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ORIGINAL: Outcomes and Complications of Laparoscopic Adrenalectomy in a Retrospective Series of 36 Patients in Sari Iran

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ABSTRACT

This study describes perioperative outcomes and recorded complications of laparoscopic adrenalectomy at two teaching hospitals in Sari, Iran.We retrospectively reviewed 36 consecutive patients who underwent transperitoneal laparoscopic adrenalectomy between March 2010 and March 2012. Demographic characteristics, tumor size, operative parameters, pathology, postoperative hospital stay, and recorded complications were summarized. There was no open-surgery comparison group. Associations were exploratory.

The cohort included 29 women and 7 men; mean age was 42.44 ± 12.82 years. Mean tumor diameter was 6.96 ± 2.81 cm (range 4–14), although the measurement source was unspecified. Mean operative time was 161.11 ± 20.80 minutes and mean postoperative stay was 3.91 ± 1.74 days. Pheochromocytoma and adrenal cyst each accounted for 17 cases (47.2%). Five patients (13.9%) had events recorded as hypertensive crisis, four (11.1%) sustained renal-vein injury, and two (5.6%) had postoperative surgical-site hernia. All renal-vein injuries were repaired laparoscopically; no conversion or transfusion was reported. Mean BMI was higher in patients with intraoperative complications (26.37 ± 1.72 versus 24.68 ± 2.00 kg/m²; P = 0.030). Complication severity could not be reliably classified from the available information.

Laparoscopic adrenalectomy was completed without conversion in this selected series, but clinically relevant intraoperative events occurred. The uncontrolled design and incomplete outcome definitions preclude conclusions about superiority to open surgery, safety across tumor sizes, or oncologic effectiveness. The BMI association requires confirmation.

Introduction

Gagner and colleagues reported laparoscopic adrenalectomy in 1992, and their subsequent 100-procedure series documented broader clinical experience with the technique (1, 2). Comparative cohorts subsequently reported advantages in selected recovery outcomes relative to open adrenalectomy, although their findings depend on patient selection and study design (3, 4). Later guidelines recommend selecting the surgical approach through assessment of hormonal activity, imaging characteristics, malignancy risk, and surgical expertise rather than tumor diameter alone (5, 6).

Both transperitoneal and posterior retroperitoneoscopic approaches have been evaluated in substantial clinical series and randomized comparisons (7, 8). An approach-specific study of pheochromocytoma also reported differences in perioperative outcomes, supporting attention to operative

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access when comparing adrenalectomy series (9).

Laparoscopic resection of selected larger adrenal masses has been described by Henry and colleagues and by Hobart and colleagues, with particular attention to suspected invasion and dissection planes (10, 11). Additional series by Novitsky and colleagues and Tsuru and colleagues extended the evidence on technical feasibility in larger tumors, but these selected cohorts do not establish universal suitability for laparoscopy (12, 13). For suspected adrenocortical carcinoma, complete resection, capsule integrity, and margin status remain essential considerations in choosing and evaluating surgery (14).

Tumor pathology is also relevant to operative risk: Kim and colleagues reported different operative courses for pheochromocytomas and aldosteronomas (15). The PRESCRIPT trial used predefined blood-pressure targets and detailed perioperative measurements to evaluate hemodynamic control during pheochromocytoma resection, illustrating the value of explicit event definitions (16).

Reliable complication comparisons require standardized reporting: Clavien–Dindo grades describe postoperative morbidity according to treatment and clinical consequences, while ClassIntra provides a separate framework for intraoperative adverse events (17–19). Transparent reporting of selection, missing information, potential bias, and generalizability is also central to interpreting observational surgical data (20, 21).

Against this clinical background, the present study describes 36 laparoscopic adrenalectomies performed at two teaching hospitals in Sari, Iran, between 2010 and 2012; its descriptive objective and interpretive limits are stated explicitly in keeping with observational reporting principles (20, 21). Because no open-surgery group was included, the study addresses local perioperative experience rather than comparative effectiveness, a distinction that remains necessary when interpreting findings alongside comparative adrenalectomy studies (3, 4, 21).

Material and Methods

Study design and patients

This retrospective case series included 36 consecutive patients who underwent laparoscopic adrenalectomy for adrenal masses at Imam Khomeini and Amir-Mazandarani Hospitals between March 2010 and March 2012. All procedures were performed by one experienced laparoscopic urologist. Patients treated by open adrenalectomy were not included. The available study information did not specify the selection criteria for choosing laparoscopy over an open approach or the number of patients undergoing open surgery during the same period.

Data collection and outcome reporting

Hospital records were reviewed for age, sex, body-mass index (BMI), comorbidities, imaging, tumor side and size, operative time, final pathology, analgesic use, conversion, hospital stay, and complications. Operative time was defined as the interval from skin incision to closure. Hospital stay reported here refers to the postoperative period; total admission-to-discharge duration was unavailable. The source of the reported tumor diameter, whether preoperative imaging or pathological examination, could not be established from the available information.

The original data collection targeted postoperative complications within 30 days and included telephone contact when follow-up information was missing. However, the completeness of follow-up and the timing of individual hernia diagnoses were not reported. Hernias are therefore presented as recorded postoperative events, without assuming that all occurred within 30 days.

Intraoperative and postoperative events were reported separately. The term “hypertensive crisis” was retained only as a recorded event label: no blood-pressure threshold, minimum duration, intervention requirement, or associated organ-injury criterion was available. These events could not be reclassified using a reproducible operational definition. Details of preoperative alpha-blockade and intraoperative treatment were also unavailable.

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Clavien–Dindo grades reflect the treatment and clinical consequences of postoperative complications (17, 18). Treatment details for the two hernias were insufficient for retrospective grading. Intraoperative hypertensive events and renal-vein injuries were described separately and were not assigned postoperative Clavien–Dindo grades. No standardized intraoperative severity classification, such as ClassIntra, could be applied from the available information (19).

Although estimated blood loss was listed among the variables collected, numerical blood-loss data were unavailable. Criteria for conversion to open surgery and surgical margin status for the lesion potentially representing malignancy were not reported. These items were treated as unavailable rather than inferred from the absence of conversion or transfusion.

Surgical technique

Under general anesthesia, patients were placed in the lateral decubitus position for transperitoneal adrenalectomy. Pneumoperitoneum was established using a Veress needle or Hasson technique, usually with four ports. On the right, liver mobilization exposed the adrenal vein at the inferior vena cava. On the left, mobilization of the spleen and pancreatic tail exposed the adrenal vein near the left renal vein. The adrenal vein was clipped and divided, and the specimen was removed in an endoscopic retrieval bag. Drains were not routinely placed.

Statistical analysis

Continuous variables were summarized as mean ± standard deviation (SD), and categorical variables as counts and percentages. The original analysis used independent-samples t-tests or one-way analysis of variance for continuous variables and chi-square or Fisher exact tests for categorical variables, with SPSS version 18 (SPSS Inc., Chicago, IL, USA). Two-sided P values below 0.05 were considered statistically significant. The reported associations were unadjusted and exploratory; they should not be interpreted as independent predictors or causal effects.The study protocol was approved by the institutional ethics committee of Mazandaran University of Medical Sciences. The requirement for individual informed consent was waived for the retrospective record review, and patient confidentiality was maintained.

Results

Patient and tumor characteristics

The cohort included 7 men (19.4%) and 29 women (80.6%). Mean age was 42.44 ± 12.82 years and mean BMI was 25.05 ± 2.05 kg/m². Seventeen patients (47.2%) had a comorbidity, most commonly hypertension with or without diabetes. All patients underwent ultrasonography and computed tomography; four (11.1%) also underwent magnetic resonance imaging. Right- and left-sided tumors each accounted for 18 cases. Mean tumor diameter was 6.96 ± 2.81 cm (range 4–14) (Table 1). The original size categories were 4–7 cm and 7–14 cm, with 18 patients in each. Because the categories overlap at 7 cm, the number strictly greater than 7 cm could not be verified.

Men were older than women (52.14 ± 7.15 versus 40.10 ± 12.86 years; P = 0.024); BMI did not differ significantly by sex (P = 0.57). Patients with solid lesions were older than those with cystic lesions (48.78 ± 6.01 versus 35.35 ± 14.76 years; P = 0.001) and had higher BMI (26.06 ± 1.50 versus 23.92 ± 1.92 kg/m²; P = 0.001). Cystic lesions were larger (7.92 ± 3.58 versus 6.10 ± 1.50 cm; P = 0.044).

Operative outcomes and pathology

Mean operative time was 161.11 ± 20.80 minutes (range 130–200), with no significant difference between BMI groups ≥25 and <25 kg/m² (P = 0.420). All patients received diclofenac 100 mg suppositories postoperatively; 14 (38.9%) also received pethidine, with a reported mean dose of 31.2 ± 11.03 mg. Mean duration of analgesic use was 2.32 ± 0.65 days.

Final pathology was reported as pheochromocytoma in 17 patients (47.2%), adrenal cyst in 17 (47.2%), and cortical

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adenoma in one (2.8%). The remaining case (2.8%) was labeled "metastatic adenoma" in the available report. This ambiguous diagnosis requires verification against the original pathology report and is not treated here as a confirmed malignant histological subtype (Figure 1). Surgical margin status was unavailable.

Table 1. Baseline characteristics of the 36 patients

Characteristic	Reported value
Age, years	42.44 ± 12.82
Male / female	7 (19.4%) / 29 (80.6%)
BMI, kg/m²	25.05 ± 2.05
At least one comorbidity	17 (47.2%)
Right / left adrenal mass	18 (50.0%) / 18 (50.0%)
Tumor diameter, cm	6.96 ± 2.81; range 4–14
Source of tumor measurement	Unspecified
Original size categories*	4–7 cm: 18 (50.0%); 7–14 cm: 18 (50.0%)

Values are mean ± SD or n (%). BMI, body-mass index. *Categories are reproduced as originally reported; assignment of tumors measuring exactly 7 cm requires verification.

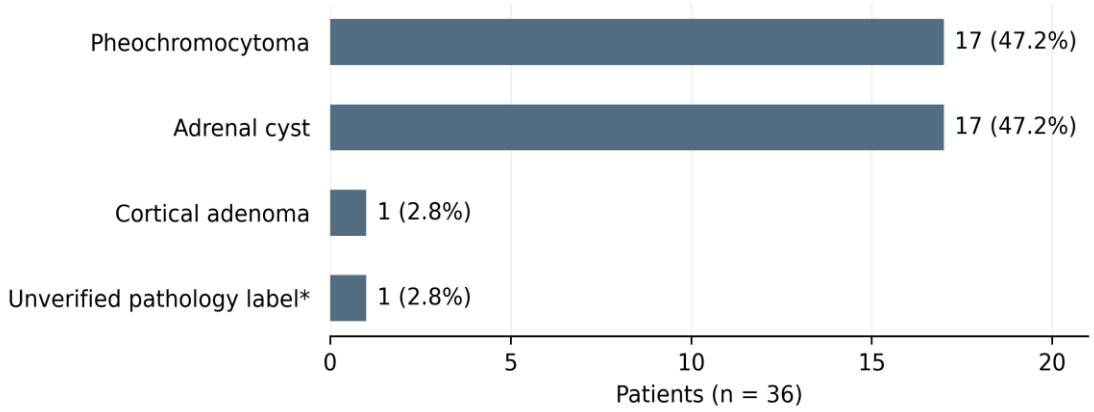


Figure 1. Reported pathological categories among 36 patients. Labels show n (%). *The original label was "metastatic adenoma"; the diagnosis requires verification.

Complications and hospital stay

Five patients (13.9%) had intraoperative events recorded as hypertensive crisis; all five had pheochromocytoma. Four patients (11.1%) sustained renal-vein injury, and all injuries were repaired laparoscopically without reported sequelae. No conversion or transfusion was reported. Event counts were not summed into an overall complication rate because overlap between the intraoperative event categories was not specified.

No diaphragmatic or splenic-vein injury was recorded. The original report described no significant hemorrhage, but neither a definition nor numerical blood-loss data were available. Two patients (5.6%) had postoperative surgical-site hernia; the date of diagnosis, treatment, and Clavien–Dindo grade were unavailable. No hyponatremia, ileus, retroperitoneal hematoma, pulmonary embolism, or pancreatic fistula was recorded. These findings reflect available documentation rather than systematic exclusion of every possible complication.

Mean postoperative stay was 3.91 ± 1.74 days (range 2–6), with no significant difference by intraoperative complication status (P = 0.957). Patients with intraoperative complications had higher mean BMI than those without complications (26.37 ± 1.72 versus 24.68 ± 2.00 kg/m²; P = 0.030). Operative outcomes and reporting gaps are summarized in Table 2.

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Table 2. Operative outcomes and recorded complications

Outcome	Reported result
Operative time, minutes	161.11 ± 20.80; range 130–200
Estimated blood loss, mL	Numerical data unavailable
Conversion to open surgery	0/36; conversion criteria unavailable
Blood transfusion	0/36
Recorded hypertensive crisis	5/36 (13.9%); definition unavailable
Renal-vein injury	4/36 (11.1%); repaired laparoscopically
Postoperative surgical-site hernia	2/36 (5.6%); timing and treatment unavailable
Postoperative Clavien–Dindo grade	Not assignable from available details
Postoperative stay, days	3.91 ± 1.74; range 2–6
Total admission-to-discharge stay	Unavailable
Surgical margin status	Unavailable

Continuous values are mean ± SD. Intraoperative event categories may overlap. Zero transfusions does not establish minimal blood loss; zero conversions does not establish a zero conversion risk.

Discussion

Completion without conversion in this cohort (Table 2) documents local technical experience, but it should be interpreted within the selected-series literature rather than as evidence of superiority to open surgery (2–4, 21). The recorded hypertensive events and renal-vein injuries also require separate assessment of severity, because procedure completion alone does not characterize perioperative morbidity (17–19).

The reported tumor range of 4–14 cm (Table 1) overlaps with the broader experience of laparoscopic surgery for selected large adrenal lesions described by Henry, Hobart, Novitsky, and Tsuru (10–13). However, the overlapping size categories and unspecified measurement source in our report prevent a precise size-stratified comparison with these studies (11–13, 21). The ambiguous pathology label and unavailable margin status further preclude claims about oncologic adequacy, particularly because guidelines for adrenal malignancy emphasize verified diagnosis and complete resection (5, 14).

Al-Otaibi reported an operative time of approximately 150 minutes and a hospital stay of 2.5 days, providing context for the 161-minute operative time and 3.91-day postoperative stay in our series (22). Gill and colleagues described same-day discharge in highly selected patients, demonstrating why admission practices and selection must be considered before comparing length of stay (23). Moreover, studies of posterior retroperitoneoscopic surgery and direct comparisons of operative approaches show that access route is another relevant source of heterogeneity (7–9).

The high proportion of pheochromocytomas in our cohort makes pathology-specific comparisons more informative than comparisons with unselected adrenal masses, as illustrated by the differing operative courses reported by Kim and colleagues (15). For the five events labeled hypertensive crisis, absent pressure thresholds, duration, and treatment details prevent comparison with the explicitly defined hemodynamic outcomes used in PRESCRIPT (16). Missing information on alpha-blockade is also relevant, because perioperative preparation is addressed explicitly in adrenalectomy guidance (5).

Laparoscopic repair of the four renal-vein injuries (Table 2) should not be interpreted as proof that these events were minor, since standardized intraoperative grading considers the intervention required and the consequences for the patient (19). Likewise, a postoperative hernia cannot be assigned a reliable Clavien–Dindo grade without information on its management, and intraoperative vascular repair should not automatically be labeled a postoperative grade III complication (17, 18).

The unadjusted association between higher BMI and intraoperative complications in our series is directionally consistent with the greater morbidity reported among obese patients by Dancea and colleagues, but the exposure definitions and patient groups are

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not equivalent (24). Erbil and colleagues examined retroperitoneal fat mass in relation to surgical outcomes, suggesting that regional adiposity may offer information beyond BMI alone (25). These studies provide context rather than validation of an independent BMI effect in our small cohort; confounding and multiple exploratory comparisons remain important alternative explanations (21, 24, 25).

Future comparative work should report patient selection, operative approach, blood loss, conversion decisions, tumor-measurement methods, and follow-up completeness using explicit definitions (5, 20, 21). Combining standardized intraoperative reporting with treatment-based postoperative grading would improve the interpretability of complication rates, while verified pathology, margin assessment, and longer follow-up are needed for oncologic conclusions (14, 17–19).

Study limitations

Selection bias is a central limitation: only patients chosen for laparoscopy were included, and neither selection criteria nor information on patients treated by open surgery were available; observational reporting guidance emphasizes disclosure of these features (20, 21). Consequently, published comparisons cannot supply the missing control group or establish comparative recovery benefits for this cohort (3, 4, 21).

Retrospective chart abstraction, undefined hypertensive events, incomplete follow-up information, and unspecified overlap of complications create risks of misclassification and underascertainment, concerns addressed by observational reporting and standardized event frameworks (16, 19–21). Missing hernia treatment and diagnosis dates prevent reliable postoperative grading and assessment of delayed morbidity (17, 18, 21). Numerical blood loss, conversion criteria, total hospitalization, tumor-measurement provenance, and margin status were unavailable, limiting perioperative and oncologic interpretation (5, 14, 20, 21).

The small sample and multiple unadjusted comparisons limit precision and leave the BMI association vulnerable to confounding and chance (21). Generalizability is restricted by the single-surgeon experience, two hospitals in one city, sex and pathology distributions, and the historical 2010–2012 treatment period; these factors are relevant when considering differences from broader surgical series and later guidance (2, 5, 7, 20). Later guidelines cited here provide interpretive context and are not evidence that their recommendations were followed during the study period (5, 6, 14).

Conclusion

Laparoscopic adrenalectomy was completed without conversion in this selected historical series, including patients with larger adrenal masses. Hypertensive events, renal-vein injuries, and postoperative hernias were recorded. The findings describe local experience but do not establish superiority over open surgery, safety for all large tumors, or oncologic effectiveness. Future comparative studies should use explicit event definitions, standardized complication grading, complete perioperative data, and longer follow-up.

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Authorship

All authors meet the ICMJE authorship criteria.

Conflicts of interest

The authors declared no conflict of interest.

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