

## Case Series

# Clinical and biochemical outcomes of laparoscopic adrenalectomy in patients with Conn's syndrome: experience from a tertiary referral center in Mexico

Denisse R. Saavedra-Flores<sup>1</sup>, Alejandra Escobar-González<sup>2</sup>,  
Itzel G. García-Félix<sup>3\*</sup>, Samuel R. Gómez-Arenas<sup>1</sup>

<sup>1</sup>Department of Surgery, High Specialty Medical Unit (UMAE) No. 25 IMSS, Monterrey, Nuevo León, México

<sup>2</sup>Department of Surgery, Regional General Hospital No. 270 IMSS, Reynosa, Tamaulipas, México

<sup>3</sup>Department of Coloproctology, 21st Century National Medical Center IMSS, Mexico City, CDMX, México

**Received:** 07 July 2026

**Revised:** 16 July 2026

**Accepted:** 27 July 2026

### \*Correspondence:

Dr. Itzel G. García-Félix,

E-mail: [itzelgafe28@gmail.com](mailto:itzelgafe28@gmail.com)

**Copyright:** © the author(s), publisher and licensee Medip Academy. This is an open-access article distributed under the terms of the Creative Commons Attribution Non-Commercial License, which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

## ABSTRACT

Unilateral primary aldosteronism, also known as Conn's syndrome, is a potentially curable cause of secondary arterial hypertension. Laparoscopic adrenalectomy represents the treatment of choice in selected patients, there are few national reports regarding its clinical and perioperative outcomes. A retrospective, observational, single-center case series was conducted on patients diagnosed with unilateral primary aldosteronism who underwent laparoscopic adrenalectomy at the Department of General Surgery of the High Specialty Medical Unit No. 25, Northeast National Medical Center, Mexican Social Security Institute (IMSS), Monterrey, Nuevo León, Mexico, between January 2020 and December 2024. The mean age was 46.3 years, and 58.3% of the patients were male. Preoperative hypokalemia was present in 91.7% of cases, and the mean number of antihypertensive medications was 3. Postoperatively, complete success was observed in 75% and partial success in 25%, with no cases of biochemical or clinical persistence. Resolution of hypokalemia was documented in 100% of patients, along with a significant decrease in serum aldosterone levels and the aldosterone-renin ratio, as well as a substantial reduction in antihypertensive requirements. There were no conversions to open surgery or perioperative complications, with a mean hospital stay of 24 hours. The predominant histopathological diagnosis was adrenal adenoma 91.7%. In this cases series study, laparoscopic adrenalectomy demonstrated a high rate of clinical and biochemical success, an excellent perioperative safety profile, and adequate resolution of the metabolic alterations associated with Conn's syndrome. These findings support its role as the treatment of choice for patients with unilateral primary aldosteronism.

**Keywords:** Primary aldosteronism, Conn's syndrome, Laparoscopic adrenalectomy, Secondary hypertension, Adrenal surgery

## INTRODUCTION

Primary aldosteronism is one of the most common causes of secondary hypertension and represents a potentially curable condition when identified and treated in a timely manner.<sup>1-3</sup> It is characterized by autonomous aldosterone production by the adrenal cortex, independent of regulation by the renin-angiotensin system, resulting in

sodium retention, intravascular volume expansion, suppression of plasma renin activity, and increased renal potassium excretion.<sup>1,4-6</sup> Consequently, affected patients may develop sustained hypertension, hypokalemia, and a higher risk of cardiovascular and renal complications compared with individuals with essential hypertension of similar severity.<sup>6,7</sup> Contemporary studies have demonstrated that the prevalence of primary aldosteronism

is considerably higher than previously estimated, affecting approximately 5–10% of the general hypertensive population and an even greater proportion of patients with resistant hypertension.<sup>1,7-9</sup> Despite its relatively high prevalence, primary aldosteronism remains substantially underdiagnosed, owing to its heterogeneous clinical presentation, the absence of hypokalemia in a significant proportion of patients, and variable access to confirmatory biochemical testing and diagnostic lateralization procedures.<sup>9</sup> As a result, delays in diagnosis may lead to progressive target-organ damage and prolonged exposure to a potentially reversible cause of hypertension.

Among the etiologies of primary aldosteronism, aldosterone-producing adrenal adenoma and unilateral adrenal hyperplasia represent the principal forms amenable to surgical treatment.<sup>10,11</sup> In patients with confirmed unilateral disease, laparoscopic adrenalectomy has become the preferred therapeutic approach because of its well-established advantages over open surgery, including reduced postoperative pain, lower intraoperative blood loss, shorter hospital stays, faster recovery, and high rates of clinical and biochemical remission.<sup>12-18</sup> International studies have consistently reported favorable outcomes in terms of blood pressure control, biochemical normalization, and quality-of-life improvement following surgical treatment.<sup>3,18</sup>

Nevertheless, postoperative outcomes may vary according to demographic characteristics, duration of hypertension, cardiovascular disease burden, severity of preoperative biochemical abnormalities, and the criteria used to define clinical or biochemical remission.<sup>3,18,19</sup> In recent years, the standardization of outcome measures through international consensus statements has enabled more uniform assessment of therapeutic effectiveness and improved comparisons among surgical cohorts from different centers.<sup>20-22</sup>

In Mexico, published evidence regarding the outcomes of laparoscopic adrenalectomy for unilateral primary aldosteronism remains limited, particularly in tertiary referral centers with expertise in minimally invasive endocrine surgery. Generating national data on perioperative outcomes, clinical control, and biochemical response is important to contextualize institutional experience and strengthen the currently available regional evidence.<sup>22</sup>

The aim of the present study was to evaluate the perioperative, clinical, and biochemical outcomes of laparoscopic adrenalectomy in patients with unilateral primary aldosteronism treated at a tertiary referral center in Mexico.

## CASE SERIES

Between January 2020 and December 2024, a total of 12 patients with unilateral primary aldosteronism underwent laparoscopic adrenalectomy and were included in the

study. All patients completed the 6-month clinical and biochemical follow-up, and no losses to follow-up were recorded.

The mean age of the cohort was 46.3 years, and 58.3% of patients were male. The most common presenting symptom was muscle weakness or fatigue (75.0%), followed by headache (16.7%) and muscle cramps (8.3%). Preoperative hypokalemia was present in 91.7% of patients.

Regarding blood pressure status, most patients presented with moderate-to-severe hypertension before surgery, with grade 3 and grade 4 hypertension observed in 41.7% and 33.3% of patients, respectively. The mean number of antihypertensive medications required before surgery was three (range, 1–5).

Preoperative hormonal evaluation demonstrated marked biochemical activity, with a mean serum aldosterone concentration of 181.9 ng/dl and a mean aldosterone-to-renin ratio (ARR) of 647.3, consistent with biochemically active primary aldosteronism.

## Perioperative outcomes

All procedures were successfully completed using a lateral transabdominal laparoscopic approach. Surgical laterality was evenly distributed, with right- and left-sided adrenalectomies accounting for 50.0% of cases each.

The mean operative time was 112.8 minutes (range, 60–200 minutes), and mean estimated blood loss was 37.1 mL (range, 15–100 mL). No conversions to open surgery were required, and no intraoperative or postoperative complications were recorded. All patients were discharged within 24 hours after surgery.

Definitive histopathological examination revealed adrenal adenoma in 11 patients (91.7%) and unilateral adrenal hyperplasia in 1 patient (8.3%) (Table 1).

## Postoperative clinical and biochemical outcomes

At 6 months of follow-up, complete therapeutic success was achieved in 9 patients (75.0%), while partial success was observed in 3 patients (25.0%). No cases of treatment failure were identified.

Resolution of hypokalemia was achieved in all patients. Likewise, all preoperative symptoms resolved after surgery, and every patient remained asymptomatic throughout follow-up.

Substantial improvement in blood pressure control was observed following adrenalectomy. At follow-up, 91.7% of patients had controlled blood pressure levels corresponding to grade 1 hypertension or better. Concurrently, the mean number of antihypertensive medications decreased from 3.0 preoperatively to 0.5

postoperatively, reflecting a marked reduction in pharmacologic requirements (Table 2).

Biochemical outcomes also demonstrated significant improvement. Mean serum aldosterone concentration decreased from 181.9 ng/dl preoperatively to 19.0 ng/dl postoperatively, while the mean aldosterone-to-renin ratio declined from 647.3 to 2.3, indicating successful correction of autonomous aldosterone secretion following surgery.

**Table 1: Perioperative outcomes.**

| Variables                             | Result    |
|---------------------------------------|-----------|
| <b>Laparoscopic approach</b>          | 100%      |
| <b>Right-sided adrenalectomy</b>      | 50.0%     |
| <b>Left-sided adrenalectomy</b>       | 50.0%     |
| <b>Mean operative time</b>            | 112.8 min |
| <b>Mean estimated blood loss</b>      | 37.1 ml   |
| <b>Conversion to open surgery</b>     | 0%        |
| <b>Perioperative complications</b>    | 0%        |
| <b>Length of hospital stay</b>        | 24 hours  |
| <b>Adrenal adenoma</b>                | 91.7%     |
| <b>Unilateral adrenal hyperplasia</b> | 8.3%      |

**Table 2: Clinical and biochemical outcomes.**

| Variables                                          | Pre-operative | Post-operative |
|----------------------------------------------------|---------------|----------------|
| <b>Hypokalemia (%)</b>                             | 91.7          | 0              |
| <b>Asymptomatic patients (%)</b>                   | 0             | 100            |
| <b>Mean number of antihypertensive medications</b> | 3.0           | 0.5            |
| <b>Serum aldosterone (ng/dl)</b>                   | 181.9         | 19.0           |
| <b>Aldosterone-to-renin ratio</b>                  | 647.3         | 2.3            |
| <b>Complete success (%)</b>                        | —             | 75.0           |
| <b>Partial success (%)</b>                         | —             | 25.0           |
| <b>Treatment failure (%)</b>                       | —             | 0              |

## DISCUSSION

In this cases series study, laparoscopic adrenalectomy for unilateral primary aldosteronism demonstrated high clinical and biochemical effectiveness, with adequate resolution of the metabolic abnormalities associated with autonomous aldosterone excess and an excellent perioperative safety profile.<sup>3,4,11-15</sup> Complete therapeutic success was achieved in 75% of patients and partial success in the remaining 25%, with no cases of treatment failure. These outcomes were accompanied by universal resolution of hypokalemia, overall clinical improvement, and a substantial reduction in antihypertensive medication requirements.

The findings observed in the present study are consistent with those reported in the international literature, where

laparoscopic adrenalectomy has been associated with high rates of biochemical success and variable degrees of blood pressure improvement.<sup>3,11-15</sup> The discrepancy between biochemical remission and complete clinical cure of hypertension has been widely described and is likely related to factors such as duration of hypertension, chronic vascular remodeling, genetic susceptibility, and the coexistence of essential hypertension.<sup>3,4,6,8</sup> In our cohort, the high proportion of favorable clinical outcomes may reflect appropriate patient selection, a lower cumulative burden of irreversible cardiovascular damage, and multidisciplinary perioperative management.

One particularly relevant finding was the complete resolution of hypokalemia in all patients, accompanied by a marked decrease in serum aldosterone concentrations and aldosterone-to-renin ratios following surgical treatment, supporting a consistent endocrinological response.<sup>1,3,8,11,13,15</sup> Likewise, the substantial reduction in the number of antihypertensive medications required during follow-up represents a clinically meaningful outcome, as it reflects therapeutic benefit beyond blood pressure control alone and may positively influence treatment adherence, quality of life, and healthcare costs associated with long-term pharmacologic therapy.

From a surgical standpoint, our experience demonstrated highly favorable perioperative outcomes, characterized by the absence of conversion to open surgery, no postoperative complications, minimal intraoperative blood loss, and short hospital stay.<sup>16-18</sup> These findings reinforce the safety and reproducibility of the lateral transabdominal laparoscopic approach in centers with expertise in minimally invasive surgery and are consistent with the advantages previously described for this technique.

Regarding histopathological findings, the predominance of unilateral adrenal adenoma (91.7%) is consistent with reports from international surgical series, whereas the identification of unilateral adrenal hyperplasia in one patient highlights the pathological heterogeneity of primary aldosteronism and underscores the importance of comprehensive clinical, biochemical, and radiological assessment when selecting candidates for surgical treatment.<sup>4,11,14</sup>

The present study has several limitations. First, its retrospective design, small sample size, and single-center nature limit the external generalizability of the findings. In addition, diagnostic lateralization was established primarily through clinical, hormonal, and radiological correlation without the routine use of adrenal vein sampling (AVS), a procedure considered the reference standard for subtype classification in many specialized centers.<sup>21</sup> Nevertheless, favorable outcomes have been reported in carefully selected patients evaluated through integrated clinical, biochemical, and imaging assessment, even in the absence of systematic AVS.<sup>22</sup> Furthermore, the consistency among preoperative findings, postoperative biochemical response, and definitive histopathological

diagnoses provides internal validity to the observed results.

Despite these limitations, this study represents the experience of a tertiary referral center and contributes regional evidence regarding the perioperative, clinical, and biochemical outcomes of laparoscopic adrenalectomy for unilateral primary aldosteronism, a field that remains underrepresented in the Mexican literature.

## CONCLUSION

Laparoscopic adrenalectomy is a safe and effective treatment for appropriately selected patients with unilateral primary aldosteronism. In this cohort, surgical management was associated with high rates of clinical and biochemical success, complete resolution of hypokalemia, substantial reductions in antihypertensive medication requirements, and excellent perioperative outcomes. These findings further support laparoscopic adrenalectomy as the preferred treatment for surgically amenable unilateral disease and contribute valuable evidence regarding its effectiveness in a Mexican tertiary referral center.

## ACKNOWLEDGEMENTS

The authors would like to acknowledge the Surgery Department of UMAE Hospital No. 25.

*Funding: No funding sources*

*Conflict of interest: None declared*

*Ethical approval: Not required*

## REFERENCES

- Adler GK, Stowasser M, Correa RR, Khan N, Kline G, McGowan MJ, et al. Primary aldosteronism: an Endocrine Society clinical practice guideline. *J Clin Endocrinol Metab.* 2025;110(9):2453-95.
- Farah MH, Hegazi M, Firwana M, Abusalih M, Saadi S, Al-Kordi M, et al. A systematic review supporting the Endocrine Society clinical practice guideline on management of primary aldosteronism. *J Clin Endocrinol Metab.* 2025;110(9):e2833-44.
- Williams TA, Lenders JWM, Mulatero P, Burrello J, Rottenkolber M, Adolf C, et al. Outcomes after adrenalectomy for unilateral primary aldosteronism: an international consensus on outcome measures and analysis of remission rates in an international cohort. *Lancet Diabetes Endocrinol.* 2017;5(9):689-99.
- Reincke M, Bancos I, Mulatero P, Scholl UI, Stowasser M, Williams TA. Diagnosis and treatment of primary aldosteronism. *Lancet Diabetes Endocrinol.* 2021;9(12):876-92.
- Yip L, Duh QY, Wachtel H, Jimenez C, Sturgeon C, Lee CR, et al. American Association of Endocrine Surgeons guidelines for adrenalectomy. *JAMA Surg.* 2022;157(10):870-900.
- Turcu AF, Yang J, Vaidya A. Primary aldosteronism: a multidimensional syndrome. *Nat Rev Endocrinol.* 2022;18(11):665-82.
- Vaidya A, Carey RM. Evolution of the primary aldosteronism syndrome: updating the approach. *J Clin Endocrinol Metab.* 2020;105(12):3771-83.
- Hundemer GL, Leung AA, Kline GA, Brown JM, Turcu AF, Vaidya A. Biomarkers to guide medical therapy in primary aldosteronism. *Endocr Rev.* 2024;45(1):69-94.
- Yang J, McCarthy J, Shah SS, Ng E, Shen J, Libianto R, et al. Challenges in diagnosing and managing the spectrum of primary aldosteronism. *J Endocr Soc.* 2024;8(7):bvae109.
- Funder JW. Primary aldosteronism. *Trends Cardiovasc Med.* 2022;32(4):228-33.
- Picado O, Whitfield BW, Khan ZF, Jeraq M, Farrá JC, Lew JI. Long-term outcome success after operative treatment for primary aldosteronism. *Surgery.* 2021;169(3):528-32.
- Nardi WS, Toffolo M, Recalde M, Saban M, Schiavone M, Quildrian SD. Outcomes after laparoscopic adrenalectomy for unilateral primary aldosteronism. *Medicina (B Aires).* 2022;82(4):558-63.
- Sawyer N, Glendenning P, Vasikaran SD, Page MM, van Schie G, Wong SL, et al. The Adrenal Vein Sampling Outcomes Study (AVOS): success rates following adrenalectomy for unilateral primary aldosteronism. *Pathology.* 2023;55(4):531-7.
- Abdel-Aziz T, Abdelsalam A, Chung TT, Srirangalingam U, Hurel S, Conway G, et al. Short- and long-term outcomes of adrenalectomy for primary aldosteronism in a single UK center: rear-mirror view. *Hormones (Athens).* 2025;24:251-8.
- Ben Abid F, Charfi N, Boussaa A, Chtourou L, Mnif MF, Abid M, et al. Predictors of successful outcome after adrenalectomy for unilateral primary aldosteronism. *Front Endocrinol (Lausanne).* 2023;14:1207266.
- Miller BS, Gauger PG, Hammer GD, Doherty GM. Laparoscopic adrenalectomy: indications, techniques, and outcomes. *Surg Clin North Am.* 2019;99(4):721-35.
- Conzo G, Musella M, Corcione F, De Palma M, Ferraro F, Palazzo A, et al. Laparoscopic adrenalectomy, a safe procedure for adrenal lesions: clinical outcomes and literature review. *Int J Surg.* 2020;76:70-82.
- Walz MK, Alesina PF, Wenger FA, Koch JA, Neumann HPH, Petersenn S, et al. Posterior retroperitoneoscopic adrenalectomy—results of 560 procedures in 520 patients. *Surgery.* 2020;168(6):1099-105.
- Monticone S, D'Ascenzo F, Moretti C, Williams TA, Veglio F, Gaita F, et al. Cardiovascular events and target organ damage in primary aldosteronism compared with essential hypertension: a systematic review and meta-analysis. *Lancet Diabetes Endocrinol.* 2018;6(1):41-50.

20. Hundemer GL, Curhan GC, Yozamp N, Wang M, Vaidya A. Cardiometabolic outcomes and mortality in medically treated primary aldosteronism: a retrospective cohort study. *Lancet Diabetes Endocrinol.* 2018;6(1):51-9.
21. Rossi GP, Auchus RJ, Brown M, Lenders JWM, Naruse M, Plouin PF, et al. An expert consensus statement on use of adrenal vein sampling for the subtyping of primary aldosteronism. *Hypertension.* 2014;63(1):151-60.
22. El Ghorayeb N, Mazzuco TL, Bourdeau I, Mailhot JP, Zhu PS, Thérasse E, et al. Basal and postadrenalectomy biochemical cure in unilateral

primary aldosteronism diagnosed by CT without adrenal vein sampling. *J Clin Endocrinol Metab.* 2016;101(7):2713-20.

**Cite this article as:** Saavedra-Flores DR, Escobar-González A, García-Félix IG, Gómez-Arenas SR. Clinical and biochemical outcomes of laparoscopic adrenalectomy in patients with Conn's syndrome: experience from a tertiary referral center in Mexico. *Int Surg J* 2026;13:1445-9.