to a triangular retrosternal hernia between pars sternalis and pars costalis during diaphragm development. Usually, the diagnosis is made radiologically and includes anterior-posterior and lateral chest radiography first⁷ Lateral radiographs show a retrosternal radiolucent paracardiac shadow with intestinal herniation⁸ Chest radiography alone, usually when the bowel is seen in the chest, can make a diagnosis about 71% of the time⁹ To confirm the diagnosis, chest computed tomography (CT) scan, oral contrast radiography can be used. Because CT scan has an accurate identification rate of up to 100%, it is often the next step in diagnosis¹⁰. We made a preliminary diagnosis with anterior-posterior and lateral chest X-ray in our entire case series. However, we preferred one of the contrast-enhanced passage radiography or CT methods before the operation.

If a herniated bowel loop is seen throughout the defect on chest radiograph, differential diagnosis may include a pericardial cyst, localized pneumothorax or hiatal hernia. Similar conditions in which chest radiography is seen as a solid structure; if the omentum or part of the liver has herniated into the defect, atelectasis, pneumonia, perikardiyal fat pad, intrathoracic lipoma, bronchial carcinoma, mesothelioma or an atypical mediastinal tumor are included in the differential diagnosis¹¹. Further imaging scans should be able to confirm a Morgagni defect.

Approximately 91% of MH cases are on the right, 5% on the left, and 4% on the bilateral sides. In our series,

there were 13 cases with a right-side hernia (56%), 5 cases with a left-side hernia (22%), and 5 cases with bilateral hernias (22%). Clinical symptoms may be asymptomatic and discovered incidentally or there may be vague gastrointestinal or recurrent chest infections with respiratory symptoms¹². In our series, four cases were asymptomatic, five cases had vomiting, and eight cases had pulmonary symptoms.

Morgagni hernias, especially when detected in infancy or early childhood, are known to be associated with other congenital anomalies with an incidence ranging from 34% to 50%⁷. The most common anomalies include heart defects (25% to 60%) and trisomy 21 (15% to 71%), as well as malrotation, anorectal malformations, omphalocele, skeletal anomalies, and pentalogy. Additionally, Cantrell was associated with Morgagni hernia. The association with trisomy 21 is thought to be due to defective dorsoventral migration of rhabdomyoblasts caused by increased cellular adhesion seen in trisomy 21 patients and it may also be why people with Down syndrome are more likely to relapse after repair. In our series, 3 cases were diagnosed with Down syndrome (17%), 1 case with Ehler danlos syndrome, 1 case with William-Bauren syndrome.

Unlike patients with Bochdalek hernia, Morgagni's hernia is asymptomatic in up to 50% of patients when diagnosed. Patients under two years of age are more likely to be symptomatic at the time of diagnosis¹³. In our case series, 6 cases were asymptomatic and under 2 years of age.

It is recommended that all Morgagni hernias be surgically repaired due to the risk of strangulation, however, the repair approach and the type of repair are still being discussed. It can be approached surgically through an abdominal approach or a thoracic incision. In the thoracic approach, posterolateral right thoracotomy is performed. However, we did not apply a thoracic approach in our cases. Because the disadvantages of this approach include the risk of bilateral defect leakage due to the inability to see the left side and the risk of chest wall deformity¹⁴.

The abdominal approach can be performed with an open laparotomy incision or with minimally invasive laparoscopic techniques¹⁵. The advantages of the abdominal approach include the ability to evaluate and repair other intra-abdominal pathologies, such as malrotation. Open laparotomy can most often be performed in emergency cases, in patients who cannot tolerate laparoscopy, in those with severe scoliosis or extensive adhesions, if large bowel resection is require.

The hernia primarily contains the large intestine (between 54% and 72%) or the omentum (65%), but it can also contain the small intestine, stomach, and liver¹⁶. In our series, there were organs including the colon, small intestine, liver, and stomach in 23 cases in the sac.

There is controversy over whether the hernial sac should be excised or included in sutures; there are those who recommend placing supplementary material for all hernias larger than 20 to 30 cm¹⁵. The defect is repaired in the style of a mattress with nonabsorbable sutures, including costal margins¹⁷⁻¹⁹. The open laparotomy approach has been shown to have shorter operative times compared to laparoscopy, but the minimally invasive approach provides more space for dissection and better visualization while providing a shorter recovery time and faster return to normal activities^{17,20,21}. In our series, all the defects were under 20 cm (ranging from 5-16 cm), so we did not use any reinforcement material.

In 1997, Georgacopulo was the first person to report the successful laparoscopic repair of Morgagni hernia in children¹⁷. The laparoscopic approach involves positioning the patient in reverse Trendelenburg on the operating table with their feet up. The camera port is inserted through the umbilicus and two working ports are positioned on the right and left upper quadrants along the midclavicular line. Depending on the size of the defect, the falciform ligament may need to be cut for sufficient expulsion¹⁸. The contents of the hernia are drained; if the pouch is to be excised, it is done at this time. The defect can be closed by bringing stitches from the abdominal wall, which can be non-absorbable stitches since the defect is generally wider transversely than anteroposteriorly. For larger defects (bigger than 20 cm), placement of the mesh is performed by first suturing the mesh to the posterior edge of the hernia defect. The mesh is then combined with non-absorbable sutures running full thickness along the anterior abdominal wall and connected to the subcutaneous tissue. The closure is achieved similarly by placing cross-abdominal, staying sutures that encompass the hernia sac, include the rear edge of the diaphragm defect, and take in the incoming "U" shaped stitches, without the need for mesh placement in the case of smaller defects. Nodes are hidden in subcutaneous tissue. This type of repair is useful in patients without anterior diaphragmatic edges and is easier to perform than intracorporeal sutures. Recovery is often smooth and most patients are discharged within three days after surgery. In our surgeries, we followed the general laparoscopic rules but placed the transfacial U sutures using the PIRS method. We preferred 2/0 prolene as a suture. We performed a sac excision in all cases.

It is recommended that even asymptomatic patients be referred for surgical correction due to the concern for intestinal obstruction, choking, volvulus, and/or necrosis, which can occur in up to 10% of cases. Complications observed after surgical correction are common complications that can occur after any surgical procedure and include low-grade wound infections, incisional or port-site hernias, suture abscesses, and the incidence of intestinal obstruction. Recurrence rates

have been reported to range from 2% to 42%, but in many studies, no recurrence has been reported up to 10 years after the repair, with follow-up periods. The risk factors for recurrence are the closure of the defect under tension without the use of a mesh, leaving the sac in place without resection, use of absorbable sutures for repair, and history of Down syndrome in the patient.

In conclusion, the laparoscopic PIRS method, which involves the removal of the hernia sac through laparoscopy and the secure attachment of the lower rim of the sac to the abdominal fascia with extra-abdominal,

subcutaneous, non-absorbable ring sutures, is a simple, safe, and cosmetically pleasing approach for the surgical treatment of Morgagni hernias. From this perspective, it may be a widely used surgical technique that can be the first option in treatment.

Conflict of interest

No

Funding

No

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