Laparoscopic Adrenalectomy for Adrenal Mass

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ABSTRACT

Adrenal gland tumors, including both benign and malignant forms, are increasingly detected due to advancements in imaging techniques. This prospective study, conducted at Nepal Mediciti Hospital evaluated thirteen patients diagnosed with adrenal masses, all confirmed benign via contrast-enhanced computed tomography. Functional assessment, preoperative endocrinological and anesthesiological evaluations and pharmacological preparations were conducted as needed. All patients underwent successful lateral transperitoneal laparoscopic adrenalectomy, performed by a single surgeon. The study population had a female predominance (9 females, 4 males), with tumor sizes ranging from 2 to 9 cm. No surgeries required conversion to open procedures, and postoperative outcomes were favorable, with no mortality or re-operations. Complications were minimal, including transient blood pressure elevation in one pheochromocytoma case and one postoperative chest infection. Histopathological findings included aldosterone-producing adenomas, cortisol-producing adenomas, and pheochromocytomas. The study supports the continued use of laparoscopic adrenalectomy as the preferred surgical method for adrenal tumors.

KEY WORDS

Adrenal gland, Adrenal tumor, Laparoscopic surgery

INTRODUCTION

Adrenal gland tumors encompass a wide range of pathological conditions. These tumors include benign non-hormone-prroducing adrenocortical adenomas, as well as hormone-secreting malignant forms like adrenocortical carcinoma and adrenal medullary tumors, such as pheochromocytoma.[1] Endocrine disorders account for approximately 10% of the causes of secondary hypertension and the common conditions includes primary aldosteronism, pheochromocytoma, and Cushing's syndrome.[2] The broader use and advancements in abdominal imaging techniques in recent years have resulted in a growing number of unexpected adrenal tumors being discovered. These incidentally found tumors, known as adrenal incidentalomas, have become a frequent clinical concern and require evaluation for potential hormonal overactivity or malignancy.[3]

The aim of this study was to evaluate the indications of laparoscopic adrenalectomy and assess intraoperative complication and post-operative outcomes.

CASE REPORT

A total of thirteen patients were diagnosed with adrenal mass in our study. All of them were benign in nature as per contrast enhanced computed tomography figure 1 and figure 2. Functional assessment of the tumor was done prior to the surgery. Endocrinological and anaesthesiological assessment was done and prepared for the surgery. Pharmacological preparation was done when indicated. Lateral Transperitoneal Laparoscopic adrenalectomy was done in all the cases by a single Surgeon (Dr. Mahesh Bahadur Adhikari, HoD of Urology and Kidney Transplant, Nepal Mediciti Hospital).

Figure 1. Large predominantly fat density lesion measuring 7.89x7.63x7.45 cm noted in right adrenal gland. Minimal enhancing scattered areas of soft tissue noted within this lesion predominantly in medial aspect of this lesion. Inferiorly this lesion is compressing upper pole of right kidney and displacing it posteriorly. Large right adrenal myelolipoma.

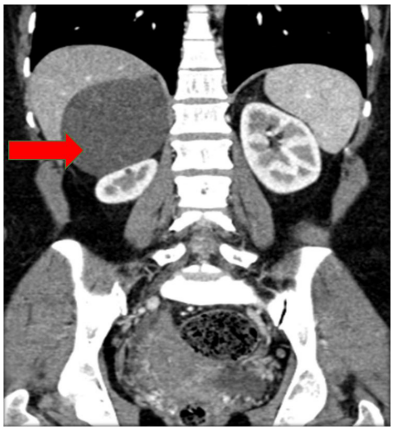

Figure 2. An approximately 8.6x7.5x6.5cm size thin walled unilocular cyst seen in right suprarenal area which is seen stretching the medial limb of right adrenal gland and seems to be arising from it.

Adrenalectomy is indicated for suspected malignancies, malignant tumors, non-functional tumors with cancer risk, and functional adrenal tumors. Functional tumors requiring surgery include those causing Cushing's syndrome (glucocorticoid overproduction), Conn's syndrome (aldosterone overproduction), and pheochromocytomas (catecholamine production). Bilateral adrenalectomy may be necessary in Cushing's disease due to pituitary or ectopic ACTH secretion. Adenomas from the adrenal cortex's reticularis layer, which may rarely secrete excess androgens or estrogens, can also indicate the need for adrenalectomy.[4]

Several surgical techniques have been developed for treating adrenal tumors, including open surgery, endoscopic approaches (laparoscopic and retroperitoneoscopic), and robotic methods. The first laparoscopic adrenalectomy using a lateral transperitoneal approach was performed by Gagner et al.[10] Since then, it has become the standard procedure in adrenal surgery due to its safety and practicality.[5] Over time, various studies have highlighted the benefits of the laparoscopic technique, including reduced morbidity and perioperative mortality. It offers advantages such as less operative blood loss, fewer complications, reduced postoperative pain, shorter hospital stays, and improved cosmetic outcomes compared to open adrenalectomy.[6]

The patient was positioned in a lateral decubitus position with a 50-60° incline relative to the operating table, which was adjusted to increase the space between the last rib and the iliac crest. Pneumoperitoneum was established using a Veress needle. The left laparoscopic adrenalectomy was performed with the patient in the right lateral decubitus position. Three trocars were placed in the left subcostal region: one 10 mm camera port and two 5 mm working ports. Mobilization of the splenic flexure was performed to open the retroperitoneal space. Dissection began lateral to the spleen at the splenorenal ligament and continued towards the diaphragm, close to the greater curvature of the stomach and the short gastric vessels. Once the spleen was fully mobilized, it retracted medially, revealing the lateral and anterior portions of the adrenal gland along with the perinephric fat. The peritoneal dissection proceeded from superior to inferior until the left renal vein was identified, from which the adrenal vein was located, clipped, and divided (Fig. 3). After completing the vascular dissection, the resection continued along the iliopsoas muscle plane from the upper pole of the kidney to the diaphragm, aiming to fully free the adrenal gland. The laparoscopic right adrenalectomy was performed with the patient positioned in the left lateral decubitus position. Four trocars were placed in the right subcostal region: a 10 mm camera port, two 5 mm working ports, and an additional 5 mm port for liver retraction. The right lobe of the liver was mobilized by dividing the triangular and coronary ligaments to expose the adrenal gland. Dissection of the posterior peritoneum overlying the right adrenal gland followed. The dissection began along the lateral border of the inferior vena cava, using the right renal vein as a landmark. The short adrenal vein was then identified, clipped, and divided. After securing the vascular structures, the dissection proceeded along the iliopsoas muscle plane, fully mobilizing the adrenal gland until it was completely freed. At the conclusion of the procedure, the surgical specimens were placed in an endo-bag and extracted through the operative trocar site figure 4. For larger lesions, a small fannensteil incision was made to facilitate specimen removal, improving cosmetic outcomes and reducing the risk of incisional hernia.[7,8]

Successful lateral transperitoneal laparoscopic adrenalectomy was performed in all the cases.The age of the patient ranges from 24 years to 69 years old. There was female predominance with 9 cases and 4 males. Right sided adrenal mass was present in 7 patients and left sided in 6 patients. The size of the adrenal mass ranges from 2 cm to

Figure 3. Lateral Transperitoneal Laparoscopic Adrenalectomy (Isolating Adrenal Vein)

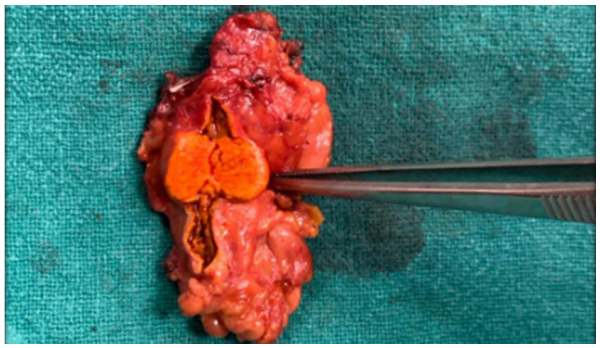

Figure 4. Adrenal gland with Adrenal Mass

9 cm. There was no conversion to open. All the surgeries were completed laparoscopically. Duration of surgery ranges from 1 hour to 2 hours. There was no re-operation or mortality. The length of hospital stay ranges from 3 days to 5 days. There was transient acceleration of blood pressur intra-operatively in one case of pheochromocytoma. There was chest infection post operatively in one case. According to histopathological report, out of thirteen patients Aldosterone-producing adenoma was diagnosed in two patients, Cortisol-producing adenoma in one, Adrenal Cyst in two, Myelolipoma in three, Non-functional adenoma in two, Pheochromocytomas in two and Adrenal schwannomas one patient shown in table 1. During twelve weeks follow up, all the patients are doing well.

Table 1. Patient demography and outcome

	Mean; n (%)
Age	42.23 (Range 24-69)
Sex (M/F)	4/9 (30%/70%)
Side (R/L)	7/6 (54%/46%)
Size (cm)	4.53 (Range 2-9)
Operating Time (Hr)	1.58 (Rangr 1-2)
Length of hospital stay (Days)	4.23 (Range 3-5)
Histopathology	
Aldosterone-producing adenoma	2(15%)
Cortisol producing Adenoma	1 (8%)
Adrenal Cyst	2 (15%)
Myelolipoma	3 (23%)
Non functional adenoma	2 (15%)
Pheochromocytoma	2 (15%)
Adrenal Schwannomas	1 (8%)
Complications	
Intra operative acceleration of Blood Presure	1 (8%)
Post operative Chest Infection	1 (8%)

Small sample size of 13 patients may limit its generalizability. Single-center and single-surgeon design may not represent broader clinical practices. The study lacks Comparison with open surgery or alternative minimally invasive techniques.

DISCUSSION

Adrenal tumors encompass a diverse array of pathological conditions, ranging from benign, non-functioning lesions to malignant, hormone-secreting neoplasms, such as pheochromocytomas and adrenocortical carcinomas. The recent advancements in imaging modalities, including computed tomography (CT) and magnetic resonance imaging (MRI), have increased the detection of asymptomatic adrenal masses, commonly termed “adrenal incidentalomas.” The clinical relevance of these tumors lies in their potential for hormonal activity or malignancy, necessitating careful evaluation and management.[9]

Adrenalectomy is the treatment of choice for functional adrenal tumors and for adrenal masses suspected of malignancy. Laparoscopic adrenalectomy, first introduced by Gagner in 1992, has since become the gold standard in surgical management due to its minimally invasive nature and favorable postoperative outcomes, including reduced morbidity, shorter hospital stays, and improved cosmetic results compared to open adrenalectomy.[10] This study aligns with the existing literature, demonstrating the efficacy of the laparoscopic approach, as all 13 cases in our cohort were successfully managed with lateral transperitoneal laparoscopic adrenalectomy without the need for conversion to open surgery.

The patient demographics in this study reveal a female predominance (69.2%) and a mean age distribution of 24 to 69 years, which is consistent with previous studies showing a higher incidence of adrenal masses among females, particularly in the case of hormonally active tumors such as aldosterone-producing adenomas.[11] In terms of laterality, this study found a relatively balanced distribution of right-sided and left-sided adrenal masses, which mirrors findings in similar cohorts.[12]

Among the pathologies identified, aldosterone-producing adenomas and pheochromocytomas were the most frequent functional tumors, reflecting the common endocrine disorders associated with secondary hypertension.[11] Notably, this study included a rare case of adrenal schwannoma, a benign tumor arising from

the nerve sheath, which is infrequently reported in the literature but has been successfully managed with standard transperitoneal adrenalectomy.[13]

In terms of perioperative outcomes, the complication rate was low, with only one case of transient intraoperative hypertensive crisis during pheochromocytoma resection and one postoperative chest infection. This is in line with existing literature, which underscores the importance of meticulous preoperative preparation, particularly in patients with pheochromocytoma, to prevent hemodynamic instability during surgery.[14] The absence of mortality, reoperations, or major postoperative complications further supports the safety and efficacy of the laparoscopic approach for adrenalectomy.

The findings from this study reinforce the established benefits of laparoscopic adrenalectomy for both functional and non-functional adrenal tumors. The favorable intraoperative and postoperative outcomes, coupled with minimal complications, suggest that this approach should continue to be the preferred surgical method in the management of adrenal masses, particularly in centers with expertise in minimally invasive surgery.

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