CASE REPORT

Two-stage endoscopic repair of congenital diaphragmatic hernia

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SUMMARY

Minimally invasive surgery (MIS) in congenital diaphragmatic hernia (CDH) repair has recently been gaining popularity and is the first choice in most departments. Loss of space in an undeveloped abdomen may cause serious problems such as difficult visceral reduction and need for conversion or postoperative complications such as abdominal compartment syndrome. A 4-month-old boy with delayed diagnosis of CDH underwent MIS repair via thoracoscopy, but the abdominal space was not large enough to accept the herniated viscera so a wide transverse fasciotomy was performed via laparoscopy and an iatrogenic ventral hernia induced. The abdomen was distended by pneumoperitoneum, which was retained for 2 days. Finally thoracoscopic CDH repair was completed successfully and the diaphragmatic defect reconstructed by prosthetic patch. Laparoscopic transverse abdominal fasciotomy is suggested as the first step in MIS repair of CDH in an undeveloped abdomen.

BACKGROUND

Minimally invasive surgery (MIS) in congenital diaphragmatic hernia (CDH) repair was first introduced by Van der zee and Bax, in 1995.¹ Since then, the MIS approach to CDH has gained more popularity and is the first choice in most paediatric surgery departments. Although endoscopic repair of CDH is believed to have several advantages such as less pain and incisional complications and sequels,² it may be challenging considering the small working space and difficult suturing, repair of large defects by prosthetics and visceral reduction complications including respiratory status deterioration or abdominal compartment, especially among those cases with an undeveloped abdominal domain. Some authors suggest an open approach via laparotomy and tension-free closure of the abdomen even by a silastic patch when encountering a scaphoid abdomen.³ We present a two-stage MIS repair of CDH in an undeveloped abdomen.

CASE PRESENTATION

A 4-month-old boy presented with dyspnoea, cyanosis, productive cough and vomiting. Physical examination revealed a scaphoid abdomen and decreased respiratory sounds in the left lung (figure 1).

INVESTIGATIONS

Chest X-ray showed a cystic mass in the left hemithorax and diagnosis of diaphragmatic hernia was confirmed with a lower contrast enema. Ultrasound

studies also showed a gastric bubble, spleen and left liver lobe in the left hemithorax.

TREATMENT

Thoracoscopic repair of the CDH was planned. A huge left diaphragmatic defect was encountered and full reduction of the bowels into the abdomen was impossible due to loss of peritoneal space. The operation was converted into a laparoscopy and a wide transverse fasciotomy was performed in the upper abdominal wall. Peritoneum, transversus and rectus fascia were excised and iatrogenic ventral hernia was induced (figure 2). The abdomen was inflated and became distended by pneumoperitoneum induction, which was retained for 2 days during which the patient was sedated, relaxed and under ventilation support in the pediatric intensive care unit (PICU). During this 2-day course, we noted 30% increase in the height of the abdominal cavity at the epigastric level. Finally, thoracoscopic CDH repair was completed successfully in a delayed second-stage operation (figure 1) and the diaphragmatic defect reconstructed by prosthetic patch. Intra-abdominal, central venous and end inspiratory pressure were monitored to prevent abdominal compartment. A nasogastric tube and Foley catheter were kept in place after the operation and respiratory support was continued in the postoperative period and the patient weaned from the ventilator on the third day after surgery.

Figure 1 Preoperative (up) and postoperative (down) clinical view of a 4-month-old boy with congenital diaphragmatic hernia and undeveloped abdomen.

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Figure 2 Laparoscopic abdominal transverse fasciotomy and pneumoperitoneum induction.

OUTCOME AND FOLLOW-UP

Abdominal pressure and urine output were monitored during the postoperative period in the PICU, where the patient was kept on support with mechanical ventilation for 2 days. The in-hospital postoperative period was uneventful. The patient was discharged after 7 days with no complication during the in-hospital course and also during 6 months of follow-up.

The patient underwent abdominal wall hernia repair at the age of 1 year and long-term follow-up was also uneventful. Control chest X-ray did not reveal any sign of recurrence at the age of 2 years (figure 3).

DISCUSSION

Minimally invasive repair of CDH is considered feasible and safe even in neonates.⁴ During the early instances of thoracoscopic repair of CDH, most authors suggested selection criteria for a MIS approach but, over the few past years, with improved technique and skills, few cases have needed to be excluded from MIS repair of CDH.⁵ Safe reduction of intra-abdominal organs, tensionless repair of the diaphragmatic defect and suturing are the main challenges in MIS repair of CDH and several innovations have been suggested to facilitate the procedure.^{6,7} Loss of abdominal domain and difficulty in reducing the hernia contents into the abdomen still remain the main cause of exclusion or conversion of the MIS approach.⁸ Reduction of intrathoracic contents into the undeveloped abdominal cavity may cause abdominal compartment syndrome, which may aggravate respiratory and haemodynamic conditions and a silastic patch may even be needed to provide additional abdominal space and

make a tension-free repair.³ This could be a dilemma while performing a MIS repair of a CDH and may lead to conversion into an open approach. We reported a novel method of two-stage minimally invasive CDH repair including abdominal transverse fasciotomy and pneumoperitoneum induction prior to final thoracoscopic CDH repair.

Learning points

- ▶ Thoracoscopic repair is accepted as the method of choice in congenital diaphragmatic hernia (CDH) repair.
- ▶ Undeveloped abdomen may be challenging for a successful minimally invasive surgery CDH repair.
- ▶ We suggest a laparoscopic transverse fasciotomy and pneumoperitoneum to provide additional intraperitoneal space in patients with an undeveloped abdomen.
- ▶ We advise two-staged endoscopic CDH repair as a novel approach to patients with CDH and loss of abdominal space.

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Contributors MH was the chief surgeon who performed the operations. RS wrote the manuscript and MG was the anaesthetist and intensivist for preoperative and postoperative management.

Competing interests None declared.

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Figure 3 Chest X-ray after 2 years follow-up does not show any signs of recurrence.

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