Introduction

Bronchogenic cysts are congenital lesions originating from the primitive ventral foregut. Nearly two-thirds are within the mediastinum, and one-third are intraparenchymal. They account for 40-50% of all congenital mediastinal cysts. Once a bronchogenic cyst has been diagnosed radiologically, it should be excised to establish the histopathological diagnosis, in order to prevent complications such as infection, hemoptysis, rupture, or fear of malignancy (1).

The traditional surgical approach is an open approach, either a posterolateral thoracotomy or median sternotomy, depending on the localization of the cyst in the mediastinum. Total enucleation is the procedure of choice, and complete excision is possible in nearly all cases, whether the cyst is complicated or not (2). In the last decade, several reports on thoracoscopic resection of mediastinal bronchogenic cysts have been published encouraging minimally invasive approach (3-5).

The use of robotic system in the surgery of mediastinal pathologies has been increasing worldwide. Many studies have already demonstrated the safety of robotic thymectomy as well as removal of other mediastinal masses (6-10). Mediastinal bronchogenic cyst resection have already been performed by using robotic system. To our knowledge, Yoshino et al. (11) reported the first resection of a mediastinal bronchogenic cyst using robotic system in 2002.
Since then, only 12 cases have been added to the English literature (10, 12-15).

The da Vinci Robotic System (Intuitive Surgical, Inc., Mountain View, California, USA) has been adopted in our institution on October 2011. Our previous reports on robotic pulmonary resections have been published elsewhere (16-18). Here in this paper we aimed to present the results of the patients with mediastinal bronchogenic cysts that underwent robotic surgery using da Vinci Robotic System.

Patients and Methods

Since the set-up of the program, 200 patients underwent robotic thoracic surgery between October 2011 and September 2015, of which 17 patients (8.5%) had mediastinal pathologies. Five of them (29%) had pathologically proven mediastinal bronchogenic cyst, and they were enrolled into the study. The decision to offer robotic approach was made according to the healthcare insurance systems, and the patients’ willingness. Their medical files were retrospectively investigated, and the symptoms at diagnosis, radiologic findings, and locations of the lesions were evaluated retrospectively.

All patients had chest X-rays and computed tomography of the chest. Additional studies included standard hematologic and chemistry panel studies, cardiac evaluation, arterial blood gases, and pulmonary function testing. No perioperative invasive diagnostic methods have been used, since the lesions were cystic in nature.

A single thoracic surgeon (AT) performed cystectomy to all patients. A dedicated team of surgeons (including table surgeon and first surgical assistant), nurses, and anesthetists involved during the procedures. The operating time, including the docking and console times, post-operative hospitalization, and peri- and post-operative complications were recorded. The definitions of docking and console times have been previously given (18).

The patient was positioned on lateral decubitus position after single-lung ventilation was established and confirmed with the fiberoptic bronchoscope. The table was tilted either anteriorly or posteriorly depending on the type of the operation to be performed before the robotic arms were docked. Three ports have been used, and were placed as previously described (14,18).

This video shows a case of a mediastinal bronchogenic cyst excision using da Vinci Robotic System (Figure 1). After the visualization of the lesion, the mediastinal pleura was opened, and the tissues alongside the lesion capsule were dissected using the Electrocautery (EndoWrist, Intuitive Surgical). The cysts were removed after the aspiration of the cystic fluid without any bleeding or harm to the adjacent tissues, and were extracted through the service port covered with ALEXIS® soft tissue skin retractor (Applied Medical, Rancho Santa Margarita, CA) using a plastic endobag.

One chest tube was used for each patient and was removed during the hospital stay as soon as the drainage was less than 200 mL/day or no air leak was present. One patient required decortication due to infection of the cyst and pleura. He was on hemodialysis for the past 6 years due to chronic renal failure. The study received institutional review board approval, with individual patient consent being waived.

Results

There were five patients (male/female: 3/2) in this study, with a mean age of 43±28 years (Table 1). All the lesions were located at the posterior mediastinum. The cysts averaged 48 mm in their largest diameter (range 30-70 mm). Three patients were asymptomatic. The lesions had been detected in the remaining two patients during the investigation of cough and abdominal pain. Complete cyst excision was performed in all patients. There were no operative deaths and no intra-operative complications. There was no need for conversion to thoracotomy or video-assisted thoracic surgery (VATS). The mean docking time was 20±12 min, the mean console time was 63±32 min, and the mean operating time was 88±41 min. Postoperative course was uneventful in all cases. The mean chest tube duration time was 2.4±1.7 days, and the mean length of stay was 3.6±2.2 days. Histologic examination was performed in all cases, and confirmed the diagnosis of bronchogenic cyst with the typical feature of a ciliated pseudostratified columnar epithelial lining with
smooth muscle present in the cyst wall and mucous glands present in the lamina propria. During follow-up, which ranged from 6 months to 3 years, no patients presented with late-onset or recurrent complications.

Discussion

Bronchogenic cysts are relatively uncommon, and usually asymptomatic if they are of the intrapulmonary type. If they are of the mediastinal type, they can cause compression to the neighbouring organs, and symptoms such as wheezing, coughing, dyspnea, atelectasis and dysphagia may develop. Besides, severe symptoms including bloody expectoration, bloody sputum, hemoptysis, fever and pyothorax may occur in some patients when the condition is complicated by an infection (1). One of our patients developed empyema, he was on hemodialysis for chronic renal failure. However, most bronchogenic cysts are found incidentally when imaging is performed for other reasons (1,5). Three patients in our study (60%) were asymptomatic.

Regarding therapeutic approach, a bronchogenic cyst should be excised to establish the definitive diagnosis, as well as to prevent possible complications and fear of malignancy. Routine surgical procedure has traditionally been complete cyst removal by open approaches (1,2,9). Accumulated experience with minimally invasive surgery has enabled a less traumatic approach in the treatment of mediastinal lesions. Several reports on thoracoscopic resection of mediastinal bronchogenic cysts have been published encouraging minimally invasive approach (3-5). The main advantage of thoracoscopy is less trauma and discomfort for the patient. Since the lack of intercostal muscle incision and the lower risk of rib fracture reduce the postoperative pain compared to thoracotomy, it is claimed that thoracoscopy reduces the chest tube duration and length of hospital stay (3).

Although thoracoscopy is less invasive than an open approach, it carries the problem of difficulty of manipulation in narrow spaces, such as the upper and lower thoracic spaces (near the apex or diaphragm) and immediately adjacent to the vertebrae and the aorta. Nowadays, several reports on the feasibility and safety of the robotic system in the surgery of mediastinal lesions located at anterior or middle mediastinum (12,20), and posterior, upper and inferior mediastinum (10,13) have been reported with encouraging results. Bronchogenic cysts in the mediastinum are mostly adherent to adjacent vital structures such as trachea, aorta and main bronchii, and thus, this makes a complete resection by conventional thoracoscopy difficult. In case of dense adhesions, surgical approach via thoracotomy should be always kept in mind. But the three-dimensional visualization, greater instrument manoeuvrability and more accurate dissection of robotic systems may overcome this difficulty, and avoid the incomplete resection of mediastinal bronchogenic cysts. The articulating instruments may be particularly helpful for dissecting around a mediastinal mass within the vital tissues in the thoracic cavity (9,10,14).

To our knowledge, Yoshino et al. (11) reported the first resection of a mediastinal bronchogenic cyst using robotic system in January 2001, and published their report in 2002. They resected a 2.0 cm bronchogenic cyst located at the left posterior mediastinum. Since that date, only 11 cases have been added to the English literature (10,12,13,15). Although robotic resection of mediastinal bronchogenic cysts in teenagers have been reported in some of the abovementioned studies, our previous report on a 8-year-old female patient is the first report concerning of patients in the first decade of life (14). In that report, we recommended minimally invasive resection of mediastinal bronchogenic cysts to avoid the risk of scoliosis development in childhood following thoracotomy. This study consisted of the patient presented before and four additional patients with posterior mediastinal bronchogenic cyst, all of whom underwent resection by robotic surgery using the da Vinci System.

Table 1 Characteristics of the five patients with mediastinal bronchogenic cyst undergoing robotic surgical resection

<table>
<thead>
<tr>
<th>No.</th>
<th>Age (years)</th>
<th>Sex</th>
<th>Symptoms</th>
<th>Location of the lesion</th>
<th>Diameter of the lesion (mm)</th>
<th>Operating time (min)</th>
<th>Hospitalization time (days)</th>
<th>Complications</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>19</td>
<td>M</td>
<td>None</td>
<td>Posterior</td>
<td>45</td>
<td>125</td>
<td>2</td>
<td>None</td>
</tr>
<tr>
<td>2</td>
<td>8</td>
<td>F</td>
<td>None</td>
<td>Posterior</td>
<td>35</td>
<td>80</td>
<td>2</td>
<td>None</td>
</tr>
<tr>
<td>3</td>
<td>62</td>
<td>F</td>
<td>Abdominal pain</td>
<td>Posterior</td>
<td>70</td>
<td>135</td>
<td>6</td>
<td>None</td>
</tr>
<tr>
<td>4</td>
<td>68</td>
<td>M</td>
<td>None</td>
<td>Posterior</td>
<td>60</td>
<td>55</td>
<td>6</td>
<td>None</td>
</tr>
<tr>
<td>5</td>
<td>59</td>
<td>M</td>
<td>Cough, sputum</td>
<td>Posterior</td>
<td>30</td>
<td>45</td>
<td>2</td>
<td>None</td>
</tr>
</tbody>
</table>

M, male; F, female.
There was no mortality or morbidity in our study, similar to the previous reports.

In conclusion, we believe that mediastinal bronchogenic cysts should be treated surgically. The robotic system has been confirmed to be a safe, accurate and minimally invasive approach with promising clinical value. Small trauma, mild pain, quick recovery and good cosmesis are among its features. Also, it can thoroughly remove the lesions in the mediastinum with high safety and success rate.

Acknowledgements
None.

Footnote

Conflicts of Interest: The authors have no conflicts of interest to declare.

Ethical Statement: The study received institutional review board approval, with individual patient consent being waived.

References