Thoracoscopic management of benign tumors of the mid-esophagus: A retrospective study

Chinnusamy Palanivelu, Muthukumaran Rangarajan*, Ramakrishnan Senthilkumar, Shankar Annapoorni, Priyadarshan Anand Jategaonkar

GEM Hospital and Postgraduate Institution, 45-A, Pankaja Mill Road, Ramnathapuram, Coimbatore 641045, India

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Abstract  Benign esophageal tumors are rare conditions. Traditionally, thoracotomy was the preferred route to approach these lesions. Now, increasingly more surgeons are using minimally invasive techniques to treat these benign mid-esophageal lesions. We present our experiences from a specialised minimally invasive surgery unit. We have managed 12 patients with benign tumors of the mid-esophagus from 1995 to 2007 in our institute. The enucleation was achieved with the patient placed in the prone position and approached via a right thoracoscopy in all cases. Hospital stay was 3–5 days and there were minor postoperative complications in 2 patients. Mortality was nil. There were 10 patients with leiomyoma and 2 with GISTs, as proved by immunohistochemistry. Short and long-term follow up was satisfactory, with none of the patients having recurrences or other problems. Leiomyomas and GISTs, respectively, are the commonest benign tumors of the esophagus. Tumors more than 5 cm have to be enucleated, and thoracotomy has been the traditional approach to these lesions. Thoracoscopy has definite benefits regarding reduced morbidity. The combined modality of peroperative endoscopy is useful in locating the lesion as well as confirming its complete removal. Based on our experience, a right thorax approach and the prone patient position is the ideal for thoracoscopic procedures.

Introduction
Benign tumors of the esophagus are rare lesions that constitute less than 10% of all esophageal neoplasms, of which leiomyomas are the commonest type, followed by gastrointestinal stromal tumors (GIST), the 2 types being differentiated by immunohistochemistry (IHC). Also, esophageal leiomyomas represent about 10% of all gastrointestinal leiomyomas, but are equally distributed between the middle and lower third levels. The potential for malignant degeneration of leiomyomas is extremely small. Benign esophageal tumors cause symptoms when they are larger than 5 cm in diameter; accounting for less than 5% of all dysphagia cases. Enucleation of the benign tumors, regardless of histological type, is the recommended treatment. Traditionally, the surgical treatment consists of enucleation through a right thoracotomy. These lesions are being increasingly approached with minimally invasive methods. We present our experiences with the thoracoscopic approach.
to benign tumors in the middle third of the esophagus. There are not many reports of thoracoscopic surgery for benign conditions performed in the prone patient position.

**Methods**

A series of 12 patients were studied retrospectively to assess the efficacy of thoracoscopic surgery for benign tumors of the middle third of the esophagus. Middle third of the esophagus was taken as the length between 24 cm and 32 cm from the upper incisor teeth on endoscopy. Nine patients were symptomatic — dysphagia (80%), odynophagia (10%), vague chest pain (5%), and retrosternal discomfort/pain (5%). The other 3 patients were accidentally discovered to have these tumors on endoscopy for suspected reflux disease and operated upon as the tumor size was more than 5 cm. All the patients underwent local excision/enucleation only, which was adequate as proven by histopathology. There no cases of malignancy. The tumors were taken as benign based on the fact that the overlying mucosa was normal and there was no extra-esophageal involvement of the tumors. Preoperative workup included upper gastrointestinal (GI) endoscopy, barium swallow and CT scan. Upper GI endoscopy showed the mass in the mid-esophagus with the overlying mucosa intact. One patient had multiple masses (Figs. 1 and 2). Thoracoscopic enucleation of the mid-esophageal benign tumors in the prone patient position was performed for all cases, approached through the right thorax. All the procedures were done under general anesthesia using a single lumen endotracheal tube. The patient was put in a prone position after endotracheal intubation and approached from the right side (Fig. 3). A Veress needle is used to create the pneumothorax and CO₂ is insufflated to a pressure of 6–8 mmHg. Right thoracoscopic was performed using three ports (Fig. 3), a 10 mm port for the camera in the seventh intercostal space and two operative ports namely a 5 mm port in the fifth intercostal space for the right working hand and a 5 mm port in the ninth intercostal space for the left working hand. The 5 mm port in the fifth intercostal space for the right working hand was placed by the assistant surgeon pushing the right scapula cranially. On thoracoscopy, the tumor was visualized in the mid-esophagus, sometimes stretching the azygos vein (Fig. 4). An endoscope was introduced into the esophagus at this point to accurately localize the tumor. The mediastinal pleura over the tumor was incised longitudinally using an electrocautery hook. The stretched azygos vein was clipped with large-size titanium clips and divided. In some cases, the azygos vein was preserved. The muscle on the summit of the tumor was split longitudinally and the tumor was identified by its smooth surface. The tumor was separated from the musculature of the esophagus carefully protecting the mucosa from...
injury (Fig. 5). After cauterizing few blood vessels on the tumor, it was successfully enucleated. Intercostal drain tubes were placed in the right chest for all the patients. After the completion of enucleation, the muscle layer was approximated with few loose interrupted stitches of 3-0 Vicryl™. The dissected area and the integrity of the esophageal mucosa were thoroughly checked by air insufflation through the endoscope. There was no leakage of air in any case. The tumors were placed in an endobag and extracted through an enlarged port incision by cutting into small pieces.

Results

There were 9 males and 3 females, and the age range was 37–72 years. The most common location was the right esophageal wall. The operating time was in the range of 85–128 min; blood loss was minimal and no transfusions were given. Contrast study was done on the 2nd postoperative day (POD) for all patients that showed no evidence of leak or narrowing. Liquids were allowed orally on the morning of the 2nd POD, followed by soft diet the next day. One patient had dysphagia on the 2nd POD and one patient had pneumonia on the 4th POD, both of whom were managed conservatively. Average day to discharge was 4 (3–5) days. Size of the tumors ranged from 5 to 7.6 cm. Histopathology confirmed leiomyoma in 10 patients and GIST in 2 patients (Fig. 6). Both the types of tumors exhibit smooth muscle spindle-shaped cells, elongated nuclei with truncated ends, and no significant mitotic activity. Only IHC can differentiate one from the other. The leiomyomas were positive for desmin and smooth muscle actin and negative for CD34 and CD117. The follow up was scheduled at 1, 3, 12, 24 and 60 months. Endoscopy and CT scan were taken during these follow-ups. Seven patients attended all the follow-ups, 4 patients were followed-up for 15–18 months, while 1 patient who was operated recently came for first the follow up. Long-term results were satisfactory as none of the patients had recurrence or other symptoms.

Discussion

Benign tumors are frequently located in the lower third of the esophagus, middle third and cervical region being uncommon. GISTs originate from the interstitial cells of Cajal and so are positive for CD117 but negative for desmin and smooth muscle actin, whereas leiomyomas are negative for CD117. Only a small percentage of patients are symptomatic. Dysphagia is by far the most common symptom. Rarely, leiomyomas can be horseshoe-shaped, conforming to the curvature of the esophagus. They characteristically produce obstruction by protruding into the lumen in more than one location (Fig. 1), similar to one patient in our series. Asymptomatic patients can be observed without surgical intervention, though resection is the only way to confirm that a tumor is not malignant. Endoscopic biopsy of the lesion was not done for obvious reasons. Surgical excision is recommended for symptomatic tumors and those greater than 5 cm, enucleation being the treatment of choice. Thoracoscopic

![Figure 4](image1.png) Tumor visible in the thoracic esophagus just distal to the azygos vein; lobes of the right lung seen below.

![Figure 5](image2.png) Enucleation being completed; horseshoe-shaped tumor appreciated.

![Figure 6](image3.png) Histopathology: smooth muscle spindle-shaped cells, elongated nuclei with truncated ends, and no significant mitotic activity.
enucleation of a benign esophageal tumor was first reported by in 1992 by Everitt et al.8 Our first case of thoracoscopic enucleation of esophageal leiomyoma was performed in 1994. In our institute, we approach lower esophageal tumors transhiatally and mid-esophageal tumors thoracoscopically. The prone patient position and right thoracoscopic approach for surgery is not very popularly practiced. Cuschieri et al. for the first time described the right thoracoscopic approach for esophagectomy in 1992 keeping the patient in the prone position.9 It is gaining popularity now with many surgeons employing this technique. In our center, we have adopted this prone position for all thoracoscopic procedures including esophagectomy for cancer and found it very effective. The pneumothorax causes partial collapse of the lung that provides an adequate working area. Also, the prone position will cause the mediastinal structures to fall away from the esophagus, further increasing the working area. In the anesthetist’s viewpoint, ventilation-perfusion ratio is better in the prone rather than lateral position. Disadvantages of a lateral position are that the non-dependant lung will collapse and the dependent lung will be compromised by pressure from the mediastinum and abdominal contents. These problems are eliminated with the patient in the prone position. There were no conversions in any patients in our series, and if conversion is needed we would approach it through a right thoracotomy with the patient in the prone position. The combined method of endoscopy and thoracoscopy has been reported by some centers.10 Peroperative endoscopy was done in all our patients to localize the tumor as well as to confirm its complete removal. In one patient, since the preoperative endoscopy showed the presence of what looked like 2–3 masses (Fig. 1), it was important to ensure the enucleation of all the masses. When the tumor in this patient was enucleated, it could be appreciated that there was only a single lesion, but shaped like a dumb-bell. This unusual shape presented as multiple masses on the preoperative endoscopy. Leiomyomas are multiple in approximately 5% of patients. It is recommended that the muscle layer of the esophagus should be loosely approximated to avoid decreasing the propulsive activity of the esophageal body.11 However, some authors have shown that large extramucosal defects following enucleation may be left open without subsequent complications developing.12 Roviaro et al. analyzed data from over 2000 thoracoscopic procedures and showed that thoracoscopic surgery for benign esophageal lesions is the gold standard.13 In conclusion, thoracoscopic enucleation of mid-esophageal benign tumors is a safe and effective operation. This approach when combined with intraoperatively endoscopy further accentuates the efficiency of the thorascopic procedure. In our experience, prone patient position is ideal for thoracoscopic esophageal surgeries. Randomized control trials comparing the lateral and prone patient position for esophageal surgeries are needed to actually confirm the superiority of one over the other.

Conflicts of interest
None.

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References