

Surgical audit of minimally invasive adrenalectomy - A retrospective observational study



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ABSTRACT

Background: The laparoscopic adrenalectomy technique is currently the standard of care for resecting small benign adrenal lesions in most countries. Some of the reported benefits of laparoscopic adrenalectomy are similar to the benefits of minimally invasive surgery.

Aims and Objectives: The objective is to study the types of adrenal tumors and to review outcomes of minimally invasive adrenalectomies. **Materials and Methods:** In this retrospective observational study, records of 306 patients undergoing minimally invasive adrenalectomy from January 01, 2001 to September 30, 2019, were analyzed. **Results:** The types of adrenal tumors were found in patients were adrenal adenoma (38), adrenal Cushing's (47), adrenal carcinoma (14), and pheochromocytoma (207). Pheochromocytoma was the most common type of tumor seen in 68% of the cases. Intensive care unit was required in case of 59 patients while inotropic support was needed for 58 patients while 6 patients required a ventilator in the immediate post-operative period. Surgical site infection was encountered in 29 patients following minimally invasive adrenalectomy. Fever was seen in 18 patients. Pneumonia was the early post-operative complication in 12 patients while paralytic ileus was encountered in 25 patients. Synchronous metastasis to lymph nodes was seen in 12 and tumor bed recurrence was seen in 12 cases each following adrenalectomy.

Conclusion: Minimally invasive techniques cause less trauma to patients, have superior visualization, decreased post-operative pain, shorter hospital stays, an earlier return to work and normal activity, and fewer perioperative and post-operative complications.

Key words: Pheochromocytoma; Minimally invasive adrenalectomy; Adrenal tumours

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INTRODUCTION

Adrenal glands are endocrine glands that are retroperitoneally situated. Life-saving hormones such as corticosteroids and catecholamines are secreted by the adrenals. Surgical removal of the abnormal adrenal gland is the treatment of choice for adrenal tumors. The choice of surgical approach depends on the size and functionality of the lesion, the degree of exposure needed, the likelihood of malignancy, and surgeon's experience.

Adrenalectomy can be performed transabdominally, retroperitoneally, or transthoracically.^{1,2} Since the advent

of laparoscopic adrenalectomy in 1992, the technique has been widely adopted and is currently the standard of care for resecting small benign adrenal lesions in most countries. Although the indications for laparoscopic adrenalectomy in Gagner's report were Cushing's syndrome and pheochromocytoma, the list of indications have extended to include most benign adrenal lesions, as well as adrenal metastases. However, the upper limits of size and the suitability of laparoscopic adrenalectomy for malignant adrenal tumors are still debated. Some of the reported benefits of laparoscopic adrenalectomy are similar to the benefits of minimal invasive surgery in general,

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including reduced postoperative pain and length of stay, reduced blood loss, lower complication rates as well as better cosmesis.

Aims and objectives

This study aims to review the outcomes of minimally invasive adrenalectomies done in a single surgical unit.

1. To study the type of adrenal tumors.
2. To evaluate the immediate, early, and late postoperative complications of minimally invasive adrenalectomy.

MATERIALS AND METHODS

Study setting

This study has been conducted in the department of general surgery at a tertiary health-care center in Mumbai, Maharashtra, India, with the availability of an advanced laparoscopic setup and a dedicated Endocrinology department.

Study design

Hospital-based retrospective observational study.

Study time and sample size

Records of 306 patients undergoing minimally invasive adrenalectomy from January 01st, 2001 to September 2019 were analyzed.

Inclusion criteria

1. All minimally invasive operated unilateral and bilateral adrenalectomies
2. Age >12 years
3. Both functional and non-functional tumors.

Exclusion criteria

1. Patients with comorbidities such as congestive heart failure, chronic renal failure, chronic obstructive lung disease, hemiplegia
2. Locally advanced disease such as any suspected adrenocortical carcinoma, i.e., presence of aortocaval nodes and surrounding organ invasion (pancreas, spleen, IVC) and any breach of a capsule of tumor of any size
3. Widely metastatic disease.

The study was initiated after an approval from the Institutional Ethical Committee (IEC). Institutional and departmental records were accessed only after protocol approval and prior permission of the IEC and the concerned departments.

Data was collected retrospectively from endocrinology, general surgery, and medical records department and assessed as per the designed protocol. Patient data were analyzed, and a surgical audit was conducted for a data

period of 19 years. Cases of Adrenalectomy registered between 2001 and 2019, meeting the Inclusion and Exclusion criteria were included in the final analysis.

Relevant information and subjective data, such as age, sex, history and clinical presentation, family history, physical examination, and imaging details, were assessed and recorded. All these details were strictly kept confidential.

RESULTS

In our study, we found female preponderance where out of 306 patients, 38% were male (115) and 62% were female (191) (Figure 1).

The minimum age of the study participant was 17 years whereas maximum age was 56 years. The hospital stay of patients varies from 1 day to 18 days with average hospital stay for 8.34 days (Table 1).

Pheochromocytoma was the most common type of adrenal tumor seen in a study group with 68% of the cases. Other tumors found in this study in decreasing order are adrenal Cushing's, adrenal adenoma, and adrenocortical carcinoma (Table 2).

Immediate post-operative complications following minimally invasive adrenalectomy

Out of 306 surgeries, the minimum time required for individual surgery was 80 min while the maximum time required was 270 min. Average time required for surgery was 146.09 min. Minimum blood loss in individual surgery was 50 mL whereas maximum blood loss was 350 mL. Average blood loss per surgery was 74.30 mL (Table 3).

Out of 306 operated patients, 59 required intensive care unit (ICU) care in the post-operative period (Table 4).

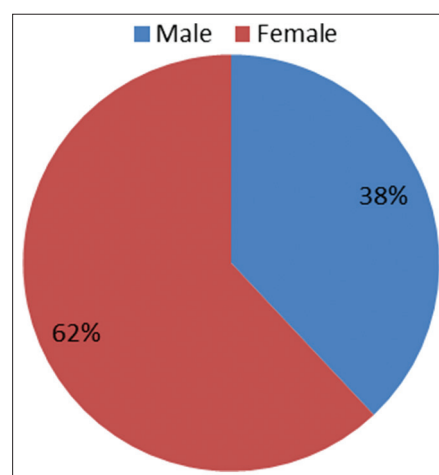


Figure 1: Gender distribution

Table 1: Age and hospital stay in days

Demographics	Minimum	Maximum	Mean	SD
Age in years	17	56	29.92	11.918
Post-operative hospital stay in days	1	18	8.34	3.622

Table 2: Percentage distribution of different adrenal tumors

Types of tumors	
Adrenal adenoma	38 (12%)
Adrenal Cushing's	47 (15%)
Adrenocortical carcinoma	14 (5%)
Pheochromocytoma	207 (68%)

Table 3: Descriptive statistics for operative time in minutes and blood loss in mL

Intra-operative parameters	Minimum	Maximum	Mean	SD
Operative time in minutes	80	270	146.09	62.635
Blood loss in mL valid (List-wise)	50	350	74.30	62.463

Table 4: Patients requiring ICU support

ICU support	
Yes	59
No	247

ICU: Intensive care unit

Out of 306 operated patients, 58 required inotropic support in the post-operative period (Table 5).

Out of 306 operated patients, only 6 required ventilatory support in the post-operative period (Table 6).

Early post-operative complications

29 patients had SSI in the post-operative period. It was the most common complication in early post-operative period (Table 7).

18 patients had episodes of fever in the post-operative period (Table 8).

12 patients had pneumonia in the post-operative period. Out of these 12 patients, one patient was found to have ventilator-associated pneumonia which required prolonged ICU care (Table 9).

Paralytic ileus was found in 25 patients in the post-operative period. It was observed to be the second most common complication in the series after surgical site infection in the early post-operative period (Table 10).

Table 5: Patients requiring inotropic support

Inotropic support	
Yes	58
No	248

Table 6: Patients requiring ventilator support

Ventilator support	
Yes	6
No	300

Table 7: Incidence of SSI

Incidence of SSI	
Yes	29
No	277

SSI: Surgical site infection

Table 8: Incidence of fever

Incidence fever	
Yes	18
No	288

Table 9: Incidence of pneumonia

Presence of pneumonia	
Yes	12
No	294

Table 10: Incidence of paralytic ileus

Paralytic ileus	
Yes	25
No	281

Late post-operative complications of minimally invasive adrenalectomy

Synchronous metastasis to lymph nodes seen in 12 cases and tumor bed recurrence was seen in 12 cases each following adrenalectomy. Metachronous metastasis to only the liver, only skeletal system, both liver and skeletal system seen in 6, 3, and 5 cases respectively as late post-operative complication (Figure 2).

DISCUSSION

The introduction of laparoscopic adrenalectomy has changed the surgical approach to the adrenal gland. As has been reported, exposure of the adrenal gland and control of its friable parenchyma and abundant vascularity has been made laparoscopy advantageous in our approach to the adrenal gland. A variety of laparoscopic approaches to the adrenal gland have been described. The lateral

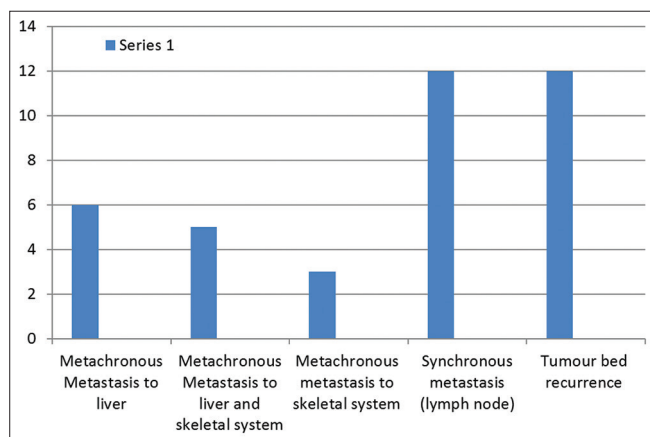


Figure 2: Recurrence of tumor

transperitoneal technique offers distinct advantages to the laparoscopist including improved visibility of anatomic landmarks, easy access to other organ systems, the use of gravity to retract the spleen and liver, and a position that permits the natural application of innovations such as the hand-assisted technique. Retroperitoneal laparoscopy confers several advantages for the experienced retroperitoneoscopic surgeon, including reduced risk of visceral injury, fewer postoperative intestinal complications to previous surgery.

Our study consisted of retrospective analysis of 306 patients who underwent minimally invasive adrenalectomy for various reasons such as adrenal adenoma, pheochromocytoma, incidentaloma, adrenocortical carcinoma, Cushing's syndrome, and metastasis. Thus, recorded immediate post-operative complications such as hypotension, hypertension, ICU care, and ventilator support along with early complications such as fever, surgical site infection, pneumonia, and paralytic ileus. Late complications included recurrence and metastasis.

Out of 306 patients in our study, females were more affected than males (M=115, F=191) while the age group of patients undergoing adrenalectomy was wide ranging from 17 years to 56 years with mean age of 29 years. A study conducted by Aporowicz et al.³ in 2016 did not find an association between patient's sex and complication rate. The present study identified that 68% of patients had pheochromocytoma on histopathology followed by primary pigmented nodular adrenocortical disease. Few studies compare outcomes of adrenalectomy between benign and malignant tumors. Kiernan and Lee⁴ concluded that type of pathology influences neither the complication rate nor the necessity of transfusions. Porpiglia et al.,⁵ found no differences in perioperative variables between secreting versus non-secreting and malignant versus benign tumors.

Walz et al.⁶ described a series of 560 retroperitoneal adrenalectomies that were performed via the posterior approach; 119 of the procedures were for Pheochromocytoma.

In 2007, Zhang et al.⁷ published a series of 824 retroperitoneoscopic adrenalectomies that were performed via the lateral retroperitoneal approach of which 62 of these procedures were for pheochromocytoma. Li et al.⁸ described the largest retrospective series specifically for describing lateral retroperitoneoscopic adrenalectomy that included 131 procedures, including 11 for extra-adrenal pheochromocytoma.

In our study in the early post-operative complications, surgical site infection was encountered in 29 patients (9.4%) and paralytic ileus in 25 patients (8.1%) while fever was seen in 18 patients (5.8%) and pneumonia in 12 patients (3.9%). Bilateral adrenalectomy is associated with a higher complication rate (23% vs. 15%); even 26% according to Alesina et al.⁹ In our study, medical and overall complications were more common after bilateral adrenalectomy. Most reviewed publications did not find the side of the operation to be a risk factor for risk of complications.

Summary

The benefits of laparoscopic surgery in the pre-operative and post-operative periods are well-established and have been widely reported. Laparoscopic adrenalectomy, in particular, represents a true success of the application of minimally invasive techniques. Minimally invasive retroperitoneal adrenalectomy is recently becoming the gold standard for surgical treatment of small (<6 cm) and benign adrenal tumors, as well as isolated small solitary metastases. It provides the most direct access to the adrenal gland; hence there is no risk of injury to intra-peritoneal organs.

Limitations of the study

1. We have only considered tumours less than 6 cm which are feasible for laproscopic adrenalectomy.
2. It is a single centre, single surgeon experience study.
3. Tumours where conversion from laparoscopy to open happened have not been considered.

CONCLUSION

The retroperitoneal approach requires no dissection of adhesions, which makes it suitable for patients with previous laparotomy. Bilateral adrenalectomy, even simultaneous, is possible without repositioning the patient.

The literature review and data analysis provided objective evidence that minimally invasive techniques cause less

trauma to patient, have superior visualization, decreased post-operative pain, a shorter hospital stay, an earlier return to work and normal activity, and fewer pre-operative and post-operative complications.

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Authors Contribution:

MSS- Definition of intellectual content, literature survey, prepared first draft of manuscript, implementation of study protocol, data collection, data analysis, manuscript preparation and submission of article; **ASD**- Concept, design, clinical protocol; **ADN**- Manuscript preparation, editing, and manuscript revision.

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