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Three-dimensional reconstruction model in the diagnosis of Morgagni's hernia

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Accepted 27 January 2021

SUMMARY

Morgagni's hernia (MH) can be diagnosed by different utilities, but all these methods are not always 100% accurate. Three-dimensional (3D) reconstruction model could be helpful in better understanding the important anatomical structures. We report a case of MH who was once misdiagnosed as diaphragmatic eventration at the other institution and we offered laparoscopic repair according to the 3D reconstruction model. Our case highlights that 3D reconstruction model could be a useful supplementary tool in the diagnosis and preoperative assessment for patients with MH especially when it is confused in diagnosis in clinical practice.

BACKGROUND

Morgagni's hernia (MH) is a relatively rare congenital diaphragmatic hernia making up about 3% of all surgical hernias.¹ MH in adults may present with non-specific symptoms such as chronic pain and pulmonary complaints. Although some diagnostic means could be useful in diagnosis and treatment, their use is still limited in preoperative evaluation and surgical planning. Three-dimensional (3D) reconstruction technology has made its way into clinical practice for better visualising anatomical structural details.

CASE PRESENTATION

A 74-year-old woman who presented with a 4-year history of mild dysphagia and intermittent epigastric pain, aggravating in the supine position while subsiding in the sitting, was admitted to our institution. The patient's body mass index was 19.8 kg/m². She was diagnosed as diaphragmatic eventration and underwent diaphragmatic plication through right thoracotomy incision in the other institution 2 years ago. However, the epigastric pain did not alleviate obviously and she had to continue to take painkillers and omeprazole until she was transferred to our hospital.

Enhanced CT scan of the chest and upper abdomen showed the presence of a right anteromedial diaphragmatic hernia, with a defect in diaphragm that measured 6.4 cm in diameter. The right lung was partly collapsed and the colon, mesenteric fat and omentum were visible within the right hemithorax (**figure 1**). The most likely diagnosis for this patient was MH. To avoid the misdiagnosis of the disease, we further decided to realise the 3D reconstruction model of the hernia using the CT images during the preoperative evaluation. The 3D model showed the protrusion of the large bowel and mesenteric vessels through the defect of diaphragm into the chest (**figure 1**). Meanwhile, the diaphragm was not elevated from the lateral perspective (**figure 2**). According to the model MH was confirmed and the patient was advised to have an operation.

TREATMENT

Laparoscopic repair of diaphragmatic hernia was performed. The contents of hernia sac were colon and omentum and MH was further definitely confirmed during the operation. After the reduction of abdominal bowel contents, a composite mesh was offered to repair the defect. The surgical procedure was uneventful and was not affected by the previous operation fortunately.

OUTCOME AND FOLLOW-UP

The patient had an uncomplicated postoperative course and symptomatic resolution and was discharged on postoperative day 4. Follow-up thoracic CT confirmed the absence of bowel contents in the thorax and the patient remained asymptomatic at 6 and 12 months.

DISCUSSION

MH is the most uncommon type of diaphragmatic hernias and always discovered in female adults.² MH often develops in the right hemithorax, while the left-sided or bilateral defects are rare because of the protection provided by the heart and pericardium. In adults, they may occasionally be asymptomatic and were found on chest X-ray, but nearly 72% of the patients are symptomatic, especially when there is the possibility of visceral obstruction or strangulation.² Therefore, early and accurate diagnosis is of great importance to avoid the undesirable serious complications and wrong treatment.

The diagnostic utilities of MH include chest X-ray, CT, barium enema or MRI. Although CT has emerged as the most common choice, it is not always 100%

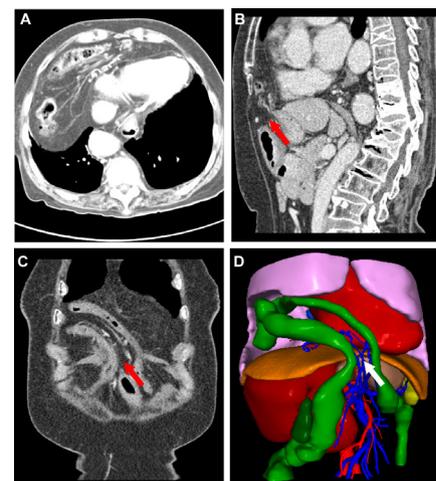


Figure 1 Preoperative CT scan and multicolour three-dimensional reconstruction model showing the hernia with abdominal contents. The hernia space contains the green loop colon and the red and blue mesenteric vessels.



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To cite: Zhang Z, Fu Y, Hu B. *BMJ Case Rep* 2021;**14**:e239911. doi:10.1136/bcr-2020-239911

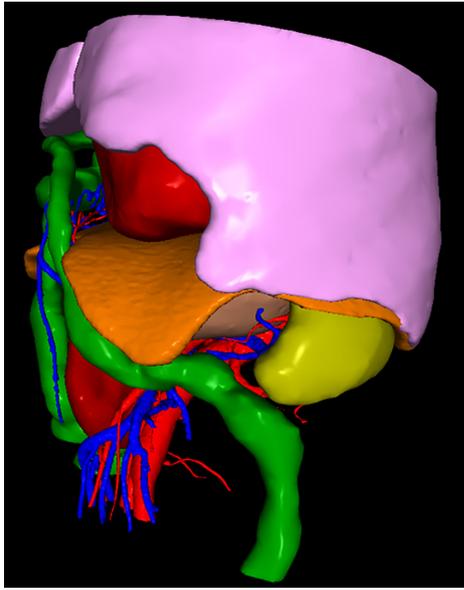


Figure 2 The diaphragm was not elevated from the lateral perspective.

accurate especially when the content of hernia sac is an anterior cardiophrenic angle abnormality with no evidence of bowel gas patterns in the chest. In this case, the 3D imaging showed the colon and omentum herniated into the chest more intuitively through the defect of diaphragm, which improves the false negative rate of CT scans for the hernia. If the 3D reconstruction model had been performed before the first surgery, the patient may not have been misdiagnosed and diaphragmatic plication via transthoracic approach could be avoided. It is really confusing and quite unimaginable that first surgery was performed on the right chest and the surgical team did not encounter any hernia sac, contents of the hernia or note the defect in the diaphragm. We once wondered whether the diaphragmatic hernia was the complication of the first surgery, but it is less likely because those chest images performed in our institution were similar with the previous CT scan in the other institution before and after the surgery. Therefore, the 3D reconstruction imaging is a fairly useful preoperative information to facilitate accurate diagnosis and surgical planning.

Both transthoracic and transabdominal approach to repairing the hernia could be adopted and preference varies from different researchers.^{3 4} Laparoscopic repair of MH has been proposed as a

Learning points

- ▶ Three-dimensional (3D) reconstruction imaging model is a useful supplement utility to avoid the misdiagnosis of Morgagni's hernia
- ▶ The 3D model could facilitate the preoperative evaluation and surgical planning for patients with Morgagni's hernia.
- ▶ It also proves helpful in better understanding the anatomical structures for residents and students in medical education.

safe and effective method with easier reduction of the hernia contents and more favourable results. With the assistance of the multicolor 3D reconstruction model, it is able to help to better visualise and apprehend the anatomy of hernia prior to the surgery, to take the appropriate manoeuvre for performing safer surgical procedures. Meanwhile, it proves particularly helpful in better understanding the surrounding important structures of the diaphragmatic defect zone for residents and surgeons.

Contributors The majority of the work was undertaken by the lead author ZZ. He performed the literature review and drafted the manuscript and assisted in the decision of which journal to submit to. YF and BH reviewed and edited the manuscript.

Funding The authors have not declared a specific grant for this research from any funding agency in the public, commercial or not-for-profit sectors.

Competing interests None declared.

Patient consent for publication Obtained.

Provenance and peer review Not commissioned; externally peer reviewed.

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