

ORIGINAL RESEARCH

Laparoscopic Adrenalectomy for Pheochromocytoma: A Single Centre experience

Dr. Ranjeet Singh Rathore¹, Dr. Arjit Kapoor², Dr. Dhanav Mahajan³, Dr. Gurpal Singh⁴

¹Assistant Professor, Department of Surgery, ASCOMS and Hospital, Sidhra, Jammu, India

^{2,3,4}Resident, General Surgery, ASCOMS and Hospital, Jammu, India

Corresponding Author

Dr. Ranjeet Singh Rathore

Assistant Professor, Department of Surgery, ASCOMS and Hospital, Sidhra, Jammu, India

Received: 29 Sep, 2023

Accepted: 11 Oct, 2023

Abstract

Background: Laparoscopic adrenalectomy has become the gold standard technique for adrenal masses under 6 cm due to a number of advantages over the conventional approach; however, for larger masses, an open approach has been suggested because it is thought to be associated with less perioperative, hemodynamic instability and ensures complete tumor resection.

Aims and Objectives: The goal of this study is to evaluate the effectiveness and viability of laparoscopic adrenalectomy for pheochromocytoma.

Study Design: Prospective cohort study.

Material and Methods: All patients who underwent laparoscopic adrenalectomy (LA) for pheochromocytoma (PCC) at ASCOMS hospital Jammu between November 2020 to January 2023 were included in the study after taking an informed consent. The surgeries were performed by the same surgeon having more than 10 years of experience.

Results: Our study included total of 52 patients (30 females and 22 males) who underwent laparoscopic adrenalectomy for different adrenal masses. Out of 52 patients who underwent adrenalectomy, only 15 turned out to be having pheochromocytoma on histopathology. The mean operative time was 145 minutes with an average blood loss of 200 ml

Conclusion: Our study's findings strongly imply that, in the hands of an experienced surgeon, laparoscopic adrenalectomy offers a safe and practical alternative to the traditional approach, even in cases of large pheochromocytomas, given the quicker recovery times and comparable results.

Keywords: Laparoscopic adrenalectomy, Flank position, Pheochromocytoma

This is an open access journal, and articles are distributed under the terms of the Creative Commons Attribution-Non Commercial-Share Alike 4.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

Introduction

Laparoscopic adrenalectomy, which was first described in 1992, is now recognized as the best treatment option for the majority of adrenal tumors. It has reportedly been linked to better short-term outcomes, including lower perioperative morbidity and a quicker postoperative recovery period(1,2) Pheochromocytomas potentially have lethal cardiovascular effects due to the catecholamine secreting tendency of this tumor(3,4). Other related complications of renal and gastrointestinal system have also been well described (6,7). With only surgical resection as the definitive treatment, multiple approaches have been described till date. The laparoscopic approach is more technically difficult, resulting in a longer operation time and a higher postoperative complication rate even in the hands of experienced surgeons because of the peculiar biological behavior of the adrenal lesions, which include high vascularity, multiple adhesions, and larger size in comparison to other adrenal lesions.(8,9,10)Concerns regarding the intraoperative hyper and hypotensive events being more prevalent in large tumors, can be attenuated by pneumoperitoneum, leading to a difficult

anesthetic management. The aim of this study was to analyze the safety, feasibility and intraoperative short term outcomes of LA for PCC in a tertiary care centre in northern India.

Material and methods

After taking institutional ethical committee clearance of the hospital, all the patients diagnosed with adrenal masses on the basis of clinical evaluation, biochemical tests (catecholamines, metanephrines and serum chromogranin A levels), abdominal USG and CT scan (assessment of size and relationship with adjacent organs) were admitted on OPD basis and underwent LA by the same surgeon at our institution during a course of three years. For Perioperative management of PCC a prospective protocol was established, after the completion of surgical learning curve. The pre-operative pharmacological treatment, administered about 2 weeks before operation, included: non-selective alpha adrenergic blocker (phenoxybenzamine 10mg OD). In a few patients who had concomitant tachycardia a beta one selective blocker was added to the pre-operative treatment. Intraoperative hypertension

and sinus tachycardia were managed by alpha adrenergic blockers and beta blockers (labetelol), respectively. To minimize the complications caused by catecholamine release, the complete voiding of adrenal surge with minimal manipulation of the tumor was the surgical strategy. All patients were put under the intensive care unit (ICU) for the first post-operative day. All the baseline investigations and variables were recorded for each patient which included comorbidities, ASA score, catecholamine and metanephrine levels, pre-operative symptoms, operative time, need of blood transfusion and intraoperative/postoperative events (Hypertension, Hypotension, tachycardia). An informed consent was taken from all the patients before the operation.

Results

A total of 52 patients underwent laparoscopic adrenalectomy for different adrenal masses. A transperitoneal laparoscopic approach was attempted in all the cases. The median tumour size was 7.5 cm and median operative time 145 min. Average blood loss reported in our study was 200 ML. Only 5 cases required conversion to open adrenalectomy in view of

severe fluctuations of blood pressure, and severe bleeding which was difficult to control laparoscopically. In other patients, failure to separate adrenal mass posteriorly was the reason for conversion due to dense adhesions with IVC with overall conversion rate of 3.84%. Intraoperative blood transfusion was given to 5 patients considering the intraoperative blood loss secondary to difficult dissection maneuvers. All the patients who required conversion to open adrenalectomy turned out to be Pheochromocytoma on histopathological examination. Post-Op morbidity was seen in 2 patients which required longer ICU stay (3 days vs 1 day); both patients developed post-op hypotension and were managed with I/v fluids and norepinephrine infusion which was slowly tapered off. The patients were discharged after stabilisation and normalisation of the endocrine panel after diligent discussion with the endocrinologist. No mortality was seen within 30 days of the operation. The pathologist confirmed a negative resection margin in all the specimens. With a follow up rate of 100%, no recurrence was reported.

Table: 1 Shows the median tumour parameters along with metanephrine levels, operative time observed, average blood loss and hospital stay during the study

Parameter	Median value	Range
Operative time [min] (median; range)	145 minutes	110-174 minutes
Tumor Size	7.5cm	4cm-11cm
Tumor Weight	200gms	50-330 gms
Metanephrine Level	374nmol/l	88 -724nmol/l
Blood loss	200 ml	70-550ml
Hospital stay	6 days	4-10 days

Table: 2 depicts The various intra operative complications encountered and their respective percentages

Conversion rate	5	3.4%
Intra operative blood transfusion	13	25%
Intraoperative hypotensive drugs	9	17.3%
Intraoperative vasopressors	10	19.2%
Intraoperative tachycardia	14	26.9%
Intraoperative desaturation	8	15.3%
Intraoperative hypertensive peaks	11	21.15%
Intraoperative hypotension	8	15.38%
Intra operative acidosis	0	0
Intraoperative hypoglycemia	0	0

Discussion

A rare neuroendocrine tumour, PCC, have always been associated with high morbidity and mortality rate, owing to its multiple cardiovascular complications and high recurrence rate (12). Open approach has been shown to have much higher perioperative morbidity when compared to laparoscopy, hence becoming the treatment of choice for PCC (13,14,15,16). With limited data on predictors of outcomes of laparoscopic adrenalectomy for PCC and its association with longer operative time, higher conversion rate and complication

rates when compared with LA for different indications (8,9,10,11). Severe hypertension and cardiovascular instability has been reported during surgical manipulation, induction of pneumoperitoneum and intubation due to massive catecholamine release during LA (16,17). Risk factors for intraoperative hypertension and post-operative hypertension have been identified as urinary epinephrine and norepinephrine levels and tumor size in many recent papers (18,19,20,21). Yet in most of the recent studies laparoscopic approach was not identified as a variable influencing perioperative

outcomes and morbidity(18,19,20,21). However a study by Kirernan et al. (22) reported the open techniques association with increased intra and postoperative hemodynamic instability. However, in our study no association of tumor size with the perioperative hemodynamic instability or any other factor of mobility was seen. The results of our study are in line with the recently published metanalysis (23) of 743 patients from 13 retrospective studies and 1 RCT comparing laparoscopic versus open approach for PCC. No Studies have yet reported any differences in recurrence rate between laparoscopic and open approach for PCC. A series of 287 malignant PCC reported by Goffredo et al. found tumor recurrence or persistent at around 3 to 13% of PCC operated. In our series with 0% loss of follow-up and a recurrence of 0% at six-month interval was registered with the survival rate of 91.7%, with the one patient loss in a RTA, unrelated to our study. This can be attributed to the small sample size and extent of feasibility of our study. Irrespective of the tumor size a minimally invasive approach was attempted in all cases in our centre, while maintaining a good hemodynamic control with a radical resection as the final goal. PCC being a volatile and aggressive tumor the surgeon must be ready for conversion to open approach with good anesthetic backup. In our study only five procedures were converted into open adrenalectomies, two in view of uncontrolled intra-op BP which was stabilised with the use of intravenous labetalol and furosemide, and in the other patients difficulty in mobilisation of the base of adrenal due to severe adhesions with the IVC along with severe haemorrhage comprised the reason of conversion. This study is subject to the inherent limitations of the small data set and PCC which are a rare tumor in itself. This study being one of the few conducted in northern india shall pave a future for better approach and understanding of the complications and challenges encountered in our setup, as most of the studies published are of foreign origin.

Conclusion

No matter the size of the tumor or any accompanying comorbidities, minimally invasive adrenalectomy represents the gold standard for pheochromocytoma. There has been no evidence that the laparoscopic approach has worsened hemodynamic instability, and both the intraoperative and short-term outcomes were unaffected. Comparable to the reported series of open resections in terms of overall survival and recurrence rate.

Hence it is clear that in the hands of experienced surgeon LA provides a safe and feasible alternative to the conventional approach even in large PCC, considering the faster recovery and similar outcomes.

References

- Gagner M, Lacroix A, Bolté E. Laparoscopic adrenalectomy in Cushing's syndrome and pheochromocytoma. *N Engl J Med.* 1992;327:1033. [[PubMed](#)] [[Google Scholar](#)]

- Assalia A, Gagner M. Laparoscopic adrenalectomy. *Br J Surg.* 2004;91:1259–1274. [[PubMed](#)] [[Google Scholar](#)]
- Olson SW, Deal LE, Piesman M. Epinephrine-secreting pheochromocytoma presenting with cardiogenic shock and profound hypocalcemia. *Ann Intern Med.* 2004;140:849–851. [[PubMed](#)] [[Google Scholar](#)]
- Petrák O, Strauch B, Zelinka T, Rosa J, Holaj R, Vránková A, Kasalický M, Kvasnicka J, Pacák K, Widimský J., Jr Factors influencing arterial stiffness in pheochromocytoma and effect of adrenalectomy. *Hypertens Res.* 2010;33:454–459. [[PMC free article](#)] [[PubMed](#)] [[Google Scholar](#)]
- Kwong YL, Yu YL, Lam KS, Woo E, Ma JT, Huang CY. CT appearance in hypertensive encephalopathy. *Neuroradiology.* 1987;29:215. [[PubMed](#)] [[Google Scholar](#)]
- Fujiwara M, Imachi H, Muraio K, Muraoka T, Ohyama T, Miyai Y, Kushida Y, Haba R, Kakehi Y, Ishida T. Improvement in renal dysfunction and symptoms after laparoscopic adrenalectomy in a patient with pheochromocytoma complicated by renal dysfunction. *Endocrine.* 2009;35:57–62. [[PubMed](#)] [[Google Scholar](#)]
- Salehi A, Legome EL, Eichhorn K, Jacobs RS. Pheochromocytoma and bowel ischemia. *J Emerg Med.* 1997;15:35–38. [[PubMed](#)] [[Google Scholar](#)]
- Conzo G, Musella M, Corcione F, et al. Laparoscopic adrenalectomy, a safe procedure for pheochromocytoma. A retrospective review of clinical series. *Int J Surg.* 2013;11:152–156. [[PubMed](#)] [[Google Scholar](#)]
- Murphy MM, Witkowski ER, Ng SC, et al. Trends in adrenalectomy: a recent national review. *Surg Endosc.* 2010;24:2518–2526. [[PubMed](#)] [[Google Scholar](#)]
- Bergamini C, Martellucci J, Tozzi F, Valeri A. Complications in laparoscopic adrenalectomy: the value of experience. *Surg Endosc.* 2011;25:3845–3851. [[PubMed](#)] [[Google Scholar](#)]
- Shen ZJ, Chen SW, Wang S, Jin XD, Chen J, Zhu Y, Zhang RM. Predictive factors for open conversion of laparoscopic adrenalectomy: a 13-year review of 456 cases. *J Endourol.* 2007;21:1333–1337. [[PubMed](#)] [[Google Scholar](#)]
- Parasiliti-Caprino M, Lucatello B, Lopez C, et al. Predictors of recurrence of pheochromocytoma and paraganglioma: a multicenter study in Piedmont, Italy. *Hypertens Res.* 2020;43:500–510. [[PubMed](#)] [[Google Scholar](#)]
- Jaroszewski DE, Tessier DJ, Schlinkert RT, Grant CS, Thompson GB, van Heerden JA, Farley DR, Smith SL, Hinder RA. Laparoscopic adrenalectomy for pheochromocytoma. *Mayo Clin Proc.* 2003;78:1501–1504. [[PubMed](#)] [[Google Scholar](#)]
- Kazaryan AM, Kuznetsov NS, Shulutko AM, Beltsevich DG, Edwin B. Evaluation of endoscopic and traditional open approaches to pheochromocytoma. *Surg Endosc.* 2004;18:937–941. [[PubMed](#)] [[Google Scholar](#)]
- Tiberio GA, Baiocchi GL, Arru L, Agabiti-Rosei C, De Ponti S, Matheis A, Rizzoni D, Giulini SM. Prospective randomized comparison of laparoscopic versus open adrenalectomy for sporadic pheochromocytoma. *Surg Endosc.* 2008;22:1435–1439. [[PubMed](#)] [[Google Scholar](#)]
- Fernández-Cruz L, Taurá P, Sáenz A, Benarroch G, Sabater L. Laparoscopic approach to pheochromocytoma: hemodynamic changes and catecholamine secretion. *World J Surg.* 1996;20:762–768. [[PubMed](#)] [[Google Scholar](#)]

17. Joris JL, Hamoir EE, Hartstein GM, Meurisse MR, Hubert BM, Charlier CJ, Lamy ML. Hemodynamic changes and catecholamine release during laparoscopic adrenalectomy for pheochromocytoma. *AnesthAnalg.* 1999;88:16–21. [[PubMed](#)] [[Google Scholar](#)]
18. Namekawa T, Utsumi T, Kawamura K, Kamiya N, Imamoto T, Takiguchi T, Hashimoto N, Tanaka T, Naya Y, Suzuki H, Ichikawa T. Clinical predictors of prolonged postresection hypotension after laparoscopic adrenalectomy for pheochromocytoma. *Surgery.* 2016;159:763–770. [[PubMed](#)] [[Google Scholar](#)]
19. Kwon SY, Lee KS, Lee JN, Ha YS, Choi SH, Kim HT, Kim TH, Yoo ES, Kwon TG. Risk factors for hypertensive attack during pheochromocytoma resection. *Investig Clin Urol.* 2016;57:184–190. [[PMC free article](#)] [[PubMed](#)] [[Google Scholar](#)]
20. Rao N, Ramachandran R, Tandon N, Singh P, Kumar R. Surgical and hemodynamic outcomes in pheochromocytoma surgery: a prospective cohort study. *Urology.* 2016;98:103–106. [[PubMed](#)] [[Google Scholar](#)]
21. Agarwal G, Sadacharan D, Aggarwal V, Chand G, Mishra A, Agarwal A, Verma AK, Mishra SK. Surgical management of organ-contained unilateral pheochromocytoma: comparative outcomes of laparoscopic and conventional open surgical procedures in a large single-institution series. *Langenbecks Arch Surg.* 2012;397:1109–1116. [[PubMed](#)] [[Google Scholar](#)]
22. Kiernan CM, Du L, Chen X, Broome JT, Shi C, Peters MF, Solorzano CC. Predictors of hemodynamic instability during surgery for pheochromocytoma. *Ann Surg Oncol.* 2014;21:3865–3871. [[PMC free article](#)] [[PubMed](#)] [[Google Scholar](#)]
23. Li J, Wang Y, Chang X, Han Z. Laparoscopic adrenalectomy (LA) vs open adrenalectomy (OA) for pheochromocytoma (PHEO): a systematic review and meta-analysis. *Eur J Surg Oncol.* 2020;46(6):991–998. [[PubMed](#)] [[Google Scholar](#)]