

# Laparoscopic Adrenalectomy for Isolated Adrenal Metastasis

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## ABSTRACT

**Background:** Laparoscopic adrenalectomy is accepted by many as the standard of care for the majority of adrenal masses less than 8 cm. The question exists whether laparoscopic removal of metastatic lesions to the adrenal is more difficult than laparoscopic removal of primary adrenal lesions.

**Methods:** We performed a retrospective analysis of all laparoscopic adrenalectomies performed at a single institution from 1998 to 2001, comparing laparoscopic adrenalectomies for primary lesions of the adrenal gland versus isolated metastatic lesions to the adrenal gland.

**Results:** Fourteen laparoscopic adrenalectomies were attempted, 10 for primary disease and 4 for metastatic disease. All 10 laparoscopic procedures were completed successfully for primary disease (average operative time=218 minutes, average tumor size=4 cm, median hospital stay=2 days). Only one of the 4 laparoscopic adrenalectomies for metastatic disease was completed successfully (average operative time=332 minutes, average tumor size=7.3 cm, median hospital stay=2 days). No major complications occurred in either group.

**Conclusions:** We feel laparoscopic adrenalectomy is the preferred approach for primary adrenal masses less than 8 cm. Based on our experience and a review of the literature, isolated metastatic lesions to the adrenal gland appear less amenable to laparoscopic removal than do primary lesions of the same size.

**Key Words:** Laparoscopy, Adrenalectomy, Adrenal metastasis.

## INTRODUCTION

Surgery of the adrenal gland has undergone a revolution over the last decade. Before the 1990s, removal of the adrenal gland required an open incision. Because the adrenal gland is a small, friable structure, and is located high in the retroperitoneum, a large abdominal or flank incision was generally required.<sup>1,2</sup> This surgery necessitated a long postoperative course. Although the posterior approach decreased postoperative morbidity, this incision often did not give sufficient exposure, especially for larger masses.<sup>2</sup> Since Gagner et al<sup>3</sup> first described laparoscopic adrenalectomy in 1992, laparoscopic adrenalectomy has gained widespread acceptance for a variety of indications.<sup>4</sup> As surgeons become more adept and technology improves, the indications for minimally invasive surgery for adrenal diseases continues to expand.

As imaging modalities improve and more incidental adrenal masses are found, the indication for laparoscopic adrenalectomies increases.<sup>1,5,6</sup> Management is based on patient age, biochemical activity, size, and imaging characteristics. Laparoscopic adrenalectomy has proven to be an excellent procedure for most cases of adrenal disease with decreased morbidity, blood loss, and hospital stay.<sup>5</sup>

While the evolution of laparoscopic adrenalectomy is underway, a more quiet change of thought has taken place regarding patients with isolated metastasis to the adrenal gland. Formerly, these patients were treated palliatively and considered unresectable. However, over the last 15 years, several small studies<sup>7</sup> have reported a modest increase in survival from aggressive surgical removal of these isolated metastases. Autopsy series demonstrate metastasis within the adrenal gland from renal cell carcinoma and bronchogenic carcinoma to be 10% and 36%, respectively.<sup>8</sup> The development of computed tomography (CT) has increased the number of patients discovered to have metastatic lesions to the adrenal gland, both synchronous and metachronous. The more commonly reported sites of origin in the literature for these tumors include renal cell, lung, melanoma, colorectal, thyroid, hepatocellular, and gastric carcinoma.<sup>7,9-12</sup>

As laparoscopic indications expand and surgical removal

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of the adrenal gland for isolated metastatic disease becomes more acceptable, a few case reports and small case series<sup>4,9,11,13,14</sup> have recently reported the use of laparoscopy for metastasis to the adrenal gland. Is laparoscopic surgery a safe and effective method for this highly select group of patients? If so, should there be different criteria for selecting these patients for laparoscopic adrenalectomy versus patients with benign disease? We retrospectively compared laparoscopic adrenalectomy for primary tumors versus laparoscopic adrenalectomy for metastatic disease at a single center over a 4-year period.

**METHODS**

A retrospective analysis of all laparoscopic adrenalectomies attempted at a single institution was performed. All patients underwent preoperative CT or magnetic resonance imaging (MRI) scanning, or both, and had a biochemical evaluation consisting of at least a 24-hour urine collection for cortisol, 18-hydroxycortisol, aldosterone, norepinephrine, epinephrine, dopamine, metanephrine, normetanephrine, and vanillylmandelic acid. Additional biochemical evaluations, such as renin levels, adrenal vein sampling, glucagon stimulations, and others, were performed as indicated. Preoperative demonstration of invasive extraadrenal pathology was an absolute contraindication for surgery.

Procedures were performed via a transperitoneal or retroperitoneal approach. Operative, anesthesia, pathology, and radiology notes were reviewed. Patients' age, clinical presentation, radiographic size and side of the lesion, history of previous abdominal surgery, surgical approach, intraoperative course and time, blood loss, hospital course, postoperative pain medications used, complications, and final pathology were recorded. Patients were separated into 2 groups, I and II. Group I underwent laparoscopic adrenalectomy for primary disease, and Group II underwent laparoscopic adrenalectomy for metastatic disease.

**RESULTS**

Fourteen laparoscopic adrenalectomies were attempted in 13 patients, 10 for primary disease in Group I and 4 for metastatic disease in Group II. Group I comprised 10 patients, and Group II comprised 3, with one patient undergoing bilateral adrenalectomy. All 10 laparoscopic procedures were completed successfully for primary disease with an average tumor size of 4 cm, average operative time of 218 minutes, blood loss of 153 mL, and a median hospital stay of 2 days. Two minor (new onset atrial fibrillation and postoperative hypokalemia) but no major complications occurred (**Table 1**).

**Table 1.**  
Group I. Laparoscopic Adrenalectomy for Primary Disease\*†

Adrenal Pathology	Lesion Side	Laparoscopic Approach‡	Previous Abdominal Surgery	Surgical Time (Minutes)	Blood Loss (mL)	Hospital Stay (Days)	Size of Adrenal (cm)
Adrenal adenoma	Right	TA	No	210	400	2	4.0
Cushing's Adrenal adenoma	Left	TA	Yes	190	100	4	5.9
Adrenal adenoma	Right	TA	No	107	300	2	2.0
Adrenocortical carcinoma	Right	TA	Yes	200	300	4	4.5
Adrenal adenoma	Left	TA	No	200	100	21§	7.0
Aldosteronoma	Right	TA	No	100	30	2	1.0
Aldosteronoma	Right	TA	No	465	100	2	2.8
Adrenal adenoma	Right	TA	No	155	50	1	6.0
Aldosteronoma	Right	TR	No	245	100	1	2.0
Cortical nodular hyperplasia	Left	TR	Yes	217	50	1	4.0

\*All patients were disease free at follow-up.  
 †There were no conversions to open surgery.  
 ‡TA: Transabdominal, TR: Transretroperitoneal.  
 §Due to atrial fibrillation.

Only one of the 4 laparoscopic adrenalectomies for metastatic disease was successfully completed with difficulty (6.5-cm mass, 315 minutes) (**Table 2**). In the second case, laparoscopic resection of bilateral metastatic disease was converted to open surgery because the left adrenal was densely adherent to the pancreas and aorta. Similarly, the right adrenal was adherent to the inferior vena cava. Ultimately, both glands were removed with difficulty. In the third case, a preoperative CT scan showed a 7-cm mass within the right adrenal gland. However, intraoperatively, the tumor was found adherent to the liver and inferior vena cava, and it proved to be unresectable. In Group II, overall surgery time was 332 minutes, with an average tumor size of 7.3 cm, blood loss of 233 mL, and median hospital stay of 2 days. No complications occurred in this group of patients. **Table 3** compares the mean objective findings of the 2 groups.

## DISCUSSION

Metastasis to the adrenal gland is relatively common for patients with bronchogenic carcinoma, melanoma, and renal cell carcinoma.<sup>7,9-12</sup> The adrenal gland has the greatest rate of metastasis for any organ on a per-gram basis.<sup>8</sup> With improved radiological techniques in CT and MRI, coupled with percutaneous adrenal biopsies, diagnosis of metastatic lesions to the adrenal is being made more often.<sup>15</sup> Prognoses for patients with widely metastatic disease from these cancers is dismal with few reports of survival greater than 5 years.<sup>10,11,16</sup> The discovery of isolated metastasis to the adrenal gland is uncommon, and although the survival benefit for patients undergoing resection is not clear, over the last 15 years, treatment philosophy has changed from one of palliation to one of aggressive surgical removal. In a large series of 37 patients at Memorial-Sloan Kettering, Kim et al<sup>10</sup> found a survival benefit to surgical resection of solitary adrenal metastasis

	Group I (Mean)	Group II (Mean)
Tumor Size (cm)	2.6	7.3
Surgical time (minutes)	218	332
Blood loss (mL)	153	233
Median hospital stay	2	2
Complications	Posthypokalemia, New onset atrial fibrillation	None
Conversion to open surgery	None	75%

as opposed to chemotherapy and radiation alone. Paul et al<sup>11</sup> found similar results with a median survival of 23 months in 77 patients. In their study, tumor size was unrelated to survival, but patients with a longer disease-free interval from time of primary cancer therapy to adrenal metastasis had a longer postoperative survival after adrenalectomy. For patients undergoing adrenalectomy for isolated metastasis, 5-year survival rates may approach 20% to 45%.<sup>11</sup> Findings of other groups support these results.<sup>16-19</sup>

The following inclusion criteria should be met when considering adrenal surgery for metastatic disease: (1) biochemical evaluation is performed and addressed appropriately, (2) the patient has a biopsy-proven adrenal metastasis that appears resectable on imaging studies, (3) no evidence is present of distant metastasis, and (4) the patient's overall health warrants an aggressive approach. Adrenal biopsy has a major complication rate of 0% to 9%.<sup>20,21</sup> In 177 biopsies of patients with known extraadrenal metastasis, De Augustin et al<sup>20</sup> found 28% nondiagnostic (unsatisfactory sample), 33% metastatic consistent

Adrenal Pathology	Lesion Side	Laparoscopic Approach‡	Surgical Time (Minutes)	Blood Loss (mL)	Hospital Stay (Days)	Size of Adrenal (cm)	Follow-up (20-48 mos)	Conversion to Open
Metastatic lung carcinoma	Left	TA	315	100	2	6.5	Alive with recurrent disease	No
Metastatic lung carcinoma	Bilateral	TA	530	500	10	8.0, 7.0	Disease free	Yes
Metastatic lung carcinoma	Left	TA	185	100	2	NR	—	Yes

\*TA: Transabdominal; NR: Not resectable.

\*All patients in Group II had had previous abdominal surgery.

with the primary cancer, 13% primary adrenal cancer, and 25% with a negative biopsy (satisfactory sample with negative result). None of the patients with a negative biopsy developed metastatic disease to the adrenal gland at follow-up, while no comment was made about the patients with a nondiagnostic biopsy.<sup>20</sup> The overall nondiagnostic biopsy rate for these patients according to Silverman et al<sup>21</sup> in 101 biopsies was 18%. It has been recommended that patients with a known primary cancer and adrenal mass with a nondiagnostic biopsy should undergo rebiopsy or surgery.<sup>11</sup>

Laparoscopic adrenalectomy for benign disease has been shown in several studies<sup>1,5,6,9,14,22</sup> to be efficacious with decreased postoperative pain, shorter hospital stay, decreased blood loss, earlier ambulation, and earlier return to normal function when compared to open surgery. Laparoscopic adrenalectomy has been performed effectively with both transperitoneal and retroperitoneal approaches. We have found that laparoscopic adrenalectomy for benign disease in our patients was equally effective and comparable to that in published series with no major complications.<sup>5,22</sup>

At the same time, we encountered 2 major difficulties intraoperatively in patients with metastatic disease. One, we encountered inoperability due to local invasion of surrounding structures. In one patient, the adrenal was adherent to both the liver and inferior vena cava even though preoperative CT did not suggest invasion of surrounding structures. Preoperative CT suggested a tumor size of 6.5 cm. As discussed previously, CT and MRI are not always reliable for determining whether the tumor is invasive. In another patient, the left adrenal was densely adherent to the pancreas and aorta with a preoperative CT interpretation of an 8.0-cm noninvasive mass on the left side. The patient underwent conversion with a difficult en bloc resection of this tumor and removal of the right adrenal that was also densely adherent to the inferior vena

cava. Another patient proved to be unresectable despite conversion with a favorable preoperative CT scan suggesting no invasion. Our second difficulty encountered was loss of fat planes. The adrenal gland is a friable organ, and a key principle leading to successful en bloc removal of the gland requires mobilization of the entire gland within its periadrenal fat. All of our patients with metastatic disease had an inflammatory reaction caused by the tumor, which made the dissection very tedious with distorted anatomy. Others<sup>4,14,23,24</sup> also describe their experience in both open and laparoscopic adrenal surgery for metastatic lesions with a “periadrenal” reaction associated with ill-defined dissection planes. None of our patients with benign disease demonstrated a periadrenal inflammatory reaction.

Few reports exist in the literature concerning laparoscopic adrenalectomy for metastatic disease (**Table 4**). Suzuki<sup>14</sup> reports the successful laparoscopic removal of a 4.5-cm left adrenal for metastatic renal cell carcinoma, but Suzuki also describes the need to convert a 5.5-cm left adrenal for metastatic disease due to dense adhesions. Beninelli et al<sup>25</sup> describe successful laparoscopic removal of 6 adrenal tumors in patients with non-small cell lung carcinoma. Four patients had metastatic disease with tumor size ranging from 2.8 cm to 4.7 cm in size. The other 2 tumors proved to be nonfunctioning adrenal adenomas. They also describe in their discussion of the 94 attempted adrenals removed laparoscopically that 2 were for colon metastasis to the adrenal, which were abandoned secondary to intraabdominal spread on the basis of laparoscopic examination. Therefore, 4 of 6 metastatic lesions were removed laparoscopically, all with tumor size less than 5 cm.<sup>25</sup> Henry et al<sup>23</sup> describe their laparoscopic experience with successful removal of 44 of 48 large tumors less than 12 cm. Four tumors were metastatic lesions and treatment for 3 of the 4 metastatic tumors was converted to open surgery. None of their patients underwent preoperative percutaneous adrenal biopsy, but in all of the metastatic

**Table 4.**  
Published Experience With Laparoscopic Adrenalectomy for Solitary Metastasis

References	Attempted Lap Adrenalectomies	Successful Lap Adrenalectomies	Mean Tumor Size (cm)	Tumor Size Range (cm)	Success Rate
Bennili <sup>23</sup>	6	4	3.4	2.8–4.7	66%
Suzuki <sup>14</sup>	2	1	5.0	4.5–5.5	50%
Henry <sup>21</sup>	4	1	5.1	3.5–11.0	25%
Heinford <sup>4</sup>	10	9	5.9	1.8–12	90%
Current series	4	1	7.2	6.5–8.0	25%

patients, they encountered difficulty dissecting the planes with dense adhesions. Heinford et al<sup>4</sup> describe successful laparoscopic removal of adrenal tumors for metastatic disease in 9 of 10 patients with an average-tumor size of 5.9 cm. Combining our experience with that in the literature demonstrates that 16 of 25 (64%) metastatic cases were successfully removed laparoscopically. Only 40% of masses greater than 5 cm were successfully removed laparoscopically. Laparoscopic adrenalectomy success rate for benign disease, however, is greater than 95% overall.<sup>1,5,6,9,22</sup>

Our average tumor size was 7.3 cm, with Bennili's group removing all tumors less than 5 cm, and Heinford's group averaging 5.9 cm. It is probable that the larger the tumor, the more likely it is to be both invasive and to incite a periadrenal reaction that makes the dissection extremely difficult. Based on our experience and a review of the literature, we believe that metastatic adrenal masses greater than 5 cm have a high likelihood of open conversion, or at the very least, a long and difficult dissection.

## CONCLUSION

Laparoscopic adrenalectomy for benign disease is an extremely successful method for removing these tumors with a greater than 95% success rate. At the same time, laparoscopic adrenalectomy for solitary metastasis coupled with meticulous preoperative evaluation has an overall success rate of 64%. For tumors greater than 5 cm, that success rate drops to less than 40%. We conclude that laparoscopic adrenalectomy for metastatic disease is less likely to be completed successfully for tumors of a similar size when compared with those of a benign origin. We encountered 2 difficulties specific to metastatic lesions, loss of fat planes and an inability to preoperatively predict the invasive nature of the tumor. We do not believe that isolated metastasis to the adrenal gland is a contraindication to laparoscopic surgery, but experienced surgeons who commit to the laparoscopic approach must be aware of the high conversion and failure rate. Further data need to be collected to determine the role of laparoscopic adrenalectomy for metastatic lesions.

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