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SURGICAL TECHNIQUE

Two Trocar Laparoscopic Repair of Morgagni Hernia in Infant and Childhood: Simplified Technique

Medhat M Ibrahim

ABSTRACT

Purpose: Morgagni hernia (MH) is a rare entity that accounts for less than 6% of all surgically treated diaphragmatic hernias in pediatric age group. They are mostly asymptomatic and discovered incidentally. Open surgical repair has been the gold standard in all cases. However, since the introduction of minimal access surgery, different laparoscopic techniques of MH repair have been reported. Most of them are reporting on few cases and the immediate outcomes. I report one of the largest experiences to date assessing the safety and efficacy two trocars laparoscopic repair of MH in children with more emphasis on the short-term outcomes, such as the recurrence, conversion rate, operative, postoperative complications and the fate of the hernia sac.

Patients and methods: Fifteen children with MHs underwent primary laparoscopic repair by placement of U-shaped, nonabsorbable sutures through the full thickness of the anterior abdominal wall incorporating, the posterior rim of the defect, and returning back out through the anterior abdominal wall with the sutures tied in the subcutaneous tissue using the Storz port closure needle and without hernia sac excision, no insertion of chest tube or drain.

Results: A total of 15 patients with MH were operated upon. There were 10 males and 5 females. Left-sided MH was present in five cases (33%), right-sided MH was present in seven cases (47%) and three bilateral MH (20%). Male-female ratio was 2:1. Intraoperative and postoperative analgesia requirement was minimal. All operations were completed laparoscopically. None of the patients developed intraoperative or postoperative complications. The maximum follow-up was 48 months (mean, 20 months). All patients are in good health without recurrence or significant sac residual.

Conclusion: This easy save technique of MH repair is reducing the operative time and postoperative hospital stay. Also it is minims the need of postoperative analgesia. The hernia sac excision or not is not affecting the outcome.

Keywords: Laparoscopic, Morgagni hernia.

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INTRODUCTION

Morgagni-Larrey type hernia occurs through a weakness in the anterior fibers of the diaphragm between its costal and sternal part, in the muscle free triangular space called the Larrey space. It is also called retrosternal, parasternal, substernal and subcostosternal hernia.[1] Although the Morgagni duct is existent congenital diaphragmatic hernias are relatively rare; occurring in 0.02 to 0.05% of live births.[2] Morgagni hernia (MH) is the least common type of congenital diaphragmatic hernia and is often diagnosed incidentally in asymptomatic adults.[3] Since or even before birth, a large number of hernias appear later in infant or childhood age. The condition is often asymptomatic but it is often diagnosed incidentally during the investigation of other conditions.[4] Diagnosis needs a high index of suspicion as misdiagnosis and noncorrection may end in a catastrophe.[5]

Standard surgical procedures for the repair of MH traditionally require a laparotomy or thoracotomy, but with the recent improvement in minimal invasive surgery instrument and vision, repair can safely be performed laparoscopically. The method of laparoscopic closure of the defect and the excision of the sac are debatable.[6] Many technique has been described as primarily closure with a continuous suture by Fernandez et al,[7] interrupted sutures with intracorporeal knot tying, and Ramachandran et al[8] laparoscopic-assisted repair of MH by taking full thickness of anterior abdominal wall in a U-shaped suture under direct vision with extracorporeal knot tying in the subcutaneous tissue is also scribed.[9,10]

I used laparoscopic two ports and Sorze port closure needle to insert U-shape sutures to close the defect in MH of infant and children without excision of the sac or insertion of chest drain. This is simplified technical and can help surgeons to overcome difficulties of the laparoscopic surgery, reduce the number of port and improve the operative outcome. This article describes the operative technique and its short-term outcome.

PATIENT AND METHODS

This study was conducted in Royal Commission Medical Center (RCMC) Yanbu, KSA between March 2008 and April 2012. All patients with Morgagni diaphragmatic hernia MH were subjected to thorough clinical examination and routine laboratory and radiological investigations. The main outcome measurements were feasibility of the technique, conversion rate, operative time, blood loss, postoperative analgesic requirement and hospital stay, fat of the nonexcised hernia sac and recurrence rate. The technique was approved by the ethical committee of the hospital. Written detailed informed consent was obtained from all

the parents. All the patients received one dose of antibiotic prophylaxis in the form of ceftriaxone 50 mg/kg at the time of induction of anesthesia. All patients went preoperative assessment aiming to exclude patients with significant pulmonary hyperplasia and identify other congenital anomalies. Preoxygenation with O_2 100% without positive pressure was done. The routine monitoring as pulse oximetry, capnometry, ECG, precordial stethoscope and noninvasive blood pressure, were applied before the induction of the anesthesia and during the operation. The induction of anesthesia was done mainly by inhalation agent (sevoflurane), intravenous fentanyl (1-2 µg/kg) and atracurium (0.5 mg/kg) then the trachea was intubated. General anesthesia (GA) was maintained with 1.5 MAC sevoflurane in air/O_2 (FiO_2 = 0.5). The lungs were mechanically ventilated using pressure-controlled ventilation aiming $EtCO_2$ between 25 to 30 mm Hg. An additional dose of 0.5 µg/kg of fentanyl was given intraoperatively, if the heart rate increased >20% of the basal record. Just before closure of the skin, anesthesia was discontinued and then tracheal extubation was done once the patient fulfilled the criteria of extubation. Maintenance of fluids was with D_5½ normal saline (4 ml/kg/hour). After induction of GA, the patient was placed in anti-Trendelenburg, position (head up 15-20º). The surgeon position was at the left side of the patient. A 5 mm vise port with 5 mm telescope was inserted supra or infra umbilicus according to the baby abdominal size by close technique under vision. Pneumoperitoneum was adjusted to a pressure of 10 to 12 mm Hg, according to the child condition and the anesthesia monitor of the cardiorespiratory state. Through this port 5 mm, scope 30° was used for initial visualization of the abdominal cavity and the diaphragmatic defect. Second 5 mm accessory port was inserted under direct vision in the left subcostal space below the nipple (Fig. 1).

The patient position and the pneumoperitoneal pressure often aids in the reduction of the hernial content to the abdomen and also increase the abdominal cavity space. Once the intestine was reduced into the abdomen, the falciform ligament of the liver was dissected by the harmonic dissector to free the liver from the diaphragm and also remove all the tissue passing from the abdomen to the chest though the defect. The diaphragmatic defect was examined all around (Fig. 2).

The defect was closed by U shape nonabsorbable 2/0 proline sutures. Knot tying was extracorporeal and subcutaneous. The sutures would be placed between the posterior rim of the diaphragmatic defect and the intercostal muscles with the aid of Storz port closure needle (Fig. 3).

Three to four stitches are usually required to complete the repair (Fig. 4). A snip incision of the skin was done over the intercostal space above the diaphragmatic defect for insertion of the facial needle. A 2/0 proline was mounted into the hollow of the needle. The needle was introduced into the chest cavity and manipulated to pass through the

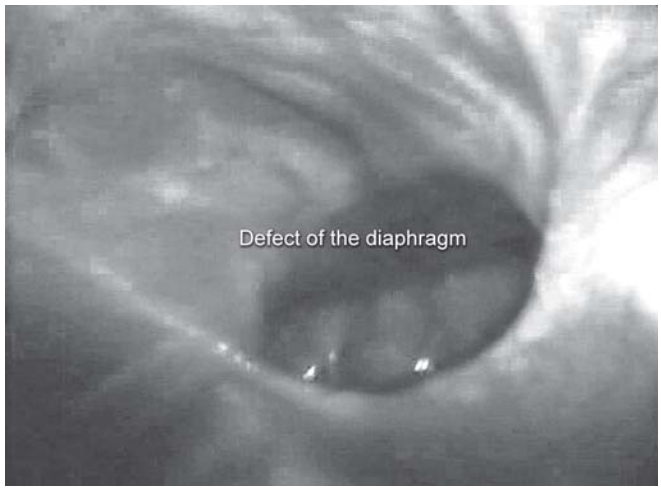

Fig. 2: The diaphragmatic defect

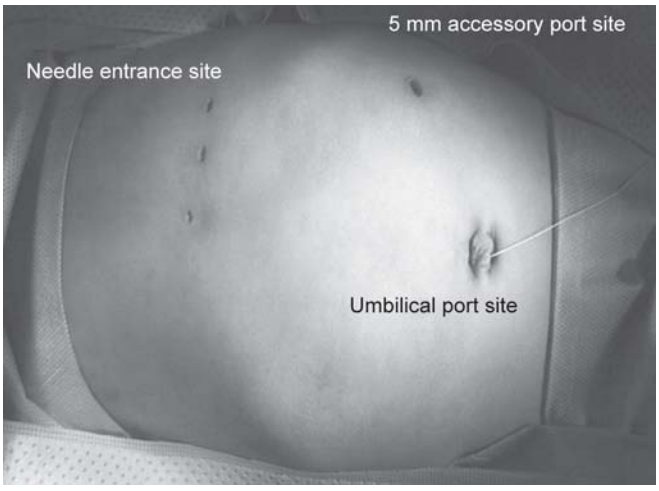

Fig. 1: This is port site

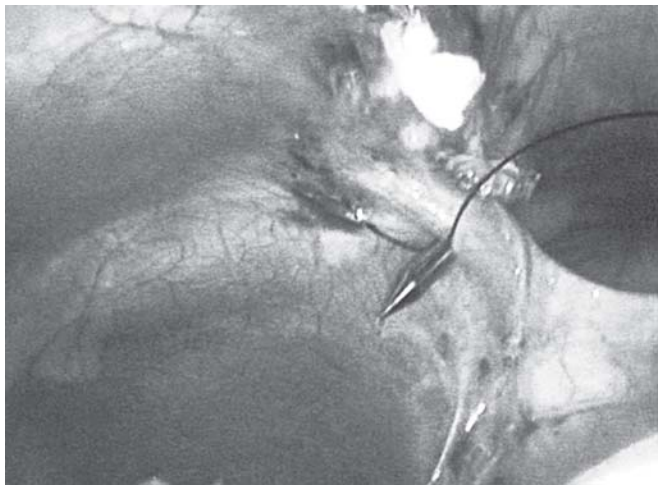

Fig. 3: This is Storz port closure needle U-shape suture

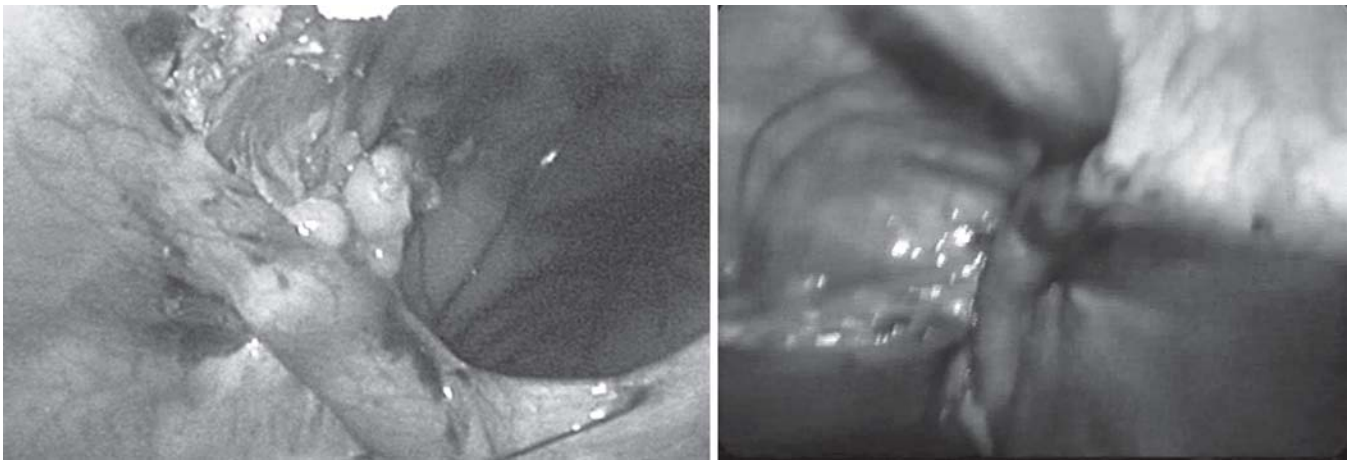

Fig. 4: This is the U sutures between the intercostals and diaphragmatic rim before and after ligation

free posterior rim of diaphragmatic defect. Then the hollow of the needle was opened and the thread was pulled out by the dissector. The needle was withdrawn to come out from the chest. Though the same previous skin incision the nonmounted facial needle was passed transverse 1.5 cm subcutaneously to re-enter the chest and pass through the diaphragmatic defect again. The hollow of the needle was opened and the thread was fixed to the needle by the grasper aid. The needle was withdrawn to come out from the chest but this time with the thread forming U-shape suture puling the diaphragmatic muscle up toward the chest wall closing the defect. The two ends of the thread were tightened extracorporeal forming a mattress suture, closing the anterior diaphragmatic defect. The procedure was repeated again to close the whole defect at the anterior aspect. All of the defects were repaired primarily without tension or need for any mesh. No drain or chest tube was inserted. Full inspection of the diaphragm and the closed defect was done. Laparoscopic abdominal exploration was done in all cases. Postoperatively, all patients started regular feeding after full recovery from anesthesia and audible normal intestinal sound. All patients were discharged with normal plan chest X-ray. Outpatient clinic visit after 7 days, 2 weeks, 6 months and 1 year later was planned for patient follow-up.

RESULTS

A total of 15 patients with MH were operated upon. There were 10 males and five females. Left-sided MH was present in five cases (33%), right-sided MH was present in seven cases (47%) and three bilateral MH (20%) (Table 1).

The statistic evaluation of the operative time and hospital stay were in Table 2.

There was a hernial sac in all patients. The hernia included in its content; transverse colon alone in 11 patients, transverse colon and small intestine in two patients, left lobe of the liver and intestine in two patients. Reduction of

Table 1: Patient's demography

No.	*Age (months)*	*Presenting symptom*	*Defect*	*Associated anomalies*	*Sex*
1	5	Nonspecific symptom cardiac	Left side	Male rotation	Female
2	6	Chest wheeze	Right side	—	Male
3	6	Nonspecific disorder neurologic	Bilateral	—	Male
4	7	Recurrent chest infection	Left side	Male rotation	Male
5	9	Recurrent chest infection	Right side	—	Male
6	11	Recurrent vomiting idiopathic	Right side	—	Male
7	13	Recurrent vomiting idiopathic	Left side	Male rotation, appendix in the falciform ligament of the liver	Male
8	10	Palpitation with dyspnea	Right side	—	Female
9	19	Nonspecific disorder neurologic	Bilateral	—	Male
10	8	Palpitation and dyspnea	Bilateral	—	Male
11	20	Vomiting	Left side	—	Male
12	14	Constipation with abdominal distension	Right side	—	Female
13	12	Recurrent chest infection with gastroesophageal reflux	Left side	—	Male
14	24	Bronchial asthma with vomiting	Right side	—	Female
15	22	Bronchial asthma	Right side	Male rotation	Female

Table 2: The statistic result

Age (months)	19 ± 12.40
Operative time (minutes)	55 ± 34.33
Hospital stay (days)	5 ± 3.47

hernial contents was easy in 13 cases and difficult in two cases. The diaphragmatic defect was closed directly by suturing the posterior diaphragmatic edge of the defect with the intercostal muscles using Storz port closure needle in all patients. The hernial sac was excised in three cases. The procedure was completed easily and successfully in 14 (93.3%) patients. Elective conversion was required only in one (6.7%) patient, because the liver was preventing save needle manipulations to do suture in small abdominal cavity. A prosthetic patch was not required in any patient, as the defects were closed without tension. There was no blood loss. A chest drain was not inserted in all patients and there was not any complication from the nonexcised sac. All patients achieved full recovery without intra- or postoperative complications. After the operation, a conventional ventilator was required for two children. The mean postoperative ventilatory support was 1 day.

All patients started with paracetamol suppository 15 mg/kg/dose, 10 patients needed second dose after 6 hours. Two patients needed fentanyl (0.5 μg/kg) plus midazolam (0.05-0.1 mg/kg).

There was no morbidity, mortality or recurrence all over the follow-up period. Chest X-ray and clinical examination were normal in all patients at the 6th month postoperatively. Practically, no visible scars were reported at the 1 year follow-up.

DISCUSSION

The diagnosis of the MH may be difficult and patients often undergo extensive investigations. However, it may be discovered accidentally during routine investigations for other problems. The diagnosis is usually apparent on chest radiograph and can be confirmed with computed tomography (CT) or magnetic resonance imaging (MRI). Barium enema or meal is rarely required as the sensitivity of CT and MRI approaches 100%.[11] In this study CT was 100% sensitive, while the chest radiography was suspecting a lesion in 11 (73.3%) cases and did not show any significant radiological signs in other four patients (26.6%). One barium enema was done to exclude colonic intestinal obstruction in the hernia.

Because MH is rare, comparing conventional open repairs with laparoscopic repairs have not been performed. Patient demographics, hernia characteristics and perioperative outcomes for the 15 cases of laparoscopic repair of MH are summarized in Tables 1 and 2. Only four patients were discharged after the second postoperative day, and there were no perioperative morbidities or operative mortalities. There have been no recurrences reported in laparoscopic MH repairs, but long-term follow-up has not been provided.

Transabdominal exploration and reduction of the hernial contents followed by suture closure of the hernial defect is commonly performed. However, laparoscopic repair, first carried out by Kustar et al[12] in 1992, since that, much modification has been described to improve, ease the operative technique and the outcome. Improved video technology, laparoscopic instruments, and surgical skills have allowed surgeons to expand the repetition of minimally invasive procedures.

In traditional laparoscopic approaches to a MH, a 3-trocar technique is generally used with the umbilical site used for visualization (usually a 3 or 5 mm telescope) and 2 upper abdominal working ports. Depending upon the patient size, the working instruments may range in size from 2 to 5 mm. Triangulation of the access sites allows intracorporeal sewing and tying with relative ease, in a sense, mimicking the natural ergonomics of open surgery.[11,13]

In this study, the facial needle was useful as it reduced the need for more than one port to perform the dissection of the falciform ligament of the liver, help in the hernial content reduction and aid the facial needle thread holding intracorporal.

In a MH the retrosternal rim of the diaphragm is frequently absent, and a simple suture technique is usually not possible. Suturing of the diaphragmatic hernial margin to the peritoneum or periosteum behind the sternum is difficult and not very solid, particularly with the laparoscopic approach.[13] The defect itself may be closed either by primary suture closure, primary placement of a mesh, or by a combination of both.[9,14] In this work, I performed laparoscopic repair of MH using the full thickness of the anterior-abdominal wall to the posterior diaphragmatic rim, with extracorporeal knot tying in the subcutaneous tissue without the need of a mesh in all cases.

Insertion of the needle from outside the thoracic cavity into the intercostal muscles was not difficult but the negotiation of the needle with the posterior diaphragmatic rim was the challenge and need for some aide by the grasper. The U sutures between the intercostal muscles and the free posterior diaphragmatic edge in the part of the defect were effective. Extracorporeal ligation of the suture was ease. It abolishes the difficulty of intracorporeal suturing and knot tying. It does not need a long learning curve and is an effective rapid technique for closure of MH in children. The repair described in this paper takes advantage of the fact that it incorporates the whole thickness of the intercostal

muscles with the anterior rim of the diaphragmatic defect and provides a tension free strong repair with minimal port site and good cosmetic outcome.

The excision of the hernial sac is controversial. Some advice hernial sac excision while other does not.[15] The cavity obliteration was the same with nonexcised cases.[10] In these study only three cases, hernial sac was excised as it comes to the abdominal cavity during the reduction of the content. There was no bleeding with hernial sac excision by harmonic tissue dissector. It was increasing the operative time. Farther more, I did not insert chest tube or chest drain in all cases. The chest X-ray was normal all over the follow-up period. Traditionally, other studies which use standard surgical procedures for the repair of MH, require a laparotomy which need more anesthetic, analgesic intervention and delayed recovery. The patient not only get benefit from the minimally invasive approach, early recovery from major surgery and minimal scaring, but also, abdominal exploration and detection of associated intra-abdominal anomalies.

CONCLUSION

This easy and save technique of MH repair is reducing the operative time, anesthetic, analgesic requirement and postoperative hospital stay. There is not effect of excision of hernial sac on the outcome of surgery.

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ABOUT THE AUTHOR

Medhat M Ibrahim

Assistant Professor, Department of Pediatric Surgery, Faculty of Medicine, Al-Azhar University, Nasr city, Cairo, Egypt, e-mail: medhat.ibrahim.elsayed@gmail.com