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EN BLOC RESECTION OF PANCOAST TUMOR WITH ADJUVANT AORTIC ENDOGRAFT AND CHEMORADIATION

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Abstract

"Pancoast" tumors frequently require a multidisciplinary approach to therapy and are still associated with high morbidity and mortality. Due to their sensitive anatomic location, complex resections and chemoradiation regimens are typically required for treatment. Those with signs of aortic invasion pose an even greater challenge, given the added risks of cardiopulmonary bypass for aortic resection and interposition. Placement of an aortic endograft can facilitate resection if the tumor is in close proximity to or is invading the aorta. Prophylactic endografting to prevent radiation-associated aortic rupture has also been described. This case describes a 60-year-old female who presented with a stage IIIa left upper lobe undifferentiated non-small-cell carcinoma encasing the subclavian artery with thoracic aorta and bony invasion. Following carotid-subclavian bypass with Dacron, en bloc resection of the affected lung, ribs, and vertebral bodies was performed. The aorta was prophylactically reinforced with a Gore TAG thoracic endograft prior to adjuvant chemoradiation. The patient remains disease-free at more than 5 years follow-up after completing her treatment course. Endovascular stenting with subsequent chemoradiation may prove to be a viable alternative to palliation or open operative management and prevention of aortic injury during tumor resection and/or adjuvant therapy in select patients with aortic involvement.

Introduction

Since its recognition in 1924 by Dr. Henry Pancoast,[1] the management of superior sulcus or "Pancoast" tumors has remained one of the most challenging aspects of thoracic surgery. Though accounting for less than 5% of all bronchogenic carcinomas, these apical masses situated at the thoracic inlet often involve the vertebral bodies, brachial plexus, and/or subclavian vessels by the time they are discovered. As a result, this leads to a unique constellation of ipsilateral pain, weakness, and paresthesia, classically referred to as Pancoast syndrome, or Horner's syndrome if the sympathetic chain is affected. Aortic invasion is a rare finding in advanced disease that has the potential to complicate resection. Thoracic endovascular aortic repairs (TEVARs) have traditionally been reserved for thoracic aortic aneurysms. However, the scope of use is increasing to include other aortic pathologies such as penetrating ulcers, aortic wall hematomas, and acute dissections.[2] This case report examines the role of endovascular interventions such as TEVAR in the multidisciplinary therapy for Pancoast tumors.

Clinical Case

A 60-year-old female with a 12-pack-a-year history of smoking presented to the Houston Methodist Hospital Emergency Department with new-onset Horner's syndrome and 5 months of left-sided shoulder and arm pain radiating down her flank that had previously been attributed to a "pinched nerve." The extremity was slightly swollen, with a focal area of sensory deficit over the medial aspect of her hand on exam over the C8 dermatome.

Chest computed tomography, positron emission tomography, and magnetic resonance imaging demonstrated a highly active (standardized uptake value = 44) large left lung mass— measuring 8.3 cm in its largest dimension, which involved the first rib— along with T1-T2 vertebral bodies and brachial plexus (Figure 1). This heterogeneous, infiltrating soft tissue mass extended from the apex of the left lung to the posterior triangle of the supraclavicular neck. It encased the left subclavian artery at the origin of the left vertebral artery and abutted the proximal thoracic aorta, displacing the esophagus and trachea to the right. Bronchoscopy showed a normal-appearing tracheobronchial tree. On mediastinoscopy, matted 4R and 7 lymph nodes were appreciated but biopsies of these nodes were negative. Core needle biopsy of the mass revealed a poorly differentiated non-small cell carcinoma with sarcomatoid features positive for pancytokeratin, CK7, and CK19. The patient was staged with T4N1M0 non-small cell lung cancer (NSCLC) by the TNM Classification of Malignant Tumours system.

She was offered and elected to undergo a multidisciplinary staged surgical resection with adjuvant chemoradiation. A trapdoor incision was created along the anterior border of the left sternocleidomastoid muscle to the upper median sternotomy and lateral incision at the third intercostal space (Figure 2). The left anterior chest wall was opened, and the anterior left first and second ribs were resected to better visualize the great vessels. The left phrenic nerve, left vagus nerve, left recurrent laryngeal nerve, left common carotid artery, left subclavian artery, left thyrocervical trunk, and vertebral artery were visualized and marked. The

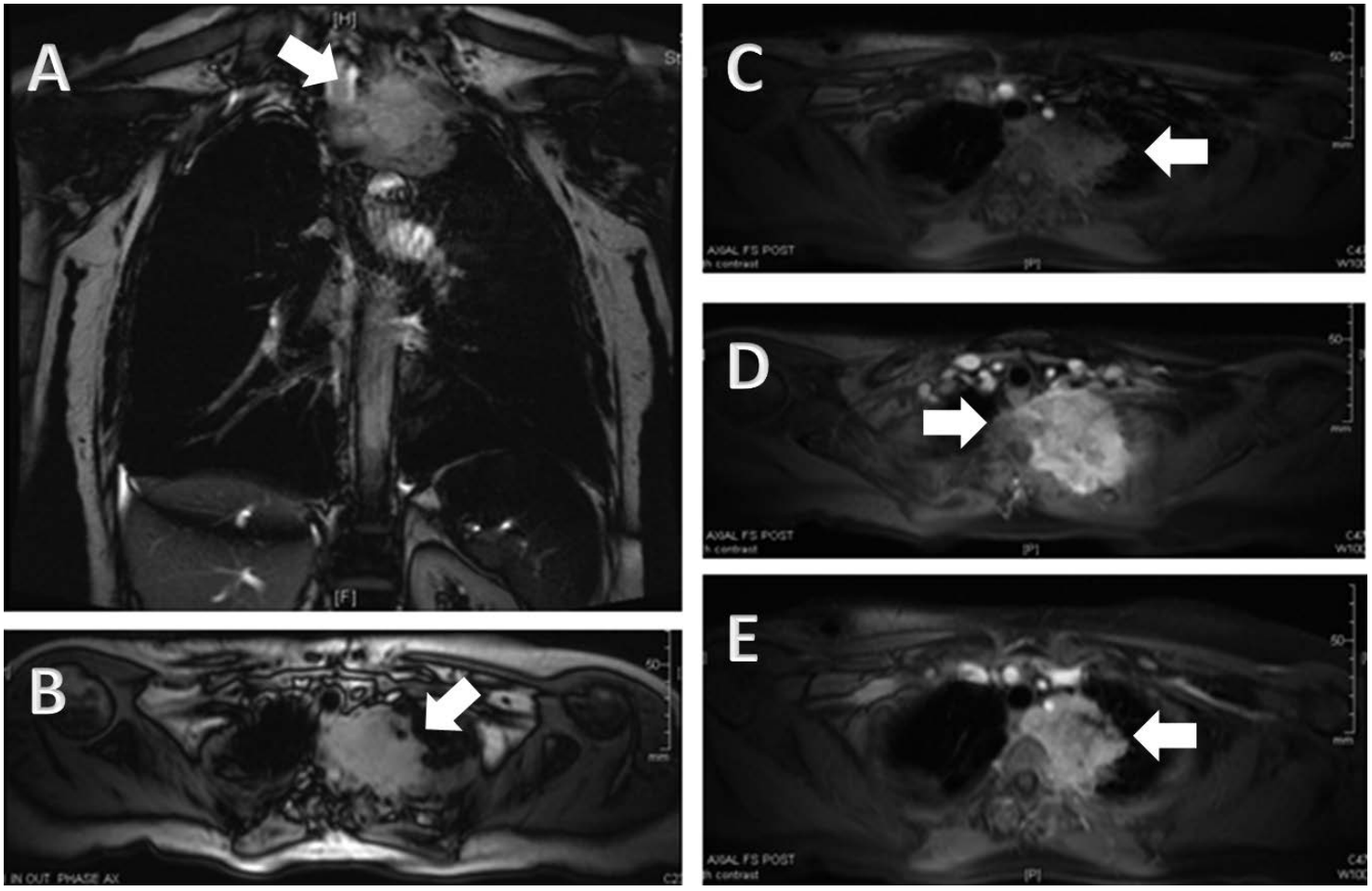

Figure 1. Preoperative magnetic resonance imaging showing mass (white arrows) in the left upper lobe involving (A) the adjacent thoracic vertebrae and (B-D) soft tissue and (E) abutting the takeoff of the left subclavian artery.

thoracic duct was ligated near its insertion into the left subclavian artery. The anterior and middle scalene muscles were divided to expose the subclavian vessels and brachial plexus. Intraoperative cervical lymph node biopsies were conducted and found to be benign. The tumor was then carefully dissected from its medial esophageal attachments and the adjacent soft tissue. A left carotid-subclavian bypass was performed using an 8-mm Dacron graft to allow resection of the involved origin of the vessel. The bulk of the tumor was then removed via a wedge resection of the left upper lobe with an endostapler, leaving behind small margins grossly invading the thoracic aorta and vertebrae. The posterior aspect of the mass was removed via corpectomy of the T2 and T3 vertebral bodies with anterior fusion of the T1 through T4 vertebra. She tolerated the procedure well and was taken to the recovery room in hemodynamically stable condition with left thoracostomy tubes in place.

The patient returned to the operating room on postoperative day (POD) 2 for further debulking. The thoracic cavity was re-entered through a left posterior midline incision. The remaining 4 x 4-cm portion of the tumor adjacent to the vertebral bodies was resected along with a grossly compromised left third rib with C7-T1, T1-T2, and T2-T3 decompressive laminectomies and left T3 nerve root transection. The remaining lung parenchyma and staple line were visually inspected through a minimally invasive left fifth intercostal space thoracotomy. The carotid-subclavian bypass was separated from the pleural cavity with GORE-TEX® mesh, and the posterior incision was covered with a paraspinous myofascial flap. The patient was transferred to the intensive care unit for postoperative management, and her thoracostomy tubes were removed on POD 9.

Her recovery was complicated by new-onset hoarseness and unilateral vocal cord paralysis found on bedside bronchoscopy on POD 10, and she returned to the operating room on POD 11 for Gelfoam injection of the left vocal cord. She was discharged from the hospital on POD 15 and evaluated for TEVAR 6 weeks later prior to her adjuvant chemoradiation to reinforce the thoracic aorta, which was necessary given the gross tumor invasion just distal to the origin of the left subclavian and concerns for subsequent structural weakness. The decision was made to deploy a 28 x 150-mm GORE® TAG® Thoracic Endoprosthesis (W. L. Gore & Associates, Inc., Flagstaff, AZ) distal to the takeoff of the left common carotid artery using a 10-mm Dacron conduit at the right external iliac (Figure 3). A post-deployment arteriogram confirmed the endograft's position, and transcranial Doppler monitoring throughout the case was negative for evidence of any emboli.

The patient has since completed her five cycles of cisplatin/docetaxel chemotherapy with 60 Gy of concurrent radiation followed by five cycles of pemetrexed. She remains radiographically negative for malignancy at more than 5 years follow-up, with no clinical complaints.

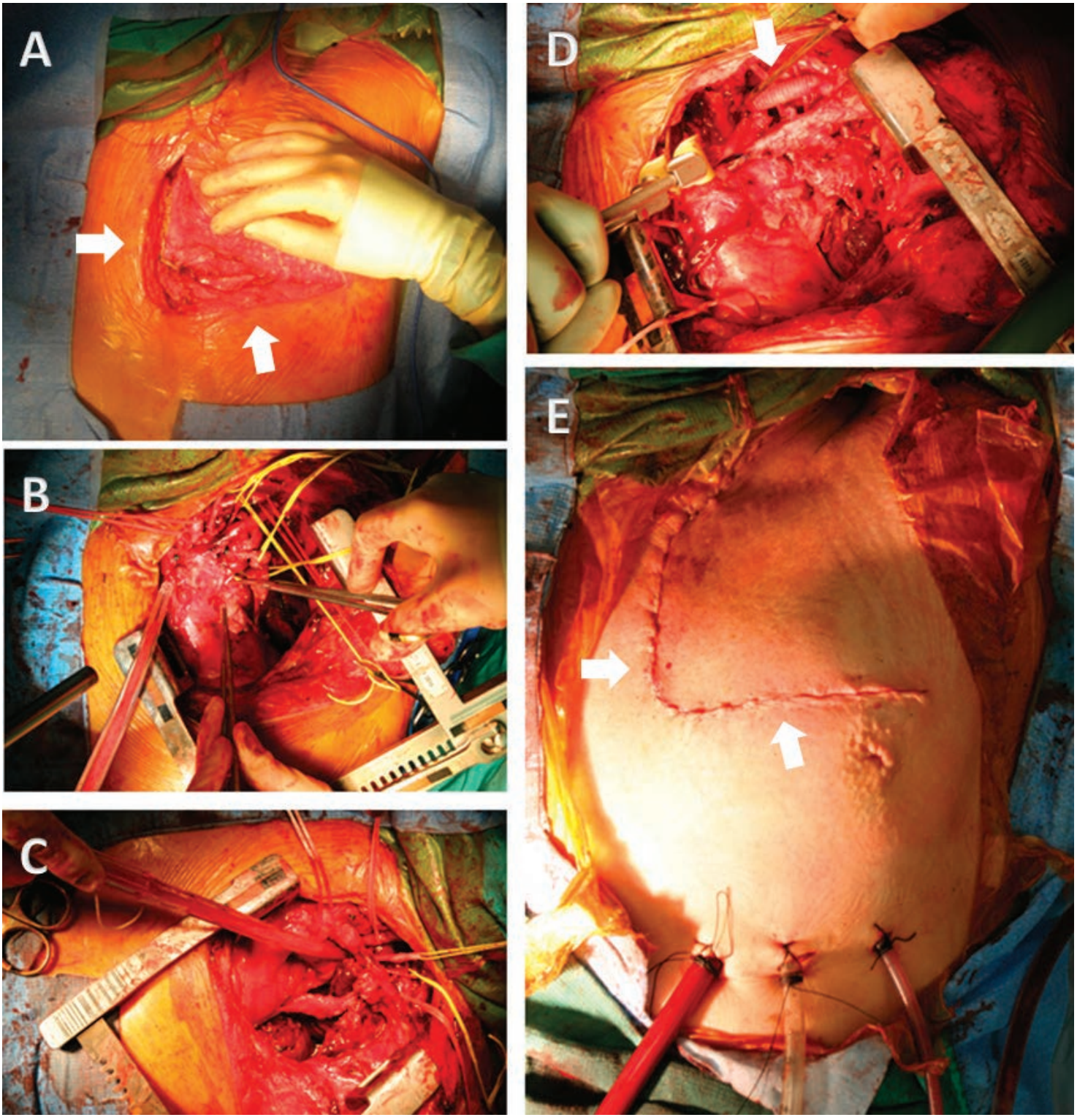

Figure 2. (A) Left trapdoor incision; (B, C) exposure of great vessels and branches; (D) Dacron carotid subclavian bypass graft; (E) skin closure and chest tube positioning.

Discussion

Once universally considered fatal, superior sulcus tumors are now managed by a multidisciplinary treatment plan, with survival rates approaching 50% when the tumor is discovered in the early stage (T3N0).[3] However, more aggressive forms of the disease with subclavian or spinal involvement (T4), as seen in this case, still remain a therapeutic challenge. While operative mortality is low at 4%, Rusch et al. reported complete resection in only 64% of T3N0 and 39% of T4N0 patients, which was linked to an overall decreased 5-year survival of 46% and 13%, respectively.

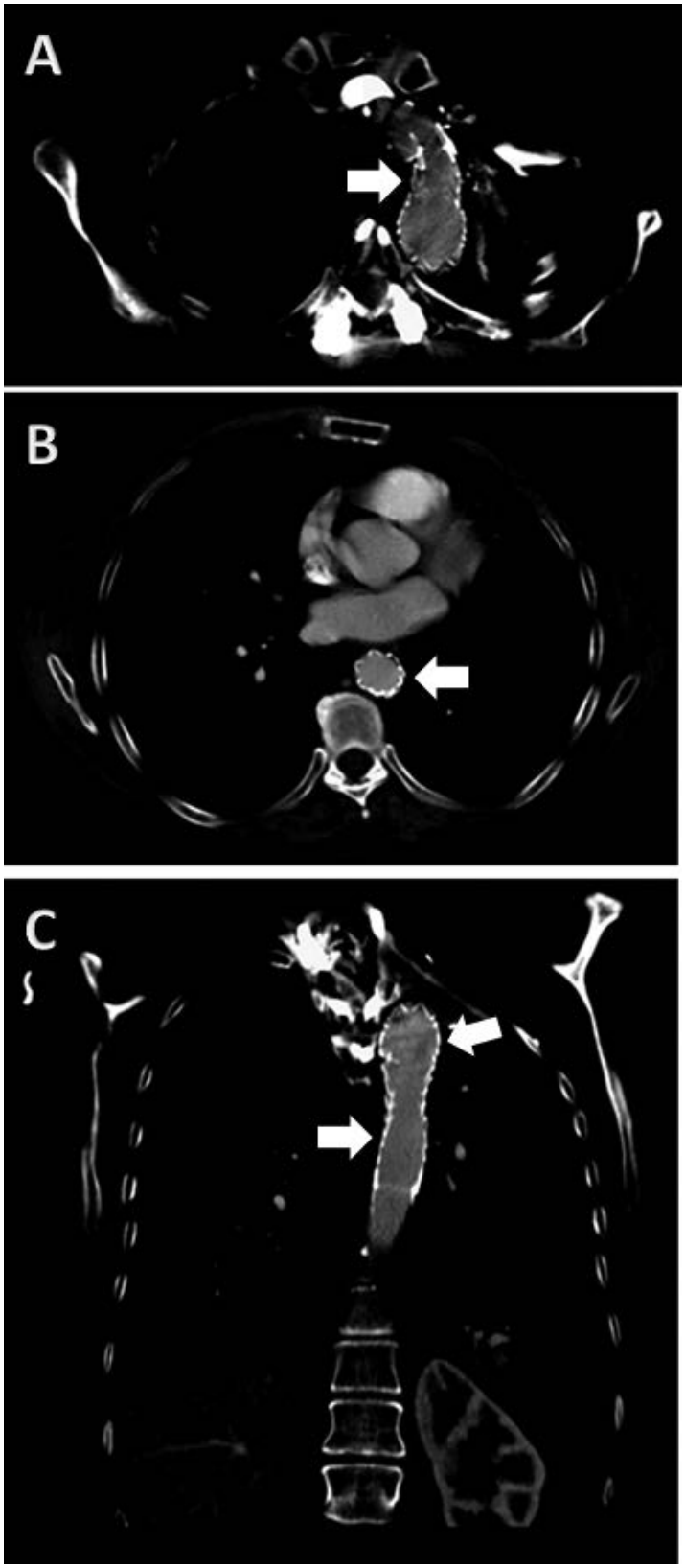

Figure 3. Postoperative magnetic resonance imaging showing extent of thoracic endograft (white arrows) from (A) distal aortic arch to (B, C) descending thoracic aorta.

An anterior transcervical approach allowing better exposure of subclavian vessels and vascular reconstruction, first described by Dartevelle et al., has shown improved overall 5-year survival for T4 patients (31%)[4] and become the accepted standard for thoracic inlet tumors with vascular invasion. However, no standard approach exists for advanced cases with aortic involvement, as in our patient, and the current American College of Chest Physician guidelines still advocate primary platinum-based chemoradiation given the difficulty in resecting these tumors.[5,6]

Endovascular therapy is rapidly becoming the first line of treatment for aortic disease including dissection, injury, and aneurysm repair.[7-9] Decreased perioperative complication rates and lengths of stay[10] compared to traditional open approaches have been powerful instigators for this change and the continual push to expand current standards. In 2004, Sasahara et al. developed a canine model to evaluate aortic stent grafting for invasive esophageal carcinoma and demonstrated successful resection of 1-cm segments of up to one-half the circumference of the aortic wall between 3 and 28 days after stent deployment.[11]

A few cases of neoadjuvant aortic stenting have since been described to facilitate resection of other thoracic pathologies,[12-14] but long-term follow-up is still lacking. Roche-Nagle et al. reported two cases, one of a chondrosarcoma indenting the posterior thoracic aorta and another of a left upper lobe mass involving the subclavian artery and aortic arch, and both had en-bloc resection of the tumors after aortic stenting.[12] Marulli et al. described a patient with recurrent metastatic eccrine porocarcinoma of the left upper lobe with aortic infiltration that benefited from an aortic endograft prior to completion pneumonectomy.[13] Similarly, Berna et al. published a case of a patient with T4 NSCLC of the left lower lobe with aortic involvement who received an aortic endostent before en-bloc resection.[14] Average follow-up for each of these cases did not exceed 23 months (Table 1).

Our patient had residual tumor adherent to her descending thoracic aorta and was stented with a Gore TAG endograft prior to chemoradiation to reinforce aortic integrity. She remains radiographically free of disease at more than 5 years follow-up without any graft complications. More studies are needed to fully elucidate the utility of this endograft in this setting, but we believe it may prove to be a valuable adjunct to complicated thoracic tumor resections.

Conclusion

Our experience suggests that aortic endografting may be a safe tool when combined with chemoradiation to treat tumors infiltrating the aortic wall and could be a useful alternative to reduce the potential morbidity and mortality of cross-clamping and interposition graft replacement. While further studies are necessary to fully evaluate this technique, we believe it may represent an appropriate option for select patients with tumors involving the thoracic aorta.

Conflict of Interest Disclosure: Dr. Lumsden has industry relationships with Hansen Medical, Inc., W.L. Gore & Associates, Inc., Boston Scientific Corporation, Maquet, Siemens AG, Medtronic, Inc., and Covidien; Dr. Reardon conducts research sponsored by Medtronic, Inc.; Dr. Marco has industry relationships with Aesculap, Inc., DePuy Synthes Spine, NuVasive, Inc., and Globus Medical, Inc.

Keywords: thoracic endovascular aneurysm repair, Pancoast tumor, non-small cell lung cancer

	1	2	3	4
	Roche-Nagle et al.[12]	Roche-Nagle et al.[12]	Marulli G et al.[13]	Berna P et al.[14]
Study type	Case report	Case report	Case report	Case report
Number of patients	1	1	1	1
Age (years)	43	52	61	59
Histology	Chondrosarcoma	Adenocarcinoma	Porocarcinoma	Adenocarcinoma
TNM	N/A	T4N0M0	N/A	T4N1M0
Stage	N/A	IIIa	N/A	IIIa
Aortic stent	Medtronic Talent	Medtronic Talent	Zenith TX2	Zenith TX2
	24 x 100 mm	30 x 150 mm	28 x 120 mm	32 x 160 mm
Complication	Empyema	None	None	None
Follow-up	6 weeks	11 days	10 months	23 months
Status	Disease free	Disease free	Disease free	Disease free
TNM: Staging by TNM Classification of Malignant Tumours.				

Table 1. Literature on aortic stenting for thoracic tumors.

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