

Surgical Management of Benign Adrenal and Extra-Adrenal Tumors: A Single Centre Experience

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Abstract: ***Background:** Adrenal and extra-adrenal masses are rare tumours, tricky to find like a needle in a haystack and have a dramatic presentation. They can be benign or malignant, are notable for their tendency to overproduce catecholamines. The incidence of adrenal incidentaloma (AI) ranges from 3-5% to upto 10% in elder population. 70% are non-functional adenomas (NFAI) and rest 30% are functional lesions. The need for surgery is inevitable due to the deleterious effects of the unbalanced catecholamines levels in the body produced by these tumours and uncommonly due to their malignant potential. Laparoscopy is feasible, safe and is associated with lesser perioperative morbidity. **Study Design:** A retrospective analysis of all the patients admitted at our centre with diagnosed adrenal and extra-adrenal masses who underwent operative management at our institution between August 2017 and September 2020. We present our, discuss the technical prospects of the procedure and surgical outcomes. **Results:** A total of 20 patients underwent surgery for adrenal and extra-adrenal masses. The LTA group consisted of 17 cases (85%) with 11 male patients and 6 female patients with a mean age of 39.11 ± 16.2 years (range 12-65 years). Three cases underwent OA where all were male with a mean age of 33.7 ± 12.68 years (range 21-51 years). Amongst the LTA group, tumour was located on the left side in 10 cases (58.8%) and on right in 7 cases (41.2%) while in the OA group, left, right and bilateral lesion had 1 case each. Amongst the LTA group, 4 (23.5% of lap. cases) were converted to open. The mean tumour size was 6.15 ± 3.8 cms (range 3-9cms) in the LTA group and 10.87 ± 5.0 cms (range 6-19 cms) in OA group, mean operative time was 131.7 ± 22.8 minutes (range 90-160) for the LTA group and 146.67 ± 29.5 minutes (range 105-170) for OA while mean duration of stay was 5.2 ± 2.3 days (range 3-10) for LTA and 6.7 ± 1.7 days (range 5-9) for OA. **Conclusion:** Laparoscopic lateral transperitoneal adrenalectomy offers excellent visualization and outcomes in terms of diligent recovery and cosmesis. It is a safe and effective technique having a reduced operative time, fewer hemodynamic instability, post-operative pain, early mobilisation, need for perioperative blood transfusion, post-operative complications, mean duration of hospital stay and subsequent monetary burden.*

Keywords: Adrenal incidentaloma (AI), Non-functional adrenal incidentaloma (NFAI), Lateral transperitoneal adrenalectomy (LTA), Open adrenalectomy (OA)

1. Introduction

The term adrenal incidentaloma is used when an unintended diagnostic test or treatment of a disease unallied to adrenal gland reveals a mass and is seen in 4%-7% of patients undergoing abdominal imaging. Retrospective metanalysis suggests a female preponderance to a ratio of 1:1.4 and a peak incidence in the 5th to 7th decades (1, 2). Adrenal masses are found on the right in 50–60% of cases, left side in 30–40% of cases and bilaterally in 10–15% of cases (3, 4).

According to origin, most commonly they arise from the adrenal cortex while medullary tumors are less frequent and are represented mainly by pheochromocytomas (5). According to activity, 70% are non-hypersecreting

adenomas or non-functional adrenal incidentalomas (NFAI), 16% are hyperfunctioning tumours (Cushing's adenoma from zona fasciculata, Conn's adenoma from zona glomerulosa, Pheochromocytomas from medulla etc), 5% are adrenocortical carcinomas, 2% are metastasis and 8% are miscellaneous lesions (Myelolipoma, Adrenal cyst etc) (6, 7, 8).

Diagnostic tests to assess adrenal incidentalomas include urine-free and plasma-free metanephrines and nor-metanephrines for pheochromocytoma, plasma aldosterone-to-renin ratio for primary aldosteronism and overnight 1-mg dexamethasone test for Cushing syndrome. A larger tumour can be easily seen on an ultrasound but a contrast enhanced CT is generally diagnostic.

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Laparoscopic transperitoneal approach for Adrenalectomy was first described by Gagner et al. in 1992. (9) The most common indication for laparoscopic adrenalectomy is a functional benign lesion and is now a gold standard treatment for smaller tumours. (10) Despite the recent advances in laparoscopy, there are still times when an open approach has no substitute specially for tumours >6cms in size. The aim of our study was to present our experience with various techniques of adrenalectomy, indications for selecting a particular method and discuss the technical outcomes.

2. Patients and Methods

2.1 Patients

We conducted a retrospective study on prospectively collected data of 20 cases who were diagnosed to have adrenal and extra-adrenal masses and were operated upon at our centre between August 2017 and October 2020. The data included a detailed history, clinical assessment, biochemical assays, radiological investigations, management and histopathology of the excised specimen. Surgical indications were functional adrenal masses, masses with suspicion of malignancy or incidentaloma.

17 patients were managed with LTA and 3 cases were managed with OA. The LTA group consisted of 11 male patients and 6 female patients with a mean age of 39.11 ± 16.2 years (range 12-65 years). The OA group consisted of 3 male patients with a mean age of 33.7 ± 12.68 years (range 21-51 years). USG could delineate presence of a mass in 14 patients (70%) amongst which 3 cases (21.4%) were found to have lesions incidentally. Contrast enhanced computerised tomography revealed masses in all the cases (100%). Additional PET-CT was required in 2 cases (10%). Amongst the LTA group, tumour was located on the left side in 10 cases (58.8%) and on right in 7 cases (41.2%) while in the OA group, 1 had left, 1 had right and 1 had bilaterally. The demographics and the tumour specifications are summarised in Table 1.

Table 1: Demographics and Tumour Specifications (n: 20)

	LTA Group (n=17)	OA Group (n=3)
Age, mean (range)	39.11 ± 16.2 years (12-65 years)	33.7 ± 12.68 years (21-51 years)
Male/female (ratio)	11/6 (1.8:1)	3/0
Side (left/right/Bilateral), ratio	10/7/0 (1.43:1)	1/1/1 (1:1:1)
Tumour size, mean (range)	6.15 ± 3.8 cms (range 3-9 cms)	10.87 ± 5.0 cms (range 6-19 cms)
Functionally active	16/17 (94.1%)	2/3 (66.7%)

2.2 Pre-operative preparation

Patients underwent a thorough endocrinological evaluation and were optimised for at least 7 days pre-operatively which included alpha and beta blocking agents (Prazosin and Metoprolol) along with calcium channel blockers (Amlodipine) to control blood pressure which was required in 18 cases out of 20 (90%), continuation of supplemental hydrocortisone in cases of Cushing's adenoma in 3 cases, 1 litre of normal saline overnight and extra salt was given to

all patients to prevent post-operative hypotension. Pre-operative preparation was not required in 1 case from the LTA group and 1 from the OA group. The criteria for pre-operative medical preparation included a blood pressure < 130/90 mmHg and a heart rate of <90/min.

2.3 Surgical technique for Lateral transperitoneal adrenalectomy

Patients were put in lateral position opposite to that of the lesion, operating table was put in anti-Trendelenburg position and surgeon stood on the opposite side as that of the lesion. (11) General anaesthesia was given in all cases and epidural catheterisation was done in some. A 12–13 mmHg pneumoperitoneum was created with a Veress needle inserted in the mid-clavicular line at the transverse umbilical plane. Camera port was made at the same point and a 30° forward oblique telescope was used. A 12mm working port in the anterior axillary line at the transverse umbilical plane, 5mm assisting port in the mid-clavicular line half way between the xiphisternum and umbilicus and another 5mm retraction port in the mid-axillary line at the transverse umbilical plane were made under direct visualisation.

A direct transperitoneal approach was used. Transmesocolic approach was taken for some left sided lesions which were seen bulging through the mesocolon. (12) For left sided lesions, Toldt's fascia was opened and the retro-pancreatic space was then entered after raising the body of the pancreas. The left renal vein was then identified after opening of the Gerota's fascia. Adrenal vein was traced, doubly ligated and cut. On the right side, liver was retracted using the Nathanson's fan retractor, the posterior peritoneum was opened longitudinally along the supraduodenal inferior vena cava and adrenal vein was then doubly ligated and cut.

Any manipulation of the gland/tumour was avoided before ligating the veins. Dissection was done with help of Harmonic Scalpel (Ethicon Endo Surgery, Cincinnati, Ohio, USA) or (LigaSure TM tissue fusion, Covidien, Mansfield, Massachusetts, USA). The SAGES guidelines recommend mobilization of the gland following a superior-lateral to medial-inferior progression unless ligating the adrenal vein is attempted early, in which case an inferior to superior and medial to lateral mobilization of the gland is preferred. (13) Retrieval was done in an Endobag and a mandatory drain was placed. Port closure was done in layers. Conversion was done with a subcostal incision.

2.4 Surgical technique for Open adrenalectomy

For bilateral large lesions, a midline laparotomy, and a subcostal incision for unilateral lesion. For right sided lesions, the right lobe of liver and for left sided lesions, spleen and pancreatic tail were mobilised followed by medial and lateral attachments of the tumor. The adrenal vein was exposed at the medial margin for the right adrenal and inferior margin for left adrenal and was doubly ligated. The specimen was removed en bloc and a mandatory drain was placed. Closure was done in layers and skin was primarily sutured.

2.5 Data Collection

Prospective documentation included age, sex, tumor side and size, functional activity, mean operative time, procedure conversions, duration of drain removal, initiation of oral feeds, duration of hospital stay and post-operative complications which included hemodynamic instability, hemorrhage, vascular or abdominal injuries and subsequent conversion in the immediate period and secondary hemorrhage, surgical site infections and pneumonia in the late period. Continuous variables with a normal distribution were reported as the mean \pm standard deviation (SD). Non-normal continuous variables were expressed as the median (interquartile range). Categorical variables were reported as the number (percentage).

3. Results

Out of the 20 cases, 17 patients underwent laparoscopic lateral transperitoneal adrenalectomy (85%) and 3 patients (15%) underwent open adrenalectomy. Amongst the laparoscopic group, 4 cases had to be converted to open (23.5%), failure achieving haemostasis in 3 cases and difficult excision in 1 case being the primary reason. Amongst the open adrenalectomy group, 2 cases were given subcostal incisions of respective sides (66.67%) and midline laparotomy incision in 1 case (33.33%). The mean tumour size was 6.15 ± 3.8 cms (range 3-9cms) in the LTA group and 10.87 ± 5.0 cms (range 6-19 cms) in OA group, mean operative time was 131.7 ± 22.8 minutes (range 90-160) for the LTA group and 146.67 ± 29.5 minutes (range 105-170) for OA. Amongst all cases, suture lines were closed primarily.

Table 2: Operative Outcomes (n: 20)

	LTA GROUP (n=17)	OA GROUP (n=3)
Number of subjects	17 (85%)	3 (15%)
Mean operating time (minutes, range)	131.7 ± 22.8 minutes (range 90-160)	146.67 ± 29.5 minutes (range 105-170)
Laparoscopic to open conversion (n,%)	4 of 17 (23.5%)	-
Mean duration of drain removal	Day 2	Day 4
Shifting from ICU	13 (76.5%)	1 (33.7%)
Initiation of oral feeds	14 (82.3%)	1 (33.7%)
Mean duration of stay (mean, range)	5.2 ± 2.3 days (range 3-10)	6.7 ± 1.7 days (range 5-9)
Post-operative complications (n,%)	2 (17.6%)	2 (66.7%)
Mortality (n,%)	0 (0%)	0 (0%)

Amongst the 17 cases who underwent LTA, 16 were functionally active masses (94.1%) and 3 cases who underwent OA consisted of 2 active masses (66.7%). Post-operatively, all the cases were monitored in the ICU overnight. On the first post-operative day, amongst the LTA group, 13 patients (76.5%) were shifted out and 14 patients (82.3%) were started with feeding. From the OA group, shifting and feeding was initiated in only 1 case (33.7%). Mean duration of drain removal was post-operative day 2 for the LTA group and day 4 for the OA group. Mean duration of stay was 5.2 ± 2.3 days (range 3-10) for LTA and 6.7 ± 1.7 days (range 5-9) for OA. Post-operative complications were seen in only 3 cases (17.6%) from the LTA group which included refractory hypotension and bronchopulmonary pneumonia while 2 cases (66.7%) from the OA group had refractory hypotension and surgical site infection. There were no cases with secondary haemorrhage and both groups had no mortality.

On histopathology, the LTA group had 12 (70.5%) **Pheochromocytomas** out of which two were extra-adrenal. Amongst these, plasma free metanephrines were found raised in 9 (75%) and plasma free nor-metanephrines was found raised in 11 (91.6%). **Adrenal cortical adenoma** constituted 4 cases (23.5%) amongst which aldosterone to renin ratio was found raised in 3 and AVS showed lateralisation to left in all and **Adrenal Epithelioid Hemangioendothelioma** constituted 1 case (5.8%).

The OA group consisted 1 case (33.7%) of **Benign Myelolipoma** and 2 cases (66.7%) of **Pheochromocytoma** out of which 1 was extra-adrenal. Amongst these, plasma

free metanephrines were found raised in 1 (33.7%) and plasma free nor-metanephrines in both (100%).

Table 3: Histopathology (n: 20)

Tumour type	LTA Group (n=17)	OA Group (n=3)
Pheochromocytoma (n, %)	12 (70.5%)	2
Adrenal cortical adenoma-functional (n, %)	3	0
Adrenal cortical adenoma-non-functional (n, %)	1	0
Adrenal Epithelioid Hemangioendothelioma (n, %)	1	0
Myelolipoma (n, %)	0	1

4. Discussion

The study is a review of the results obtained from our experience of 20 patients with benign adrenal and extra-adrenal masses who underwent surgical management between August 2017 to September 2020 at our centre.

Adrenalectomy, open or laparoscopic, is a challenging procedure mainly due to an excess of circulating catecholamines, high vascular nature of the tumour and proximity to major vessels. Surgical approaches that have been described in the literature include open, laparoscopic and robotic. The transperitoneal-lateral/anterior and retroperitoneal-lateral/posterior are techniques which utilise the principles of minimally invasive surgery and offer respective advantages. Most practiced are the lateral transperitoneal and retroperitoneal approaches. (13)

The retroperitoneal approach gives direct access to the gland with good exposure to posterior/retrocaval portion. Since, the intervention is limited to the retroperitoneum; there is less chance of bowel injury and peritoneal contamination. Also, it can be used in patients with history of prior abdominal surgery. (14,15) But due to a longer learning curve, difficult orientation, crowding of ports and less working space specially in patients with a high BMI, retroperitoneal approach remains a reserved approach in patients with history of previous transperitoneal surgery. (16,17) On the other hand, the transperitoneal approach provides advantage on the grounds of bilateral access using the same ports, extra working space for larger size tumours, unparalleled vision and prompt recognition of surgical landmarks, early vessel ligations before gland manipulation and should conversion be required, it allows a quick response without the need to change patient position. Added advantage of the lateral transperitoneal approach is the gravity pulls away the abdominal organs away from the operative field minimising the risk of damaging organs. (14, 18-26)

There is no debate about the need for surgery in functional masses while the current recommendations for non-functional masses are tumour >5 cm, patients younger than 50 years and documented increase in the mass size on follow-up. Although size is not a definite contraindication, laparoscopy is not generally advisable for tumours larger than 10 to 12 cm due to increasing risk of malignancy. (27) We preferred the lateral transperitoneal approach because of the many forementioned advantages plus our familiarity with the procedure. Open adrenalectomy (OA) is still the most common strategy for large lesions (>6cms) because of the wide surgical field. (28)

5. Conclusion

Laparoscopic lateral transperitoneal adrenalectomy offers superlative visualization and excellent outcomes in terms of diligent recovery and cosmesis. It is a safe and effective technique having a lesser operative time, fewer hemodynamic instability, post-operative pain, early mobilisation, need for perioperative blood transfusion, post-operative complications, mean duration of stay and subsequent monetary burden.

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