

# Laparoscopic repair of a Morgagni diaphragmatic hernia in a child, using a trans-sternal technique

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## ABSTRACT

Laparoscopic repair of Morgagni hernia has been described in adults and children. In the published reports, the crux of the repair consists of suturing the posterior part of the diaphragmatic defect to the undersurface of the sternum or the posterior rectus sheath. The tissue on the undersurface of the sternum is variable in its nature and may be inadequate for suturing, hence compromising the strength of the repair. A technique that circumvents this problem and offers a strong anatomical repair is described. A Morgagni hernia was diagnosed in a 2-year-old girl with trisomy 21, who presented with recurrent chest infections. She underwent laparoscopic repair of the hernia using three ports. The tissue on the undersurface of the sternum was inadequate for a conventional repair. The procedure was modified as follows: a small transverse incision was made over the lower end of the sternum. Three nonabsorbable mattress sutures were inserted through the sternum, the anterior edge of the diaphragmatic defect, and back through the sternum and tied with extracorporeal knots. The child was discharged home on the second postoperative day. At 6-month follow up, the child was asymptomatic, and had been infection free. A chest radiograph was normal. This is a simple, novel, noninvasive method, which offers a secure anatomical repair and it is not dependent on the adequacy of the tissue on the undersurface of the sternum.

**KEY WORDS:** Child, laparoscopy, Morgagni diaphragmatic hernia

Morgagni hernia arise as a result of a congenital defect in the anterior part of the diaphragm. They are rare and account for 1-6% of all diaphragmatic herniae.<sup>[1,2]</sup> Laparoscopic repair of Morgagni hernia was first described in 1994.<sup>[3]</sup> Anatomical repair of such a defect comprises suturing the posterior edge of the diaphragmatic defect to the retrosternal and retrocostal tissues. The amount of retrosternal/retrocostal muscle can be minimal in some instances, hence compromising the strength of the repair. A modification of the published laparoscopic techniques is described, which offers a strong anatomical repair irrespective of the adequacy of the retrosternal/retrocostal tissues.

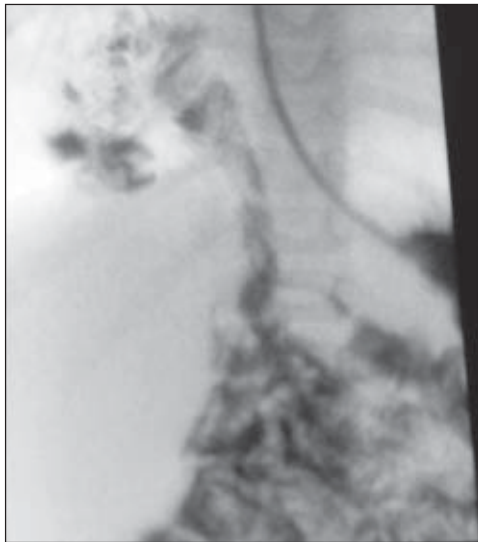
## CASE REPORT

A 2-year-old girl with trisomy 21 was diagnosed with a diaphragmatic hernia following a chest radiograph [Figure 1] performed for recurrent chest infections. An upper gastrointestinal contrast study [Figure 2] revealed a Morgagni hernia.

The child underwent laparoscopic repair of the hernia. She was placed in a supine position and pneumoperito-



**Figure 1:** Plain radiograph showing a Morgagni diaphragmatic hernia



**Figure 2:** Upper gastrointestinal contrast study showing loops of bowel in the chest

neum (flow 1.0 l/min, pressure 10 mm Hg) was created through a 5-mm subumbilical port placed using Hasson's technique. The surgeon stood at the foot end and the assistant to the right of the surgeon. Two further 5-mm ports were placed in each flank below the level of the umbilicus. The child was placed in reverse Trendelenburg. An elliptical 8 × 5-cm substernal diaphragmatic defect was seen, wider in its transverse diameter. The hernial contents, comprising a few loops of small bowel, the hepatic flexure and omentum, were reduced without difficulty. The peritoneum was excised all around the edges of the defect and the sac partially excised. There was no anterior rim of muscle and the retrosternal endothoracic fascia was deemed inadequate for suturing.

A small transverse skin incision was made over the lower end of the sternum. A 2-0 Ethibond suture was introduced percutaneously through the sternum into the abdominal cavity under direct vision. A mattress suture of the posterior rim of the diaphragmatic defect was then taken and the needle was passed through the sternum and out of the skin incision. Two further sutures were taken in a similar fashion. The sutures were tied extracorporeally at the end of the procedure and the knots were buried subcutaneously. Good apposition was obtained between the diaphragm and the sternum.

The child made an uneventful postoperative recovery. She was discharged home on the second postoperative day. At 6-month follow up, she was asymptomatic and had been free of infection. A chest radiograph showed no recurrence of the hernia.

## DISCUSSION

Since Morgagni's first description of an anteromedial diaphragmatic hernia in 1761, herniae have traditionally been repaired using an open technique through an abdominal or thoracic approach. The advent of endoscopic surgery has enabled the closure of these defects laparoscopically, first described in 1994. It is argued that irrespective of the approach, the principles of repair should remain unaltered. Those principles are: (i) anatomical closure of the defect, (ii) secure repair, (iii) minimization of tissue trauma, and (iv) avoidance of prosthetic materials when possible.

The defect at the foramen of Morgagni arises as a result of failure of fusion of the septum transversum to the sternum. Anatomical closure of the defect should therefore approximate the posterior rim of the diaphragmatic defect to the lower end of the sternum. The anatomy of the defect is variable in that the anterior rim of the diaphragm may be present or absent. The method of closure should take into account the anatomy. The methods described in the literature include direct suture repair using interrupted or continuous sutures, which is suitable for small defects. In those instances where the anterior rim of the diaphragm is absent, a technique has been described where the diaphragm is sutured to the retrosternal/retrocostal endothoracic fascia. In children, this fascia is thin and may compromise the strength of the repair. A technique has been described where the diaphragm is sutured to the upper posterior rectus sheath and the whole thickness of the abdominal wall is included in the repair.<sup>[1]</sup> Although such a technique provides a secure repair, the closure of the defect is not anatomical. The repair described in this paper takes advantage of the fact that the sternum offers little resistance to the passage of a needle in a child. The repair incorporates the whole thickness of the anterior chest wall and hence provides a secure closure of the hernial defect. The posterior rim of the diaphragm is approximated to the sternum, hence providing an anatomical repair.

The insertion of prosthetic materials such as polytetrafluoroethylene and polypropylene has been described using sutures or staples.<sup>[4-6]</sup> Such devices have not been used in children. The technique described here provides a secure tension-free repair using native tissue and avoids the use of a prosthesis, which predisposes to adhesions and infection.

The hernial sac was only partially excised. There is controversy in the literature concerning the management of the hernial sac. Some authors recommend excision of the



sac,<sup>[1,7]</sup> whereas others leave the sac *in situ*<sup>[8,9]</sup> without compromising the outcome. In the case described here, only the redundant sac was excised and the remainder of the sac was left *in situ* to avoid pleural or pericardial injury. This case confirms that the presence of the sac in the chest does not affect the outcome of the repair of a Morgagni hernia.

The laparoscopic approach has the advantage that tissue trauma is kept to a minimum compared with the traditional open approach. There have been only four reports of the laparoscopic repair of a Morgagni hernia in children.<sup>[10-13]</sup> The techniques have included a direct suture technique where the diaphragm is sutured to the retrosternal tissues using a Keith needle<sup>[14]</sup> or inclusion of the whole of the upper abdominal wall in the repair with extracorporeal knots. The technique described here is the first of its kind to be reported. It offers a secure anatomical repair in the absence of an anterior rim of the diaphragm, makes use of minimally invasive techniques, avoids the use of prosthesis and takes advantage of unique properties of pediatric tissues such as a soft sternum in a young child.

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