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Transthoracic, Transdiaphragmatic Excision of Simultaneous Lung and Adrenal Lesions

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Simultaneous adrenal and pulmonary lesions frequently present a therapeutic challenge to the thoracic surgeon. We describe 2 cases in which a transthoracic, transdiaphragmatic approach was used to establish tissue diagnosis and complete removal of gross tumor. In 1 case an intraoperative decision to perform a pneumonectomy was dictated by the tissue diagnosis of the adrenal mass, which was obtained with relative ease via this method. In both cases the morbidity of traditional approaches for adrenal operation was avoided.

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The surgical approaches to the adrenal gland are dictated by the lesion's size, its physiologic properties, and the preferences of the individual surgeon. Traditionally described methods include flank, anterior, posterior, and thoracoabdominal approaches. Successful staged and simultaneous resections of lung and adrenal lesions have been previously described [1] in which separate thoracic and abdominal incisions were used to accomplish the metastasectomies. Recently, a thoracoscopic, transdiaphragmatic needle biopsy of an adrenal mass was described [2]. We report 2 cases in which lung resection and transthoracic, transdiaphragmatic adrenalectomy were performed, obviating the need for a separate abdominal or flank incision. In 1 case a significant intraoperative decision to perform a pneumonectomy was based on the findings obtained by this method.

Case Reports

Patient 1

A 58-year-old woman underwent total abdominal hysterectomy for uterine leiomyosarcoma. Six years later, she underwent right upper lobe wedge and chest wall resections for recurrent leiomyosarcoma. She remained asymptomatic until 5 years later when, on routine screening, she was found to harbor a recurrence in the right

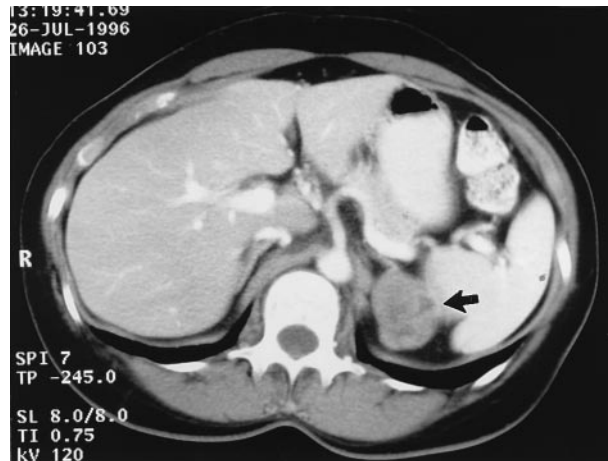


Fig 1. Abdominal computed tomographic scan after administration of oral and intravenous contrast reveals a left adrenal mass (arrow). No other evidence of intraperitoneal metastases was noted.

upper lobe and new deposits in the right lower and left upper lobes, as well as a left adrenal mass (Fig 1).

In an effort to resect all recurrences, we performed a left thoracotomy first with the intent of performing a right thoracotomy at a later date to resect the remaining tumor. Under epidural and general anesthesia with a double-lumen endotracheal tube, the patient was positioned in the right lateral decubitus position. A left posterolateral thoracotomy was performed through the eighth interspace. Wedge resection of the left upper lobe lesion was performed. Intraoperative frozen section confirmed recurrent leiomyosarcoma. To avoid a second incision in the abdomen, the decision was made to proceed with adrenalectomy via a transdiaphragmatic approach.

An 8-cm curvilinear incision was made along the posterolateral aspect of the left hemidiaphragm. A 5.0 × 4.0-cm adrenal mass could be seen abutting the diaphragmatic undersurface. Feeding vessels were serially clamped and the mass was resected en bloc and delivered through the thoracotomy incision. The diaphragmatic defect was reapproximated using continuous non-absorbable suture. A chest tube was placed in the left pleural cavity and the thoracotomy incision was closed in a standard manner. She had an uneventful postoperative recovery and was discharged home on the fifth postoperative day.

Pathologic examination revealed leiomyosarcoma. She was readmitted 4 months later, at which time she underwent a right thoracotomy and right upper and lower lobe wedge resections. She recovered without sequelae and is currently free of recurrence at 4-month follow-up. Follow-up chest roentgenograms revealed no evidence of diaphragmatic herniation.

Patient 2

A 67-year-old man presented with stage IIIA squamous cell carcinoma of the right lung. He was treated with two cycles of cis-platinum and vinorelbine tartrate and exter-

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Fig 2. Abdominal computed tomographic scan, taken with the patient in the prone position, demonstrating a right adrenal mass (arrow). No other intraperitoneal evidence of disease noted.

nal-beam irradiation with partial response. A computed tomographic scan after chemoradiation showed tumor limited to the right hemithorax with no evidence of mediastinal invasion or adenopathy. A work-up for metastatic disease revealed a 2-cm right adrenal mass on computed tomographic scan (Fig 2). A computed tomography-guided core biopsy was nondiagnostic.

The operative plan was for right pneumonectomy with transdiaphragmatic right adrenalectomy. A right posterolateral thoracotomy was performed with a fifth rib resection. At exploration, the tumor was noted to extend into the right atrium. Because of this degree of local invasion, we decided to proceed with the pulmonary resection only if the adrenal mass proved not to be a metastasis. The posterolateral diaphragm was incised in a circumferential fashion. The liver was retracted medially, and the right kidney was retracted laterally. Dissection in the retroperitoneal fat allowed exposure of the right adrenal gland. The gland, which was largely replaced by the mass, was mobilized by sharp dissection; the arteries and vein were exposed and clipped. The frozen-section diagnosis was cortical adenoma; hence, the pneumonectomy proceeded as planned. The postoperative course was uneventful. Final pathologic diagnosis confirmed the finding of adrenal cortical adenoma; the pulmonary resection specimen showed microscopic tumor involvement of the bronchial margin and in one of twelve peribronchial lymph nodes. Follow-up chest roentgenograms revealed a normal right hemidiaphragm.

Comment

A variety of operative approaches have been described for performing adrenalectomy. In general, the surgical approach is dictated by the size and nature of the adrenal lesion. However, all the traditional approaches are cumbersome and time consuming, and they carry additional morbidity in patients already undergoing a thoracotomy. Our approach allows for simultaneous removal of tho-

racic and adrenal tumors through a single incision. In situations in which surgical management depends on histologic evaluation of the adrenal gland, an accurate sample of tissue can be obtained with relative ease.

Our first patient underwent repeated surgical procedures in an effort to control her metastatic leiomyosarcoma. For a subset of patients with visceral metastases from sarcomas, surgical resection of the metastatic deposits can result in prolonged disease-free survival and cure [3, 4]. There are no current guidelines limiting the number of metastatic nodules to be considered for resection, and these patients usually undergo multiple staged procedures in an effort to minimize the morbidity from the underlying disease. However each additional surgical procedure increases their overall operative morbidity. Our approach in patients with simultaneous lung and adrenal metastasis would reduce the number of separate surgical procedures required to obtain the desired amount of tumor control, therefore, decreasing overall morbidity.

Our second patient underwent a pneumonectomy based on the intraoperative identification of a benign adrenal lesion. Adrenal metastases are noted in approximately 15% of lung cancer patients in some series [5], and benign cortical adenomas of the adrenal glands are a frequent normal finding seen in 3% to 5% of the general population [6]. Percutaneous biopsy of the adrenal gland is advocated when preoperative computed tomographic evaluation reveals adrenal enlargement in patients with non-small cell bronchogenic carcinoma. However, biopsy results are subject to sampling error and differing pathologic opinions; furthermore, specimens are commonly nondiagnostic. The transthoracic, transdiaphragmatic approach is an easy and convenient method of determining with certainty the nature of an adrenal mass in equivocal cases.

The literature suggests that extrathoracic spread of lung cancer implies inoperability, so patients with primary lung lesions solely metastatic to the adrenal gland have not been considered surgical candidates. However, with modern adjuvant therapy, aggressive surgical resection may require reevaluation. There have been several reports of combined excision of primary lung tumors and metastatic adrenal lesions with improved survival [7, 8]. The transthoracic, transdiaphragmatic adrenalectomy may offer a less morbid and technically easier approach to aggressive tumor resection in this subset of patients.

Transthoracic, transdiaphragmatic adrenalectomy is a useful tool for the subset of patients in whom resection of simultaneous lung and adrenal lesions is warranted and fine-needle aspiration of the adrenal has failed. The procedure can be done on either side of the diaphragm. The approach is technically simple and expeditious and provides excellent exposure while obviating the need for a separate abdominal incision. The transthoracic, transdiaphragmatic approach appears to be a safe and useful option in the surgeon's armamentarium in managing simultaneous thoracic and adrenal disease.

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Obstructive Rhabdomyoma and Univentricular Physiology: A Rare Combination

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We report the successful excision of a large left atrial rhabdomyoma producing complete obstruction of both inflow and outflow to the left ventricle. Systemic perfusion was dependent on anterograde ductal flow. The resultant univentricular physiology was initially managed medically, with spontaneous tumor regression contemplated as a means of possible long-term "cure." Failure to achieve hemodynamic stability compelled urgent surgical excision. This neonate was successfully discharged home with an in-series biventricular circulation.

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Cardiac rhabdomyomas are the most common benign cardiac tumor in infancy and are associated with tuberous sclerosis in 51% to 86% of patients [1]. Sponta-

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neous tumor regression is well documented; however, the mechanism is not fully understood. In general, surgical resection when required remains rewarding. Although rhabdomyomas are histologically benign, they may cause life-threatening arrhythmias or significant hemodynamic obstruction [2].

Obstructive left-sided rhabdomyomas remain a surgical challenge. A retrograde approach via the aortic valve is hampered by the limited size of the aortic valve annulus (5 to 7 mm in the neonate). Less desirable approaches are antegrade via the mitral valve with or without detachment of a valve leaflet, or via a left ventriculotomy. Rarely does the tumor attach to a semi-lunar or atrioventricular valve requiring either repair or replacement [3].

A 39-week gestation, 3.8-kg neonate born by emergency cesarian section remained cyanosed and with refractory supraventricular tachyarrhythmias. A 12-lead electrocardiogram revealed preexcitation with a delta wave axis indicating an accessory pathway between the left lateral and the left anterior positions [4]. Echocardiographic analysis demonstrated (1) a large left atrial mass measuring 1.7×1.6 mm arising from the atrioventricular groove with possible adherence to the posterior mitral valve apparatus, (2) near-total obliteration of mitral inflow, (3) absence of anterograde aortic flow, (4) retrograde ascending aortic blood flow, and (5) mild aortic regurgitation, possibly related to the tumor's mass effect. The possibility of circumflex coronary arterial compression was entertained based on the unexpected finding of significant left ventricular dysfunction. A large unrestrictive atrial septal defect with a left-to-right shunt and patent ductus arteriosus with a right-to-left shunt permitted survival. A trial of medical management failed with evidence of progressive systemic hypoperfusion. Urgent tumor excision was deemed necessary.

Cardiopulmonary bypass with moderate hypothermia was established via the ascending aorta and venae cavae. Manual cardiac compression and intravenous administration of adenosine were required for hemodynamic compromise due to runs of supraventricular tachycardia. Anterograde sanguineous cardioplegia was introduced, arresting the heart in diastole. A right atriotomy was performed with the caval snares tightened. Via an enlarged patent foramen ovale, the left atrium was exposed and examined. A firm, white to grey multilobulated mass was identified and, as demonstrated by the preoperative echocardiogram (Fig 1), was found adherent to the posterolateral region of the atrioventricular groove. External examination revealed the tumor mass to be without evidence of circumflex arterial involvement.

The tumor was secured with a 5-0 silk suture, and gentle traction provided sufficient exposure to initiate resection. The tumor was removed in several large pieces, being too large to be extracted en masse via the atrial septum. The mitral valve apparatus came into view. The anterior leaflet was completely free of tumor. The posterior leaflet required partial separation from the tumor mass. Tumor resection stopped flush with the left

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