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First experience of robotic cystectomy and partial splenectomy in a child with congenital splenic cyst

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ABSTRACT

Background Congenital splenic cyst of children is an uncommon lesion. Robotic

manipulations for congenital splenic cyst of children have not been reported.

Methods A nine-year-old girl with cystic neoplasm originating from the middle-lower pole of spleen was performed robotic cystectomy and partial splenectomy. 5 ports of robotic instrument assignment were applied. After cystic fluid aspiration, the collapsed cyst was excised using Harmonic scalpel accompanied with margin portion of splenic parenchyma adjacent to the cyst. The inner surface of cyst overlying the splenic parenchyma was obliterated by argon beam coagulation. The wound was covered with hemostatic agent and packed by greater omentum. The sample was placed in the retrieval bag and delivered out through the assisting port.

Results The total procedure time was 80 minutes, and the capnoperitonium time was 60 minutes. The blood loss was 15 ml with no blood transfusion. No abdominal drainage tube was used. The child recovered without complications. She was discharged 10 days after operation. Pathological diagnosis was splenic cyst.

Conclusion This case supports that robotic cystectomy and partial splenectomy may be safe and feasible in pediatric congenital slplenic cyst patients.

Keywords: Child, Cysts, Minimally invasive surgical procedures, Spleen, Splenic-neoplasms.

BACKGROUND

Congenital splenic cyst of children is an uncommon lesion with a lining derived from mesothelium. They may present with symptom due to gastric compression with enlargement that require definite treatment. Laparoscopic partial cyst excision and cyst resection with partial splenectomy have been reported with good success. Partial splenectomy with excision of the cyst at the margin with the spleen can be performed with the Harmonic scalpel or with the use of stapling devices in an open or laparoscopic fashion. Use of cautery, sutures, and omental packing of the defect may also be useful. Robotic manipulations for congenital

splenic cyst of children have not been reported. Herein, we prescribed the first case and preliminary experience of robotic procedure for this lesion. We verified that it is safe and applicable of robotic cystectomy and partial splenecomy, with the inner surface overlying the splenic parenchyma being cauterized by argon beam coagulation.

METHODS

Subjects

A nine-year-old girl with 142cm height and 45kg weight admitted to our hospital on November 2018, who complained of upper abdominal pain when she had a fast walking after overeating. This symptom had been persisting for 4 years before she was unexpectedly discovered of a cystic lesion of her spleen by ultrasound scan. The diagnosis of splenic cystic neoplasm was ascertained by subsequent CT and MRI images. B-ultrasound scan described the lesion: The spleen was abnormal in figure with a 6.8cm×6.1cm×6.8cm cystic lesion arising from the lower pole. The lesion was well-circumscribed and well-echolucent. CDFI detected no blood signals from the inner portion. No free fluid was found in the abdominal cavity. Ultrasound diagnosis was cystic lesion of the lower pole of spleen, possibly benign. MRI scan diagnosed it as a benign lesion with a possibility of mucus or blood containing, probably originating from vascular (Fig. 1). CT scan diagnosed it as a cystic benign lesion with a possibility of lymphangioma (Fig. 2). No abdominal mass was palpated during physical examination. MRI and CT images showed that the cystic neoplasm originated from the middle-lower pole of spleen, anterior-laterally. The basement of the cyst adjacent to the splenic parenchyma obtained slim vascular branches from the splenic artery (Fig. 3, 4). There was some gap between the basement of cystic and the main hilar pedicles of spleen. Based on the anatomic pathology of the lesion, we designed robotic cystectomy and partial splenectomy for the child.

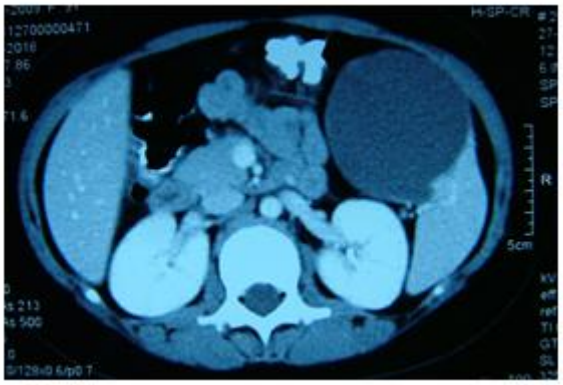

Fig. 1 Enhanced CT scan of the splenic cyst pre-operatively

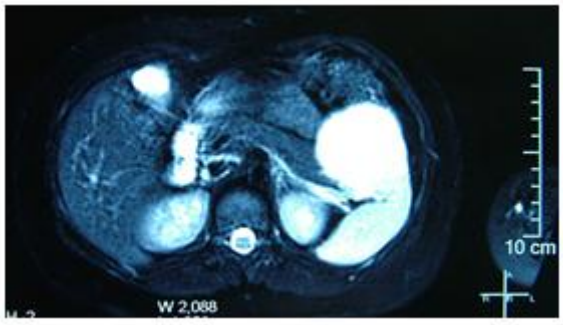

Fig. 2 Enhanced MRI scan of the splenic cyst pre-operatively

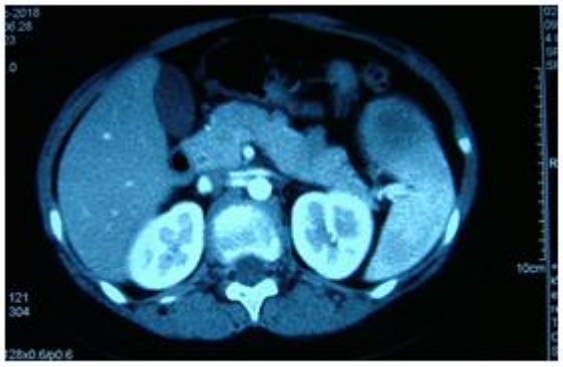

Fig. 3 Enhanced CT scan pre-operatively: the cyst originating form the middle-lower pole of the spleen with vascular branches supplying.

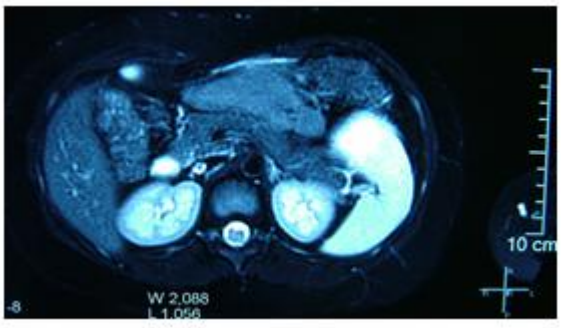

Fig. 4 Enhanced MRI scan preoperative: the cyst originating form the middle-lower pole of the spleen with vascular branches supplying.

Procedure

1. Anesthesia and preoperative arrangement

She was indwelled with stomach tube on the morning of surgery day. After success of tracheal intubation and anesthesia, urethral tube was inserted for urine output detection. The patient was positioned according to a modified lithotomy with head-up tilt. Da Vinci robotic dock was projected from the patient's head. The first assistant surgeon stood between the two legs of the patient. The nurse for instruments transmission stood at the right foot side of the patient.

2. Port placement

Five ports arrangement were applied for the patient (Fig. 5). Below the umbilical level, the endoscope port was placed laterally to the right rectus muscle with a diameter of 12mm. The assisting port was placed laterally to the left rectus muscle with a diameter of 12mm. At the umbilical level, arm 1 was placed at the left midaxillary line with a diameter of 8mm, and arm 2 was placed at approximately the right midclavicular line with a diameter of 8mm. Arm 3 with a diameter of 8mm was placed at the right anterior axillary line up the umbilical level.

Fig. 5 Port placement. A: assistant port; C: camera port; and 1, 2, 3 ports for the robotic arms.

3. Robotic techniques

The capnoperitonium pressure was 12 mmHg. A cystic lesion originating from the middle-lower pole of the spleen showed on the screen with 3D vision (Fig. 6). The cyst protruded anteriorly with greater omentum lying on the surface of it. The gastrocolic ligament was divided by Harmonic scalpel to expose the cyst. The cyst anterior wall was opened by Harmonic scalpel. The containing clear yellow fluid was sucked out. The collapsed cyst wall accompanied with adjacent parenchymal margin was excised by Harmonic scalpel. The slim vascular branch to the cystic wall originating from the splenic artery was coagulated by Harmonic scalpel and bipolar cautery. The inner surface of cyst adjacent to the splenic parenchyma was obliterated by argon beam coagulation. Hemostatic agent was covered on the wound, followed by the greater omentum packing on (Fig. 7). The sample was manipulated into the endoscopic retrieval bag and withdrawn through the assisting port. No abdominal drainage needed.

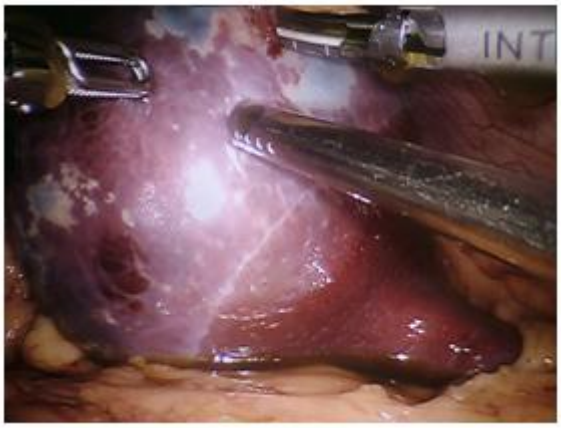

Fig. 6 Cyst presentation grossly: originating from the middle-lower pole of the spleen.

Fig. 7 Manipulation of the defect after cystectomy and partial splenectomy: the defect was covered with hemostatic agent and greater omentum.

4. postoperative management

The patient had anal aerofluxus on the first day postoperatively. On the third day postoperatively when abdominal distension disappeared, she was allowed to drink water. Without nausea or vomiting happening, she took fluid food on the fourth day. On the fifth day, she was allowed to take half-liquid food. On the ninth day she obtained MRI examination for recovery evaluation (Fig. 8).

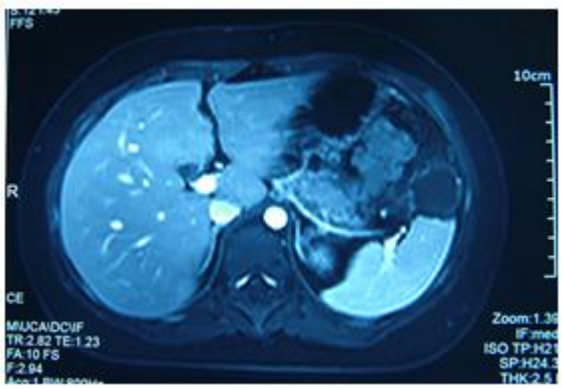

Fig. 8 Enhanced MRI scan postoperatively: no residual of cystic lesion

RESULTS

The operative time was 80 minutes. The capnoperitonium time was 60 minutes. Blood loss was 15 ml. No blood transfusion was needed. No abdominal drainage tube was used. She experienced an uneventful period postoperatively. She was discharged on the 10th day after operation. Postoperative MRI scan demonstrated a complete removal of the lesion. Grossly, the sample presented with a grey-red mass of 6.5cm×4cm×1cm without content. The inner surface was smooth with alternating colors of grey and yellow. The thickness of cystic wall was 0.3cm. Histologic evaluation was fibrous capsular tissue overlying with non-keratinized squamous epithelium or mono-layer cubical epithelium. Splenic parenchyma presented around the cystic wall. The pathologic diagnosis was splenic cyst.

DISCUSSION

Primary splenic systs have an epithelial lining, frequently with a trabeculated internal appearance. They most likely originated from inclusion of the surface mesothelium into the splenic parenchyma [1]. The cause of primary cysts remains controversial [2]. A study of 28-year period with 23 patients of this lesion demonstrated with its congenital origination [3]. They may be asymptomatic or may present as pain, rupture, abscess, or symptoms due to gastric compression. Small (＜5 cm) simple cysts can be observed; however, larger, enlarging

or symptomatic cysts require definitive treatment. Percutaneous aspiration and sclerosis have been utilized, but recurrence is common and partial splenectomy has been required. Marsupialization can be associated with recurrence if an adequate segment of cyst is not removed. Laparoscopic partial cyst excision and cyst resection with partial splenectomy have been reported with good success. Cyst excision and partial splenectomy can be performed with the Harmonic scalpel or with the use of stapling devices in an open or laparoscopic fashion. Use of cautery, sutures, and omental packing of the defect may also be useful.

Robotic surgery for splenectomy began from 2002, when Chapman WH and colleagues [4] first described its applications. In children, this technique was first described by Luebbe [5] et al, who performed a series of 20 cases treated with the da Vinci system, including 2 splenectomies. They reported the intraoperative complication rate was 15%, including conversion to laparotomy during attempted splenectomy to control bleeding at the splenic hilum in two and intraoperative percutaneous evacuation of pneumothorax during Morgagni hernia repair in one. The conversions to laparotomy were reported to have occurred quickly. Robotic splenic procedures for children have been rarely reported until 2012, when Vasilescu C [6] et al reported 10 cases of robotic subtotal splenectomy in hereditary spherocytosis. They documented that subtotal splenectomy seems to be a suitable candidate for robotic surgery, requiring a delicate dissection of the splenic vessels and a correct intraoperative evaluation of the splenic remnant. Robotic subtotal splenectomy is comparable to laparoscopy in terms of hospital stay and complication. The main benefits are lower blood loss rate, vascular dissection time, and a better evaluation of the splenic remnant volume. As for the robotic procedures for partial splenectomy or cystectomy with partial splenectomy, no reports have been found [7-19].

For robotic upper abdominal operations for children, suitable placement of instrument ports was importance for subsequent procedures. We applied a modified lithotomy position of head-up tilt. Da Vinci robot system docked from the patient’s head and the first assistant surgeon positioned between the two legs of the patient, thereby allowing the robotic arms and assistant surgeon greater mobility to operate. In order to utilize the limited space of abdominal cavity for children, we firstly placed the telescope port lateral to the right rectus muscle lower

than the umbilicus. After capnoperitonium had been formed, with a direct vision of the abdominal cavity, reasonable placement of the trocars was designed according to the “C” configuration. The assisting port was often placed at the opposite position of the telescope one’s and connected with the carbon dioxide duct during operation. Arm 1 was usually placed at the left side of the patient and was used for Harmonic scalpel manipulating. Arm 2 was placed at the right side for bipolar cautery manipulating. Arm 3 was used for non-harmful lifter manipulating of the surrounding organs for surgical exposure.

Based on the pathologic origination of the cyst, especially its relationship with the hilar vessels, we suggested that robotic procedures for splenic cysts should be performed individually. For this child, the cyst originated from the middle-lower pole of the spleen, protruding outside of the splenic parenchyma anteriorly. The cystic wall was not thick with slim blood supply originating from the hilar vessels to the cystic basement adjacent to the splenic parenchyma. The slim supplying branches can be coagulated safely with robotic electronic instruments. There was some distance between the cystic basement and the hilar pedicles. Cystectomy and partial splenectomy was curable for this child. When we tried to expose the cyst, there was no need to interrupte the surrounding ligaments of the spleen except for transecting the gastrocolic ligament for this patient. The wound hemostasis of spleen can be fulfilled by Bipolar cautery. Argon beam coagulation was applied for obliterating the inner surface of the cyst. Hemostatic agent and greater omentum were overlaid in the defect surface. This method of robotic cystectomy and partial splenectomy was proved to be applicable, safe and effective with postoperative MRI scan findings.

CONCLUSIONS

This is the first case of robotic cystectomy and partial splenectomy in a child with congenital splenic cyst. From the limited experience, we preliminarily demonstrate that robotic cystectomy and partial splenectomy may be safe and feasible in pediatric congenital slplenic cyst patients. More data should be accumulated for robotic splenic procedures for children in the future.

DECLARATIONS

Ethics approval and consent to participate

Not applicable.

Consent for publication

Not applicable.

Availability of data and material

The dataset supporting the conclusion of this article is included within the article.

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

QL and ZZ carried out the data analysis. YX drafted the manuscript. MH, YX, GW, XZ, GZ participated in the studying design and data collection. MH Participated in the critical reversion. All authors read and approved the final manuscript.

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Human participants and animal rights

This article does not contain any studies with human participants or animals performed by any of the authors.

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