

Laparoscopic Adrenalectomy for Suspected Metastasis of Adrenal Glands: Our Experience

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OBJECTIVES

To present our experience in laparoscopic adrenalectomy for isolated adrenal metastasis.

METHODS

A total of 34 adrenalectomies were performed in 32 patients for incidental adrenal masses discovered at primary tumor diagnosis or during follow-up. The primary tumors diagnosed were 13 cases of lung carcinoma, 9 of renal cell carcinoma, 2 of colorectal carcinoma, 2 of bladder carcinoma, and 1 each of ovarian carcinoma, breast cancer, gastric cancer, and melanoma. Two patients had no history of a primary tumor. The mean patient age was 59 years (range 26 to 75). The male/female ratio was 1.9:1.

RESULTS

The mean operative time was 87 minutes (range 40 to 240). The average blood loss was 89 mL (range 0 to 1000). No conversions to open surgery were needed. The mean hospital stay was 3 days (range 1 to 5). One intraoperative diaphragmatic lesion developed that was repaired laparoscopically, and 1 patient had a pancreatic fistula that was managed by percutaneous drainage. The mean tumor size was 4.3 cm (range 1.5 to 9). The microscopic analysis revealed 22 malign lesions (64.7%) and 12 cases of benign pathologic features (35.3%). The mean survival time was 26 months (range 4 to 64) for the 22 patients with malign lesions. In 2 patients (9.1%), the surgical margins were positive.

CONCLUSIONS

Laparoscopic adrenalectomy for small isolated metastases is feasible. However, because of the high risk of positive margins, this procedure should only be done by expert laparoscopists. We did not find a correlation between mass size and malignancy. Nevertheless, we believe that longer follow-up is mandatory before definitive conclusions can be drawn. UROLOGY 69: 637–641, 2007. © 2007 Elsevier Inc.

The adrenal gland is a site of metastatic spread for many tumors.¹ The adrenal gland's rich sinusoidal blood supply explains the common occurrence of adrenal metastases. With the widespread use of imaging techniques, an increasing number of adrenal lesions are being detected incidentally, during follow-up, or at the initial diagnosis of the primary tumor.² Adrenal metastases originating from the lung, breast, and colon and renal cell carcinoma are not uncommon. Cases of adrenal metastases from melanoma and prostate, liver, transitional cell, and gastrointestinal carcinoma have also been reported.^{3,4} Usually the presence of adrenal metastasis signals widespread disease; however, isolated adrenal me-

tastasis have been reported, particularly in non-small cell lung cancer.^{5–8}

Since 1992, laparoscopic adrenalectomy has become the reference standard in the management of benign adrenal masses. In 1999, laparoscopic adrenalectomy for cancer was first reported by Heniford *et al.*⁸ Nevertheless, controversy persists on the use of laparoscopic adrenalectomy in the setting of malignancy.^{9–11} However, several reports have described long-term survival after laparoscopic adrenalectomy for isolated adrenal metastasis.^{7,8}

We present our experience in the laparoscopic management of suspected metastasis of the adrenal gland.

MATERIAL AND METHODS

Of a total of 228 laparoscopic transperitoneal adrenalectomies performed at our institution from June 1993 to April 2006, 34 were performed for incidental adrenal masses in 32 patients. These lesions were discovered at the primary tumor diagnosis or during follow-up. The primary tumors diagnosed were 13 cases of lung carcinoma, 9 of renal cell carcinoma, 2 of colorectal carcinoma, 2 of bladder cancer, and 1 each of ovarian carcinoma, breast cancer, gastric cancer, and melanoma. Two pa-

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Table 1. Demographic data

Procedures (n)	34
Patients (n)	32
Male/female ratio	1.9:1
Side (n)	
Left	24
Right	10
Primary tumor (n)	
Lung	13 (41)
Kidney	9 (29)
Bladder	2 (6)
Colon	2 (6)
Melanoma	1 (3)
Gastric	1 (3)
Breast	1 (3)
Ovarian	1 (3)
Unknown primary tumor	2 (6)

Data in parentheses are percentages.

Table 2. Outcomes

Mean operative time (min)	87
Mean operative bleeding (mL)	89
Mean hospital stay (days)	3
Complications	3 (8.7)
Intraoperative (diaphragm injury)	1 (2.9)
Postoperative (pancreatic fistula)	1 (2.9)
Delayed (incisional hernia)	1 (2.9)
Mean tumor size (cm)	4.3
Mean tumor size for malignancy (cm)	5.1
Microscopic analysis	
Malignant lesions	22 (64.7)
Benign lesions	12 (35.3)
Positive surgical margins (n)	2 (9.1)
Mean survival time for patients with malignancy (mo)	26

Data in parentheses are percentages.

tients had no history of a primary tumor. The mean patient age was 59 years (range 26 to 75). The male/female ratio was 1.9:1. All patients underwent complete preoperative staging with computed tomography (CT). The transperitoneal lateral approach was used for all procedures. The selection criteria for this approach were an adrenal mass of 10 cm or less without evidence of periadrenal infiltration, caval thrombus, or locoregional lymphadenopathy on preoperative CT. Bilateral synchronous laparoscopic adrenalectomy was performed in 2 patients, 1 with suspected melanoma and 1 with lung carcinoma metastasis. Patients were followed up with CT every 6 months, or sooner if they became symptomatic. The patient demographic data are presented in Table 1.

All procedures were done transperitoneally. The patient was placed in either the left or right lateral decubitus position. When left-side adrenalectomy was performed, three trocars were placed 3 cm below the costal rim: a 10-mm trocar on the medial axillary line for the camera, a second 10-mm trocar on the posterior axillary line, and a third 5-mm trocar on the median clavicular line as working ports. In these cases, it was necessary to divide the splenicocolic ligament and reflect the splenic angle of the colon. The spleen and tail of the pancreas were mobilized medially to visualize the adrenal gland. Gerota's fascia was opened between the medial portion of the kidney and the adrenal mass, allowing the mass to fall medially and facilitating identification of the renal and adrenal veins.

For the right-side procedures, a fourth 5-mm trocar was added in the epigastrium, through which the forceps were placed to keep the liver from obstructing the field. In these cases, the triangular hepatic ligament was sectioned, allowing the liver to move forward and out of the way. Then, the posterior peritoneum was incised transversally, immediately caudally along the length of the liver. We found it very useful to dissect the avascular plane between the upper pole of the kidney and the adrenal gland. This dissection was deepened until the posterior muscular structures were clearly visualized. Next, the dissection was extended laterally along Toldt's line and medially over the inferior vena cava. This maneuver allowed the mass to reflect cephalically, facilitating the exposure of the inferior vena cava and the right adrenal vein.

For the right and left procedures, the main suprarenal vein was dissected, clipped, and divided, and the surgical specimen was always extracted in a polyurethane bag.

RESULTS

The mean operative time was 87 minutes (range 40 to 240). The average blood loss was 89 mL (range 0 to 1000). No conversions to open surgery were needed. The mean hospital stay was 3 days (range 1 to 5). Only one intraoperative complication (2.9%) developed, a diaphragmatic lesion that occurred during excision of a 5-cm left adrenal mass in a patient with lung carcinoma. The lesion was effectively repaired laparoscopically without the need for chest tube placement. The adrenal mass was a cortical adenoma. One patient (2.9%) had a pancreatic fistula that was successfully managed by percutaneous drainage. The pancreatic lesion occurred during left adrenalectomy for a 5-cm renal cell carcinoma metastasis. Delayed complications occurred in 1 patient (2.9%) represented by an incisional hernia. No perioperative mortality occurred in the series. The mean tumor size was 4.3 cm (range 1.5 to 9). In 2 cases, renal invasion mandated en bloc radical nephrectomy. One of these patients had a 9-cm adrenal melanoma metastasis and the other presented with a 5-cm renal cell carcinoma metastasis. Microscopic analysis revealed 22 malign lesions (64.7%) and 12 cases of benign pathologic features (35.3%), included adenoma in 9, nodular hyperplasia in 2, and adrenal hemorrhage in 1. The mean survival time was 26 months (range 4 to 64) for the 22 patients with malign lesions. In the 2 patients with an unknown primary tumor, the histologic specimens revealed squamous cell carcinoma and embryonal carcinoma. The mean tumor size for malignant lesions was 5.1 cm (range 2.5 to 9) and the mean tumor size for benign lesions was 4.3 cm (range 1.5 to 6.5); the difference was not statistically significant ($P = 0.09$). In 2 patients (9.1%), 1 with bladder cancer and 1 with lung carcinoma, the surgical margins were positive. Both patients had a mass of less than 6 cm. No port site recurrences developed. Two patients underwent bilateral adrenalectomy, one for bilateral melanoma and one for lung carcinoma. The outcomes are summarized in Table 2. Table 3 shows the correlation between the

Table 3. Correlation between primary tumor and final pathologic mass analysis

Primary Tumor	Patients (n)	Histologic Analysis Positive for Cancer (Surgical Specimens)
Lung	13 (41)	1.0
Kidney	9 (29)	4 and 1 (lymphoma)
Bladder	2 (6)	1
Colon	2 (6)	0
Melanoma	1 (3)	2
Gastric	1 (3)	1
Breast	1 (3)	0
Ovarian	1 (3)	1
Unknown	2 (6)	2*

Data in parentheses are percentages.

* One embryonal carcinoma and one squamous cell carcinoma.

primary tumor and final pathologic mass examination findings.

COMMENT

Adrenal metastases from many types of tumors are rarely diagnosed during a patient's lifetime.¹ However, with the increased use of modern imaging studies, adrenal lesions are being diagnosed more commonly.¹²⁻¹⁴ An incidentally discovered adrenal mass in a patient without a history of cancer is rarely malignant or metastatic.¹² In contrast, as many as 83% of clinically suspected adrenal metastases are truly positive.^{2,4} Because a solitary adrenal metastasis from an extra-adrenal primary tumor is usually small and confined within the adrenal gland, the use of laparoscopic adrenalectomy has been advocated for its management.^{11,15} Various imaging techniques have been used in an attempt to define the nature of the adrenal masses, especially in patients with a history of cancer. CT cannot reliably characterize an adrenal lesion as benign or metastatic, and magnetic resonance imaging is also of limited value because of its high false-positive rate.¹² However, a lesion larger than 5 cm, invasion into the adjacent adrenal tissue, and evidence of growth during follow-up are helpful criteria in distinguishing malignant lesions from adenomas.^{2,11} Despite the 13% rate of malignant lesions reported in masses of less than 5 cm, the inability of radiologic imaging to accurately differentiate malign from benign lesions has resulted in the persistent use of size as an indicator of malignant potential.^{2,16} However, we observed that the mean tumor size for metastases was not significantly different from that of benign pathologic lesions (5.1 cm and 4.3 cm, respectively, $P = 0.09$). However, these lesions were not incidental and the size criterion is much more predictive for patients without a history of malignancy. The use of 2-[F-18]-fluorodeoxyglucose-positron emission tomography, an imaging technique that uses the increased levels of hexokinase (the enzyme responsible for glucose phosphorylation) in malignant cells, appears promising in characterizing metastatic adrenal masses.^{13,14} Although it

is not diagnostic, three-dimensional CT and/or magnetic resonance imaging should be performed to precisely image the adrenal mass and its surrounding structures. Critical radiographic findings determining the feasibility of laparoscopic adrenalectomy are the visualization of fat between the adrenal gland and aorta or inferior vena cava, evidence of local invasion into the perirenal fat or adjacent organs, and ruling out the presence of venous thrombus.^{2,17} Intraoperative laparoscopic ultrasonography can be used to evaluate the adrenal mass, its relationship to the surrounding structures, and the presence of local lymphadenopathy.¹⁸ Fine needle aspiration cytology for the diagnosis of adrenal metastases has good sensitivity but is of poor value in the diagnosis of adrenal carcinoma.¹⁹ Also, this technique risks tumor capsule disruption and tumor cell spillage and dissemination along the needle tract. Moreover, fine needle aspiration cytology can cause bleeding and adhesion of the adrenal gland to the surrounding tissues, making subsequent dissection more difficult.¹⁹ The only justifiable use of fine needle aspiration cytology is in deciding the patient's best possible treatment such as in the case of a nonresectable adrenal gland with a suspected chemosensitive tumor. Laparoscopic adrenalectomy for malignant disease is risky; concern exists regarding the possibility of tumor rupture and abdominal dissemination of malignant cells, as well as port site seeding.²⁰ Adrenal cancer is usually large and often locally infiltrative into the perirenal fat, increasing the potential risk of tumor dissemination.²¹ Moreover, adrenal cancer may invade adjacent organs or regional lymph nodes, which also require resection. However, several investigators have published series of laparoscopic adrenalectomy for malignancy and reported recurrence rates similar to those for patients who have undergone open adrenalectomy for adrenal carcinoma.⁴ Kebebew *et al.* reported a 60% locoregional recurrence rate 1 to 2.5 years after laparoscopic adrenalectomy for primary adrenal cancer.^{4,9}

Several investigators have documented that aggressive surgical resection of adrenal metastasis, when done in patients with solitary, excisable disease and after a long disease-free interval, can result in prolonged patient survival (especially in patients with non-small cell lung cancer or renal cell carcinoma).⁷ Heniford *et al.*⁸ reported a 5-year survival rate of 20% to 45% in patients with a solitary adrenal metastasis who underwent complete excision of the adrenal mass. Other investigators have compared adrenalectomy with chemotherapy in the setting of a single adrenal metastasis and found significant longer survival times for the surgical group.⁷ Nevertheless, few studies have been done on laparoscopic adrenalectomy for solitary adrenal metastasis. No studies have compared open versus laparoscopic resection of solitary adrenal metastasis, because it is difficult to recruit patients. Moreover, no prospective randomized studies have been done demonstrating that resection of solitary adrenal metastasis increases patient survival. We used the laparoscopic

Table 4. Correlation with previously published series

Investigator	n	Tumor Type	Surgical Technique	Conversion to Open Surgery	Complication Rate (%)	Positive Surgical Margins (n)	Median Survival (mo)
Heniford <i>et al.</i> , ⁸ 1999	12	Various*	Transperitoneal 8 Retroperitoneal 4	1	9	0	8.3 (91% survived)
Kebebew <i>et al.</i> , ⁴ 2002	24	Various†	NR	1	12.5	0	40 (65% survival)
Sarela <i>et al.</i> , ²² 2003	11	Various	NR	0	NR	NR	21 (60% survival)
Moinzadeh <i>et al.</i> , ²³ 2005	33	Various‡	Transperitoneal 17 Retroperitoneal 15 Transthoracic 1	1	13	1 (2 indeterminate and 1 not documented)	26 (52% survived)
Present series	34	Various	Transperitoneal	0	9	2	26 (44% survived)

NR = not reported.

Only series with 7/10 patients included.

* Including 1 adrenal carcinoma.

† Including 5 adrenal carcinoma.

‡ Including 7 adrenal carcinomas.

approach in the patients with suspected adrenal metastasis—with palliative intent for large symptomatic synchronous adrenal metastasis and with curative intent for solitary small adrenal metastasis.

We emphasize that special care must be taken to avoid positive surgical margins when performing adrenalectomy for suspected metastasis. In our series, the surgical margins were positive in only 2 cases (9.1%); both patients had a tumor of less than 6 cm. This fact suggests that size was not a direct cause of the positive surgical margin and that other factors, such as previous surgery or adhesion to other anatomic structures, could play a decisive role, independent of whether the surgical approach was laparoscopic or open. We believe that laparoscopic adrenalectomy for an adrenal mass in the setting of malignancy permits safe resection while maintaining oncologic principles, independent of size. Also, the complication rate associated with laparoscopic adrenalectomy for suspected adrenal metastasis was not increased. Moinzadeh and Gill²³ reported four complications (13%) in their 33-patient series; however, none of these complications were associated with technical difficulty. In our series, 3 patients (9%) presented with complications that were not directly related to the tumor size or pathologic findings. Table 4 shows the correlation with previously published series. In a multi-institutional study by Yoshida *et al.*,²⁴ a 15% complication rate was observed in 369 patients who underwent laparoscopic surgery for benign pathologic lesions. It is evident that the incidence of complications is comparable to that occurring during laparoscopic adrenalectomy for benign pathologic features.

CONCLUSIONS

Laparoscopic adrenalectomy for small isolated metastases is a feasible procedure. Significant improvement in survival has been observed after adrenalectomy in the setting of a single adrenal metastasis. Well-selected patients may benefit from the minimally invasive approach. However, we believe that longer follow-up is mandatory before definitive conclusions can be made.

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