JOURNAL OF LAPAROENDOSCOPIC & ADVANCED SURGICAL TECHNIQUES
Volume 18, Number 2, 2008

DOI: 10.1089/lap.2007.0067

Case Report

Robotic Extirpation of Complex Massive Esophageal Leiomyoma

DANIEL A. DEUGARTE, MD,[1] DANIEL TEITELBAUM, MD,[2] RONALD B. HIRSCHL, MD,[2] and JAMES D. GEIGER, MD[2]

ABSTRACT

Esophageal leiomyomas are the most common benign mesenchymal esophageal tumors, but they occur rarely in the pediatric population. Leiomyomas are conventionally treated with extramucosal enucleation via an open thoracotomy. In this paper, we report a case of a complex massive retrocardiac esophageal leiomyoma that was successfully extirpated by using a robotic-assisted thoracoscopic technique. Intraoperative esophagoscopy and transillumination were useful adjuncts in identifying the esophagus and developing a safe extramucosal dissection plane.

INTRODUCTION

LEIOMYOMA IS THE MOST COMMON benign mesenchymal esophageal tumor and accounts for up to 80% of benign esophageal tumors.[1] Esophageal leiomyomas can occur at any age, but the peak incidence is in the third to fifth decades of life.[2] Lesions in adults are usually localized to the middle- and lower third of the esophagus.[3] In children, the diffuse form of the disease predominates and can be associated with familial syndromes (e.g., familial leiomyoma and Alport's syndrome).[4] In cases of diffuse esophageal leiomyomatosis or giant esophageal leiomyoma, esophagectomy is often required.[4,5] Localized esophageal leiomyomas have been conventionally resected via an open thoracotomy and extramucosal enucleation.[6] Thoracoscopic techniques have been described for simple leiomyomas and are associated with reduced operative morbidity.[6–8] However, complex lesions may not be amenable to standard thoracoscopic techniques because of limitations posed by the two-dimensional visual field and the reduced range of motion of thoracoscopic instruments. Robotic-assisted thoracoscopic surgery offers the benefit of three-dimensional (3D) imaging, motion scaling, tremor filtration, and the full range of motion from articulated instruments.[9,10] In this paper, we report a case of a large (7-cm), complex, multilobulated retrocardiac leiomyoma that encircled the esophagus and was successfully extirpated by using a robotic-assisted thoracoscopic approach.

CASE REPORT

A 17-year-old asymptomatic boy was incidentally noted to have a retrocardiac rounded density on a chest X-ray following a motor vehicle accident. A magnetic resonance image of the thorax demonstrated a bi-lobed $7 \times 7 \times 5.5$ cm complex encircling esophageal mass adjacent to the posterior aspect of the heart and anterior aspect of the descending aorta (Fig. 1). The differential di-

[1]Division of Pediatric Surgery, David Geffen School of Medicine at UCLA, Los Angeles, California.
[2]Division of Pediatric Surgery, University of Michigan, Ann Arbor, Michigan.

FIG. 1. Magnetic resonance imaging demonstrates a middle mediastinal mass adjacent to the posterior aspect of the heart and anterior aspect of the descending aorta. The mass is somewhat bi-lobed, with the larger component on the left side, and has a maximal dimension of 7 cm. The esophagus is difficult to identify.

agnosis included esophageal leiomyoma versus foregut duplication cyst, although a tumor could not be excluded.

The patient was positioned in the right lateral decubitus position. A dual-lumen endotracheal tube was utilized for single-lung ventilation. The first-generation da Vinci robot (Intuitive Surgical, Inc., Sunnyvale, CA) was utilized and positioned near the patient's left shoulder (Fig. 2). A 12-mm trocar was placed for the 3D vision system. Two 8-mm trocars were placed as working ports for the robotic instruments. Two additional ports were utilized to help retract, irrigate, and suction. The mass was multilobulated and encircled the esophagus. In order to identify the esophagus and identify an extramucosal dissection plane, an endoscope was introduced and used both as a bougie and for transillumination. A multilobulated tumor within the muscularis propria was identified and dissected free from the intact underlying mucosa. Air insufflation at the end of the procedure revealed no leak. A postoperative esaphogram demonstrated a mildly dilated distal esophagus, with no extravasation and easy passage of contrast into the stomach. On postoperative day 2, the patient was transitioned to a full-liquid diet and oral pain medication. The chest tube was removed and the patient discharged on postoperative day 4. A repeat esophagram 1 year later demonstrated less dilation of the distal esophagus. The patient remains asymptomatic 2 years postoperatively.

DISCUSSION

There has been an explosion in the use of laparoscopic and robot-assisted techniques for esophageal procedures, including Heller myotomies for achalasia, esophagectomies for esophageal cancer, and the excision of benign esophageal tumors. The success of laparoscopic Heller myotomies in the treatment of achalasia is well documented and has achieved a 90% success rate in achieving good or excellent swallowing status while minimizing postoperative pain and hospitalization, compared with open procedures.[11–14] The esophageal perforation rate with laparoscopy is equivalent to open procedures and ranges from 1 to 15% (average, 5%). Several recent reports demonstrate the benefit of a robotics platform in decreasing the esophageal perforation rate to 0%.[15–17] The ability of the robot platform to decrease the perforation rate is attributed primarily to improved visualization with three dimensions and secondarily to improved instrument handling, ergonomics, and motion scaling.

The role and benefit of minimally invasive techniques in esophagectomies for esophageal cancer is not as clearly defined.[18–21] Several papers demonstrate that minimally invasive approaches result in decreased postoperative pain and earlier discharge but increased operative time. In most series, the minimally invasive approach did not appear to compromise the oncologic resection, as the extent of lymphadenectomy and 5-year survival rate were similar for that of open procedures. A few case reports describe laparoscopic and robotic approaches to the resection of benign simple esophageal tumors.[6–8,10] However, there is limited experience with the minimally invasive resection of complex benign esophageal lesions.

Robot-assisted thoracoscopic techniques have several advantages that can facilitate the extirpation of complex

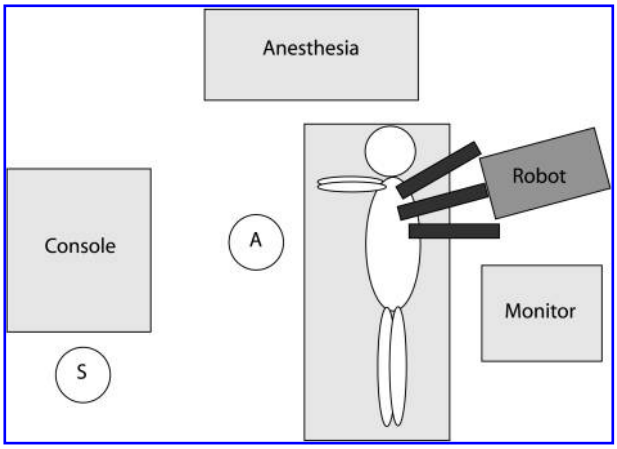

FIG. 2. Patient positioning for the lower paraesophageal mass. The mass was predominantly on the left side and in the lower esophagus. Therefore, the patient was positioned in the right lateral decubitus position. The da Vinci robot and monitor were positioned posterior to the patient. The tableside assistant (A) is positioned anterior to the patient. The surgeon (S) sits at the console away from the operative field.

esophageal lesions and help avoid technical complications, including esophageal perforation. The free range of motion obtained with the multiarticulated robotic instruments facilitates circumferential dissection around the esophagus. Motion scaling and tremor filtration help to prevent inadvertent motions that can lead to mucosal disruption. The 3D vision system enhances magnification, improves visuospatial orientation, and aids in the identification of the extramucosal tissue plane. The da Vinci robotic system does have drawbacks, including high cost, longer setup and operative time, and the lack of haptic feedback. Proper room setup, patient positioning, and trocar placement are critical to an efficient operation.

Intraoperative endoscopy is an extremely helpful adjunct in the thoracoscopic resection of esophageal tumors. Endoscopy can be useful in localizing the tumor when the mass itself can be visualized. When the entire esophagus is circumferentially involved with tumor, as in this case report, transillumination can be used to identify anatomic landmarks, including the proximal and distal extent of the tumor. The endoscope can also be used as a bougie to facilitate dissection. Once extirpation of the tumor is completed, insufflation of air into the esophagus can be used to check for a leak and verify mucosal integrity. Finally, a breach in the musculature can be identified as a bulge and suggest the need for myotomy repair. In this case, the tumor was so extensive and the esophageal musculature so thinned out that a reapproximation of the esophageal musculature was not feasible. An alternative would have been to buttress the myotomy site with a collagen scaffold or transposed autologous tissue. The need for repair of the myotomy to prevent aperistalsis and the formation of a diverticulum remains controversial[8] but is recommended, when feasible, in large series.[2,22]

CONCLUSIONS

Extramucosal enucleation of esophageal leiomyomas can be performed thoracoscopically with minimal morbidity. Many institutions limit the thoracoscopic resection of esophageal leiomyomas to cases where the tumor is simple, small, and round and when the submucosal plane can be easily identified. Robot-assisted thoracoscopy enables the resection of more complex lesions, which account for up to one third of esophageal leiomyomas.[22] These minimally invasive surgery approaches may offer advantages of decreased pain, reduced atelectasis, and shorter hospital stay. Robot-assisted surgery arguably offers technical advantages over open surgery, including better exposure, magnification, and instrument control, facilitating the completion of complex esophageal surgery. Finally, as seen with Heller myotomies, the robotic platform may help avoid technical complications, including esophageal perforation.

REFERENCES

1. Seremetis M, Lyons W, DeGuzman V, Peabody J. Leiomyomata of the esophagus. Cancer 1976;38:2166–2177.
2. Lawrence SL, Sunil, Clayton JB, Blair M. Michael LK, Larry RK, John CK. Current management of esophageal leiomyoma. J Am Coll Surg 2004;198:136–146.
3. Schmidt HW, Clagett T, Harrison EG. Benign tumors and cysts of the esophagus. J Thorac Cardiovasc Surg 1961;41: 717–732.
4. Bourque MD, Spigland N, Bensoussan AL, Collin PP, Saguem MH, Brochu P, Blanchard H, Reinberg O. Esophageal leiomyoma in children: Two case reports and review of the literature. J Pediatr Surg 1989;24: 1103–1107.
5. Cheng B-C, Chang S, Mao Z-F, Li M-J, Huang J, Wang Z-W, Wang T-S. Surgical treatment of giant esophageal leiomyoma. World J Gastroenterol 2005;11:4258–4260.
6. von Rahden BHA, Stein HJ, Feussner H, Siewert JR. Enucleation of submucosal tumors of the esophagus. Surg Endosc 2004;18:924–930.
7. Nguyen NT, Alcocer JJ, Luketich JD. Thoracoscopic enucleation of an esophageal leiomyoma. J Clin Gastroent 2000;31:89–90.
8. Roviaro GC, Maciiocco M, Varoli F, Rebuffat F, Vergani C, Scarduelli A. Videothoracoscopic treatment of oesophageal leiomyoma. Thorac 1998;53:190–192.
9. Elli E, Espat NJ, Berger R, Jacobsen G, Knoblock L, Horgan S. Robotic-assisted thoracoscopic resection of esophageal leiomyoma. Surg Endosc 2004;18:713–716.
10. Bodner JC, Zitt M, Ott H, Wetscher GJ, Wykypiel H, Lucciarini P, Schmid T. Robotic-assisted thoracoscopic surgery (RATS) for benign and malignant esophageal tumors. Ann Thorac Surg 2005;80:1202–1206.
11. Bloomston M, Serafini F, Rosemurgy AS. Videoscopic Heller myotomy as first-line therapy for severe achalasia. Am Surg 2001;67:1105–1109.
12. Finley RJ, Clifton JC, Stewart KC, Graham AJ, Worsley DF. Laparoscopic Heller myotomy improves esophageal emptying and the symptoms of achalasia. Arch Surg 2001; 136:892–896.
13. Patti MG, Pellegrini CA, Horgan S, Arcerito M, Omelanczuk P, Tamburini A, Diener A, Eubanks TR, Way LW. Minimally invasive surgery for achalasia: An 8-year experience with 168 patients. Ann Surg 1999;230: 587–593.
14. Sharp KW, Khaitan L, Scholz S, Holzman MD, Richards WO. One hundred consecutive minimally invasive Heller myotomies: Lessons learned. Ann Surg 2002;235: 631–638.
15. Galvani C, Gorodner MV, Moser F, Baptista M, Donahue P, Horgan S. Laparoscopic Heller myotomy for achalasia facilitated by robotic assistance. Surg Endosc 2006;20: 1105–1112.

16. Horgan S, Galvani C, Gorodner MV, Omelanczuck P, Elli F, Moser F, Durand L, Caracoche M, Nefa J, Bustos S, Donahue P, Ferraina P. J Gastrointest Surg 2005;9:1020–1029.
17. Melvin WS, Dundon JM, Talamini M, Horgan S. Computer-enhanced robotic telesurgery minimizes esophageal perforation during Heller myotomy. Surgery 2005;138:553–558.
18. Braghetto I, Csendes A, Cardemil G, Burdiles P, Korn O, Valladares H. Open transthoracic or transhiatal esophagectomy versus minimally invasive esophagectomy in terms of morbidity, mortality, and survival. Surg Endosc 2006; 20:1681–1686.
19. Fernando HC, Christie NA, Luketich JD. Thoracoscopic and laparoscopic esophagectomy. Semin Thorac Cardiovasc Surg 2000;12:195–200.
20. Nguyen NT, Follette DM, Wolfe BM, Schneider PD, Robert P, Goodnight JE, Jr. Comparison of minimally invasive esophagectomy with transthoracic and transhiatal esophagectomy. Arch Surg 2000;13:920–925.
21. Swanstrom LL, Hansen P. Laparoscopic total esophagectomy. Arch Surg 1997;132:943–947.
22. Mutrie CJ, Donahue DM, Wain JC, Wright CD, Henning AG, Grillo HC, Mathisen DJ, Allan JS. Esophageal leiomyoma: A 40-year experience. Ann Thorac Surg 2005;79: 1122–1125.

Address reprint requests to:
Daniel A. DeUgarte, MD
UCLA School of Medicine
10833 Le Conte Avenue
Box 957098
Los Angeles, CA 90095-7098