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Association of the Size of Adrenal Tumor with Safety and Efficacy of Laparoscopic Adrenalectomy

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Abstract **Original Research Article**

***Introduction*:** Laparoscopic adrenalectomy (LA) is the gold standard treatment for small adrenal tumor. But the role of laparoscopic adrenalectomy (LA) in a large tumor is still debatable due to risk of technical difficulty and malignant potential. This study was aimed to find out the association of the size of adrenal tumor with safety and efficacy of laparoscopic adrenalectomy in a tertiary level hospital. ***Objective*:** To observe the association of the size of adrenal tumor with safety and efficacy of laparoscopic adrenalectomy. ***Methods*:** Following convenience sampling 24 patients of adrenal tumor who underwent unilateral transperitoneal LA in the Department of General Surgery, Bangabandhu Sheikh Mujib Medical University, from January 2020 to December 2021 were included and classified by tumor size into 2 groups. Patients in group I had tumor size <5 cm (n = 11) and patient in group II had tumor size ≥ 5 cm (n = 13). Demographic data, perioperative outcomes, complications, and pathologic reports were compared between groups. Data were analyzed with SPSS version 23 and Chi-square ($\chi 2$) test and unpaired t test were done to find out the impaction of the size of adrenal tumor with safety and efficacy of laparoscopic adrenalectomy. ***Result*:** Average size of the tumour was 3.21±1.17 cm (range 1.5-4.9 cm) for group I, 5.58±0.69 cm (range 5-7 cm) for group II respectively. Operative time was 61.82±12.3 minutes (range 50 to 80 minutes) for group I, 68.08±9.69 minutes (range 55 to 90 minutes) for group II. Estimated blood loss, mean was 47.27±18.62 mL (range 30 to 80 mL) and 71.92±26.26 mL (range 40 to 120 mL) for groups I and II respectively. We observed no complications in groups I and II respectively. Average hospital stay was 5.2±1.8 days (range 3 to 9 days), 5.4±2.1days (range 4 to 12 days) respectively for groups I and II. Operative time and mean hospital stay were not significantly different for group II compared with group I. ***Conclusion*:** Laparoscopic transperitoneal adrenalectomy in large adrenal tumor ≥5 cm is feasible and not associated with significantly intraoperative complications except blood loss, postoperative complications and recovery. Careful patient selection with the expert surgeon in adrenal surgery is the key factor for successful laparoscopic surgery in a large adrenal tumor.

Keywords: Adrenal Tumor, Laparoscopic Adrenalectomy, Safety and Efficacy.

INTRODUCTION

Tumors arising from adrenal cortex are adrenal adenomas and carcinomas, whereas tumors of adrenal medulla are neuroblastoma, pheochromocytoma, ganglioneuroblastoma and ganglioneuroma. Other tumors like lipoma, myelolipoma, adenomatoid tumor, benign mesenchymal tumors, sarcoma, malignant lymphoma and melanoma are very rare. Primary adrenal tumors encountered in clinical practice are functioning or, non-functioning tumors. Asymptomatic adrenal masses discovered incidentally (incidentalomas)

are becoming increasingly frequent with availability of advanced imaging modalities like Computed Tomography (CT) Scan/magnetic resonance imaging (MRI). These techniques can now define adrenal masses as small as 0.5 cm in size and prevalence is up to 4% of abdominal studies [1].

Although multi-modal therapy can improve survivability of patients, still surgery is generally considered as the only treatment modality that can cure adrenal tumor. Despite the advances in surgical technology and perioperative care, adrenalectomy for adrenal tumor is still associated with higher morbidity and mortality rate. The open approach to the adrenal gland typically requires a large incision to expose a small working space with its resultant significant postoperative morbidity [2].

In the era of minimally invasive surgery, laparoscopic adrenalectomy has become the standard of care for surgical resection of the small adrenal gland tumors. It can be done either retroperitoneal or transperitoneal approach. As we are at the beginning state, we approach through the transperitoneal route. This approach offers the greatest visualization of the operative field, reducing intraoperative injuries and ensuring minimal morbidity. The advantages are less peroperative blood loss, less pain in postoperative period, shortened hospital stay, earlier return to work and better cosmetic results make laparoscopy more preferable by the patients.

Ramacciato *et al.*, (2007) were performed 18 consecutive laparoscopic adrenalectomies from 1996 to 2005 on patients with adrenal lesions larger than 7 cm. The mean tumor size was 8.3 cm (range 7–13 cm), mean operative time was 137 min, mean blood loss was 182 mL (range 100–550 mL), rate of intraoperative complications was 16%, and in three cases, they had switched from laparoscopic procedure to open surgery due to encountering any difficulty in dissection caused by adhesions and fixation of the mass or local tissue reaction and also the risk of violating the capsule of a potential malignant adrenal lesion and came in conclusion that, laparoscopic adrenalectomy for adrenal masses larger than 7 cm is a safe and feasible technique, offering successful outcome in terms of intraoperative and postoperative morbidity, hospital stay and cosmesis for patients. It seems open surgical oncological principles demonstrating similar outcomes as survival rate and recurrence rate, when adrenal cortical carcinomas were treated. The main contraindication for this approach is the evidence malignancy, local infiltration of periadrenal tissue [1].

Sturgeon, Shen, Clark (2006) concludes that, at a size threshold of 4 cm, the likelihood of malignancy doubles (to 10%) and that it is more than nine fold higher for tumors 8 cm (47%) [2].

Copeland *et al.*, (1983) examining the data from six series of patients with adrenal tumors, reported that 92% of 114 adrenocortical carcinoma were >6cm.

Ross and Aron (1990) concluded that, with no radiological evidence of malignancy, less than 1 in 10,000 adrenal neoplasms smaller than 6 cm would be a carcinoma and concluded that the likelihood of adrenocortical carcinoma is 35–98% in masses >6 cm [3].

Therefore in this study, we primarily aimed to evaluate the impact of the size of adrenal tumor with safety of laparoscopic in a tertiary hospital. We hope, this overall knowledge will result in a positive impact on the adrenal tumor patient management and thus help to improve the outcomes of surgery for benign adrenal tumor in the future.

OBJECTIVE

To observe the association of the size of adrenal tumor with safety and efficacy of laparoscopic adrenalectomy.

METHODOLOGY

This study is a cross sectional study and this study was carried out in the Department of General Surgery, Bangabandhu Sheikh Mujib Medical University (BSMMU), Shahbag, Dhaka, conducted from January 2020 to December 2021. Fulfilling the inclusion and exclusion criteria patients with adrenal tumor whom were operated in the Department of General Surgery, Bangabandhu Sheikh Mujib Medical University, were included in this study. Patients were classified by tumor size into 2 groups. Patients in group I had tumor size < 5 cm (n = 11) and patient in group II had tumor size ≥ 5 cm (n = 13). Convenience sampling was used for the sampling technique and the total number of population was 24.

Inclusion Criteria

- All diagnosed cases of adrenal tumor.
- Age more than 18 years.

Exclusion Criteria

Patients having the following criteria were excluded from the study-

- Suspected/Proven malignancy.
- Contraindication for laparoscopic surgery.

Data Collection and Analysis

An interest-variable-containing questionnaire was used to collect data. Questionnaires, clinical exams, and organized follow-up documents/records were used to collect patient data. The study ran from January 2020 to December 2021 at BSMMU's Department of General Surgery. The study comprised 24 adrenal tumor cases that met the selection criteria. A checklist established by the researcher was used to collect data on age, sex, clinical symptoms, laboratory investigation (24-hour

urine VMA, Metanephrine), ultrasonogram of the whole abdomen, CT scan of the whole abdomen (non-contrast and contrast enhanced), or MRI scan. Patients were divided by tumor size. In group I (n = 11), tumors were 5 cm and in group II (n = 13).

After preoperative preparation, including nutritional status improvement, anemia (if present), dehydration, electrolytes imbalance correction, and anesthetic fitness assessment, all cases are sent for surgery. After telescope introduction, surgical operation was done. Documented surgical and histopathological details. Peroperative drain tube collection, weight differential between blood-soaked and wet gauze, visual impression were used to estimate blood loss. Post-operative follow-up and complications were properly managed. All patients were followed from the first post-operative day to one month or hospital stay. During hospitalization, post-operative adverse events are recorded in a data sheet. Later, the patient's condition and treatment outcome are determined at a follow-up clinic or by phone. After collecting, master sheet data was reviewed and modified. Then, the study's variables were processed and analyzed using SPSS-23 (Statistical Package for Social Sciences). Following are tables and figures with the results. This study includes mean, percentages, and standard deviations. Chi-square (X2) and Unpaired-t tests were used for statistics. 95% confidence interval was used with a significance level of 0.05.

RESULTS

Table 1 shows the Distribution of the study subjects according to demographic characteristics. It was observed that majority 9(81.8%) of patients belonged to age <50 years in group-I and 9(69.2%) in group-II. The mean age was 37.55±10.26 years in group- I and 37±13.69 years in group-II. Majority 9(81.8%) of patients were female in group-I and 9(69.2%) in group-II. The differences of age and sex were statistically not significant (p>0.05) between two groups.

Table 1: Distribution of the study subjects according to demographic characteristics (n=24)

Demographic characteristics	**Group-I (n=11)**		**Group –II (n=13)**		***p* value**
	N	**%**	**n**	**%**	
Age in years					
<50	9	81.8	9	69.2	
≥50	2	18.2	4	30.8	
Mean±SD	**37.55±10.26**		**37±13.69**		**[a]0.913[ns]**
Range (min-max)	**24-50**		**18-55**		
Sex					
Male	2	18.2	4	30.8	[b]0.478[ns]
Female	9	81.8	9	69.2	

[a]p value reached from Unpaired- test, [b]p value reached from Chi-square test

Table 2 shows the distribution of the study subjects according to BMI. It was observed that all (100.0%) of patients belonged to BMI <30 kg/m2 in group-I and 11(84.6%) in group-II. The mean BMI was 25.97±2.03 kg/m2 in group-I and 25.94±3.29 kg/m2 in group-II. The differences of BMI was statistically not significant (p>0.05) between two groups.

Table 2: Distribution of the study subjects according to BMI (n=24)

BMI (kg/m^2)	**Group-I (n=11)**		**Group –II (n=13)**		***p* value**
	n	**%**	**n**	**%**	
<30	11	100.0	11	84.6	
≥30	0	0.0	2	15.4	
Mean±SD	25.97±2.03		25.94±3.29		0.979[ns]
Range (min-max)	21.3-28.4		20.9-31.5		

ns= not significant, p value reached from Unpaired-t test

Table 3 shows the distribution of the study subjects according to co-morbidity. It was observed that almost two third 7(63.6%) of patients had HTN in group-I and 8(61.5%) in group-II. More than one third 4(36.4%) of patients had DM in group-I and 6(46.2%) in group-II. One (9.1%) patient had CKD, hypothyroid & medullary Ca of thyroid in group- I and not found in group-II. One (7.7%) patient had dyslipidaemia & hepatis B carrier in group-II and not found in group-I. The differences of co-morbidities were statistically not significant (p>0.05) between two groups.

Table 3: Distribution of the study subjects according to co-morbidity (n=24)

Co-morbidity	Group-I (n=11)		Group –II (n=13)		*p* value
	n	%	n	%	
HTN	7	63.6	8	61.5	0.915[ns]
DM	4	36.4	6	46.2	0.627[ns]
CKD	1	9.1	0	0.0	0.266[ns]
Hypothyroid	1	9.1	0	0.0	0.266[ns]
Medullary Ca of thyroid	1	9.1	0	0.0	0.266[ns]
Dyslipidaemia	0	0.0	1	7.7	0.347[ns]
Hepatis B carrier	0	0.0	1	7.7	0.347[ns]

s= significant, ns= not significant, p value reached from Chi-square test

Table 4 shows the distribution of the study subjects according to tumour status. It was observed that almost two third 7(63.6%) of patients had left site tumour in group-I and 7(53.8%) in group-II. The mean tumour size was 3.21±1.17 cm in group-I and 5.58±0.69 cm in group-II. Almost half 5(45.5%) of patients had functioning tumor in group-I and 4(30.8%) in group-II. The differences of tumor size was statistically significant (p<0.05) between two groups.

Table 4: Distribution of the study subjects according to tumour status (n=24)

Tumour status	Group-I (n=11)		Group –II (n=13)		*p* value
	n	%	n	%	
Site of tumour					
Right	4	36.4	6	46.2	[a]0.627[ns]
Left	7	63.6	7	53.8	
Size of the tumour (cm)					
Mean±SD	3.21±1.17		5.58±0.69		[b]0.001[s]
Range (min-max)	1.5-4.9		5-7		
Funtional state					
Funtioning	5	45.5	4	30.8	[a]0.459[ns]
Non funtioning	6	54.5	9	69.2	

s= significant, ns= not significant, [a]p value reached from Chi-square test, [b]p value reached from Unpaired-t test

Table 5 shows the distribution of the study subjects according to investigations. The mean serum Na was 141.27±3.07 mmol/l in group-I and 138.69±2.21 mmol/l in group-II. The mean serum K was 3.34±1.11 mmol/l in group- I and 3.67±0.78 mmol/l in group-II. The mean plasma aldosterone was 199.14±164.28 pg/ml in group-I and 190.38±207.38 pg/ml in group-II. The mean plasma renin activity was 8.6±14.38 pg/ml in group-I and 17.07±33.74 pg/ml in group-II. The mean plasma cortisol was 471.84±211.96 nmol/l in group-I and 256.69±65.55 nmol/l in group-II. The mean 24 hr urinary cortisol was 217.5±163.87 microgram in group-I and 109.93±65.36 microgram in group-II. The mean serum ACTH was 16.93±17.54 pg/ml in group-I and 20.18±10.24 pg/ml in group-II. The mean dexamethasone suppression test was 706.56±761.47 in group-I and not found in group-II. The mean 24 hr urinary free metanephrine was 1818.7±832.86 nmol in group-I and 1425.3±537.5 nmol in group-II. The mean 24 hr urinary free nor-metanephrine was 4255±1576.8 nmol in group-I and 3431.3±1346.7 nmol in group-II. The mean 24 hr urinary VMA was 12.75±3.5 mg/day in group-I and 7.15±5.11 mg/day in group-II. The mean DHEAS was 93.64±84.8 microgm in group-I and 147.1±112.22 microgm in group- II. The differences of serum Na, plasma cortisol, 24 hr urinary cortisol and 24 hr urinary VMA were statistically significant (p<0.05) between two groups.

Table 5: Distribution of the study subjects according to investigations (n=24)

Investigations	Group-I (n=11)	Group –II (n=13)	*p* value
	Mean±SD	Mean±SD	
Serum Na (mmol/l)	141.27±3.07	138.69±2.21	0.025[s]
Range (min-max)	137-147	135-143	
Serum K (mmol/l)	3.34±1.11	3.67±0.78	0.402[ns]
Range (min-max)	1.6-5.2	2.2-5.2	
Plasma aldosterone (pg/ml)	199.14±164.28	190.38±207.38	0.911[ns]
Range (min-max)	26-490	2-531	

Investigations	**Group-I (n=11)**	**Group –II (n=13)**	***p* value**
	Mean±SD	**Mean±SD**	
Plasma renin activity(pg/ml)	8.6±14.38	17.07±33.74	0.447^{ns}
Range (min-max)	2.11-41.09	0.99-93	
Plasma cortisol (nmol/l)	471.84±211.96	256.69±65.55	0.002^{s}
Range (min-max)	159.75-717	169.14-348	
24 hr Urinary Cortisol (microgram)	217.5±163.87	109.93±65.36	0.040^{s}
Range (min-max)	74-402	39.48-204	
Serum ACTH(pg/ml)	16.93±17.54	20.18±10.24	0.577^{ns}
Range (min-max)	4.9-42.3	10-33	
Dexamethasone suppression test	706.56±761.47	-	-
Range (min-max)	168.12-1245	-	
24 hr Urinary free metanephrine (nmol)	1818.7±832.86	1425.3±537.5	0.176^{ns}
Range (min-max)	1097-2730	817-2337	
24 hr Urinary free nor-metanephrine	4255±1576.8	3431.3±1346.7	0.181^{ns}
Range (min-max)	3140-5370	1922-4510	
24 hr Urinary VMA(mg/day)	12.75±3.5	7.15±5.11	0.005^{s}
Range (min-max)	9.65-16.55	2.1-13.5	
DHEAS (microgm)	93.64±84.8	147.1±112.22	0.208^{ns}
Range (min-max)	12.92-182	79.99-314	

s= significant, ns= not significant, p value reached from Unpaired-t test

Table 6 shows the distribution of the study subjects according to dissection & haemostasis. It was observed that no patient had found difficulty dissection in group-I and 1(7.7%) in group-II. One (9.1%) patient had found difficulty haemostasis in group-I and 3(23.1%) in group-II. The differences of dissection and haemostasis were statistically not significant (p>0.05) between two groups.

Table 6: Distribution of the study subjects according to dissection & haemostasis (n=24)

	Group-I (n=11)		**Group –II (n=13)**		***p* value**
	n	**%**	**n**	**%**	
Dissection					
Difficulty	0	0.0	1	7.7	0.347^{ns}
No difficulty	11	100.0	12	92.3	
Haemostasis					
Difficulty	1	9.1	3	23.1	0.359^{ns}
No difficulty	10	90.9	10	76.9	

ns= not significant, p value reached from Chi-square test

Table 7 shows the distribution of the study subjects according to operation note. The mean duration of operation was 61.82±12.3 approx. min in group-I and 68.08±9.69 approx. min in group-II. The mean estimated blood loss was 47.27±18.62 approx. ml in group-I and 71.92±26.26 approx. ml in group-II. No patient had need conversion into open in group-I and 1(7.7%) in group-II due to encountering difficulty in dissection caused by adhesions and risk of capsular tear. The differences of estimated blood loss was statistically significant (p<0.05) between two groups.

Table 7: Distribution of the study subjects according to operation note (n=24)

Operation Note	**Group-I (n=11)**		**Group –II (n=13)**		***p* value**
	n	**%**	**n**	**%**	
Duration of operation (Approx. min)					
Mean±SD	61.82±12.3		68.08±9.69		^{a}0.176^{ns}
Range (min-max)	50-80		55-90		
Estimated blood loss (Approx. ml)					
Mean±SD	47.27±18.62		71.92±26.26		^{a}0.016^{s}
Range (min-max)	30-80		40-120		
Conversion into open					
Yes	0	0	1	7.7	^{a}0.347^{ns}
No	11	100	12	92.3	

ns= not significant, ^{a}p value reached from Unpaired-t test, ^{b}p value reached from Chi-square test

Table 8 shows the distribution of the study subjects according to drain collection. The mean 1st POD was 48.18±38.1 ml in group-I and 81.82±80.23 ml in group-II. The mean 2nd POD was 18.18±10.31 ml in group-I and 31.36±25.7 ml in group-II. The mean 3rd POD was 22.5±3.54 ml in group-I and 29.17±21.08 ml in group-II. The mean 4th POD was 32.5±10.61 ml in group-I and 35±21.21 ml in group-II. The mean 5th POD was 12.5±10.61 ml in group-I and not found in group-II.

Table 8: Distribution of the study subjects according to amount of drain fluid collection

Amount of drain fluid Collection	Group-I (n=11)	Group –II (n=13)	*p* value
	Mean±SD	Mean±SD	
1st POD(ml)	48.18±38.1	81.82±80.23	0.216ns
2nd POD(ml)	18.18±10.31	31.36±25.7	0.125ns
4th POD(ml)	32.5±10.61	35±21.21	0.726ns
5th POD(ml)	12.5±10.61	-	-

ns= not significant, p value reached from Unpaired-t test

Table 9 shows the distribution of the study subjects according to drain removal. It was observed that majority 9(81.8%) patients had drain tube removal on 3rd POD in group-I and 9(69.2%) in group-II. The differences of drain removal was not statistically significant (p>0.05) between two groups.

Table 9: Distribution of the study subjects according to drain tube removal (n=24)

Drain tube removal	Group-I (n=11)		Group –II (n=13)		*p* value
	n	%	n	%	
3rd	9	81.8	9	69.2	
4th	0	0.0	2	15.4	0.397ns
5th	2	18.2	2	15.4	

ns= not significant, p value reached from Chi-square test

Table 10 shows the distribution of the study subjects according to complications. It was observed that, no complication was found in both groups.

Table 10: Distribution of the study subjects according to complications (n=24)

Complications	Group-I (n=11)		Group-II (n=13)	
	n	%	n	%
Wound infection				
Yes	0.0	0.0	0	0.0
No	11	100.0	13	100.0
Respiratory complication				
Yes	0.0	0.0	0	0.0
No	11	100.0	13	100.0
Cardiac complication				
Yes	0.0	0.0	0	0.0
No	11	100.0	13	100.0
Urinary complication				
Yes	0.0	0.0	0	0.0
No	11	100.0	13	100.0

Table 11 show the distribution of the study subjects according to hospital stay. It was observed that majority 9(81.8%) of patients stayed in hospital ≤5 days in group-I and 9(69.2%) in group-II. The mean hospital stay was 5.2±1.8 days in group-I and 5.4±2.1 days in group-II. The differences of hospital stay was not statistically significant (p>0.05) between two groups.

Table 11: Distribution of the study subjects according to hospital stay (n=24)

Hospital stay (days)	Group-I (n=11)		Group –II (n=13)		*p* value
	n	%	N	%	
≤5	9	81.8	9	69.2	
>5	2	18.2	4	30.8	
Mean±SD	5.2±1.8		5.4±2.1		0.806ns
Range (min-max)	3-9		4-12		

ns= not significant, p value reached from Unpaired-t test

Table 12 shows the distribution of the study subjects according to histopathology. It was observed that almost Three-quarters 8(72.7%) of patients had adrenocortical adenoma in group I and 6(46.2%) patients in group II. In group 1, 2 patients (18.2%) had adrenal myelolipoma, and in group 2, 3 patients (23.1%). Two (15.4%) patients had a pheochromocytoma in group-II, which was not found in group-I. One patient (7.7%) had a ganglioneuroblastoma in group II and was not found in group I.

Table 12: Distribution of the study subjects according to histopathology (n=24)

Histopathology	Group-I (n=11)		Group –II (n=13)	
	n	%	n	%
Adrenocortical adenoma	8	72.7	6	46.2
Adrenal myelolipoma	2	18.2	3	23.1
Pheochromocytoma	0	0	2	15.4
Ganglioneuroblastoma	0	0	1	7.7
Not available	1	9.1	1	7.7

DISCUSSION

This study evaluated the relationship between adrenal tumor size and laparoscopic adrenectomy safety and efficacy in a tertiary hospital. Our study included 24 laparoscopic adrenectomy patients. Tumor size determined patient groupings. Group I (n = 11) had tumors less than 5 cm while Group II (n = 13) had tumors greater than or equal to 5 cm.

Demographics-based study subject distribution. The majority of patients (81.8%) were under 50 and 9 (69.2%) in group I was in group II. Group 1's mean age was 37.5510.26 while group II's was 3713.69. In group I (81.8%) and group II (69.2%), most patients were female. Age and sex differences weren't significant (p>0.05).

Prakobpon *et al.,* (2021) analyzed clinical data from patients who had unilateral peritoneal LA between April 2000 and June 2019. They compared LA surgery outcomes and complications. Tumor size determined patient groupings. In group 1, 408 individuals had tumors smaller than 6 cm in size, and 48 had larger tumors. Comparing groups' demographic, perioperative, and pathological data. Laparoscopic transperitoneal adrenalectomy in big adrenal tumors 6 cm is feasible but linked with worse intraoperative, postoperative, and recovery. Most issues were modest and manageable. Laparoscopic surgery on a big adrenal tumor requires careful patient selection and a competent surgeon [4]. This supported our study.

Deger *et al.,* (2019) studied adrenal tumor patients. 33 patients (53.2%) had left adrenal mass and 29 (46.8%) had right. 46 (74.2%) of 62 adrenal masses were less than 5 cm (Group I), while 16 (25.8%) were larger (Group II). Group I tumors were 3.20.15 cm and group II 6.43.5 cm. Age, operation time, and hemorrhage were not significantly different. Group 1 hospital stays averaged 37.620.9 hours. Group 2: 49.822.9 hours (p0.05). One I and II patient had elevated intraoperative blood pressure. In group 2, the capsule above the lump was opened in a patient suspected of cancer. One patient in group I had hypokalemia, atelectasis, and pneumonia 5 cm or bigger without preoperative invasion suspicion. LA is a minimally invasive surgical procedure that can be used successfully in skilled centers on tumors larger than 5 cm with no suspected invasion [5].

LA is gaining popularity among surgeons due to its minimal morbidity, quick hospital LOS, and reduced pain. Tumor size, histology, function, concomitant surgeries, and surgeon experience may affect patient outcome [6, 7].

Serji *et al.,* (2016) performed a retrospective analysis on 45 individuals (56 laparoscopic adrenectomy) from January 2006 to December 2013. Based on tumor size, they split patients into two groups and compared pre- and postoperative demographic data. Conversion rate (3.7% vs 11.7% P = 0.32), postoperative complications (14% vs 12% P = 0.4), postoperative hospital stay (5 vs 6 days P = 0.43), or death (3.5% vs 0% P) = 0.99. 155 (60) versus 247 (71) minutes (P 0.001) was the sole statistical difference [8]. Laparoscopic adrenectomy for large tumors takes longer, but is safe and doable with an experienced surgeon.

Agrusa *et al.,* (2014) studied LA in 14 patients with >6 cm adrenal tumors (mean 8.2 cm), surgical death, or open conversion. Parnaby *et al.,* (2008) compared LA results in 101 patients with adrenal tumors larger than 6 cm. Without local invasion, pre- and post-operative results were identical [9].

Natkaniec *et al.,* (2016) revealed that LA for adrenal tumors greater than 6 cm increased operational time, EBL, and conversion rates. Bozkurt *et al.,* (2015) compared peritoneal LA results between adrenal tumors more than 8 cm (n = 16) and smaller than 8 cm (n = 19). LA showed feasibility for big benign adrenal tumors [10], although not significantly (p=0.05).

Abraham *et al.,* (2014) and Bozkurt *et al.,* (2015) reported a 15cm LA-treated myelolipoma. The largest tumor in a research was a 17 cm mature cystic

teratoma. Malignancy risk in adrenal tumors is closely related to tumor size, making laparoscopic surgery in ACC dubious. Li *et al.,* found that ACC is 1% for tumors less than 4 cm, 6% for 4-6 cm, and 20% for > 6 cm (2018). Rare, aggressive tumor. The benefits of minimally invasive laparoscopic surgery must be evaluated against the risk of partial resection and capsule puncture [11, 12]. Some experts advocate avoiding LA for adrenal tumors larger than 6 cm with probable ACC, but others have demonstrated it's safe and practical.

Brix *et al.,* (2010) compared laparotomy with LA for 152 patients with ACCs of 10 cm or smaller. They found no differences in disease-specific survival, recurrence-free survival, tumor capsule violations, or postoperative peritoneal carcinomatosis [13].

Machado *et al.,* (2015) showed no difference in oncological outcomes between open and laparoscopic methods. Poor surgical outcomes were most likely related to inadequate surgery [14].

Wu *et al.,* (2018) observed LA had a greater relapse rate and shorter relapse time than open adrenectomy [15].

Cooper *et al.,* (2013) observed greater peritoneal recurrence, shorter recurrence-free survival, and poorer overall survival with LA in ACC [16].

Alberici *et al.,* devised a scoring algorithm to anticipate the difficulties of laparoscopic adrenectomy in 2021 [17].

Lindeman *et al.,* (2019) recommended transabdominal adrenectomy using imaging markers. S-GF, the distance between the adrenal gland and kidney. Pararenal fat distances (PNFs) were measured for adrenal glands and 12th ribs. Pearson's correlation or analysis of variance was used to compare BMI, sex, age, tumor size, diagnosis, operation time, and estimated blood loss. Higher BMI was related with greater tumor size and longer operational time (r = 0.341) for transabdominal adrenectomy. S-GF and PNF were marginally linked with operative time (r = 0.464 and 0.494, respectively). The posterior adiposity index (PAI) was found to be closely related to operation time (r = 0.590), but not to estimated hemorrhage. Larger lesions and PAI predicted longer operational times [18].

In our analysis, 763.6% of group-I patients and 53% of group-II patients had left-sided malignancies. Group-I tumors averaged 3.211.17 cm and group-II 5.580.69 cm. 45.5% of patients had group I function, 30% group II. The two groups' tumor sizes differed significantly (p0.05).

2/3 7(63.6%) group-I patients and 8(61.5%) group-II patients experienced HTN. Group 1 had 36.4% DM and group 2 had 46.2%. One (9.1%) patient in group I had CKD, hypothyroidism, and medullary thyroid Ca. 7.7% of group II patients had dyslipidemia and were hepatitis B carriers. Comorbidity didn't differ between groups (p>0.05).

Group I had no dissection difficulties, while group II had one (7.7%). One (9.1%) patient in group-I developed hemostasis problems, and 3 (23.1%) in group-II. Dissection and hemostasis didn't differ across groups (p>0.05).

Mean operation time was 61.8212.3 min in group-I and 68.089.69 min in group-II. In group-I, the mean blood loss was 47.2718.62 ml and in group-II, 71.9226.26 ml. No patient in group-I needed open surgery due to adhesions and capsular tear, while 1 (7.7%) in group-II did. Estimated blood loss differed between groups (p0.05). Neither group had complications.

The majority of patients in group I (81.8%) and group II (69.2%) were hospitalized within 5 days. In group 1, the average hospital stay was 5.21.8 days and in group 2, 5.42.1 days. Hospitalization length was not different across groups (p>0.05).

Three-quarters Group I had 8 (72.7%) and group II had 6 (46.2%) adrenocortical adenomas. 2 patients (18.2%) in group 1 and 3 patients (23.1%) in group II developed adrenal myelolipoma. Two (15.4%) individuals had group-II pheochromocytomas, not group-I. One patient (7.7%) had a group II ganglioneuroblastoma but not group I.

CONCLUSION

Laparoscopic transperitoneal adrenalectomy in large adrenal tumor ≥ 5 cm is feasible and not associated with significantly intraoperative complications except blood loss, postoperative complications and recovery. Careful patient selection with the expert surgeon in adrenal surgery is the key factor for successful laparoscopic surgery in a large adrenal tumor.

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