Surgical outcomes following laparoscopic adrenalectomy for treatment of Conn’s syndrome (primary hyperaldosteronism) between 1999 and 2006

Andrew Herd, Richard Harman, Eletha Taylor

Abstract

Background Primary hyperaldosteronism is a recognised cause of secondary hypertension with its aetiology most commonly due to a secreting aldosterone adenoma of the adrenal gland. Laparoscopic resection of the adrenal tumour has now become the accepted form of intervention. The aim of this study was to assess the effectiveness of such procedures performed by one surgeon over a 7-year period.

Method An observational study was conducted in respect of 33 patients who underwent adrenalectomies for primary hyperaldosteronism between 1999–2006. Information on blood pressure, electrolytes, medications, histology, patient characteristics and patients’ perception of benefit was gathered via clinical notes and a patient questionnaire.

Results 33 patients were reviewed. The mean follow-up was 38.4 months. Blood pressure and number of medications all had statistically significant decreases. Systolic blood pressure decreased from 146 mmHg preoperatively to 130 mmHg at final follow-up (p<0.00005). Diastolic blood pressure decreased from 91.0 mmHg preoperatively to 81.5 mmHg (p<0.00005). There was also a significant decrease in number of blood pressure medications from 2.3 preoperatively to 1.0 on average (p<0.00005). Only one patient required potassium at final review. Overall 36% had clinical cure and 50% had significant improvement in terms of blood pressure and medications requirements.

Conclusion The results suggest unilateral laparoscopic adrenalectomy is an effective tool in treatment for benign primary hyperaldosteronism caused by aldosterone secreting adenomas.

Conn’s syndrome, or primary hyperaldosteronism, is typified by hypertension and hypokalaemia, accompanied by increased aldosterone secretion from, most commonly, an adrenal adenoma (approximately 60%). Other causes include adrenal hyperplasia. The syndrome was first described by Jerome Conn in 1955 in a patient who had an aldosterone-producing adenoma.

Independently of the effects of elevated blood pressure, primary hyperaldosteronism may cause cardiovascular complications, such as cardiac myopathy and as such patients may be at higher risk than other hypertensive patients in respect of potential damage to the heart and kidneys.

Generally, the most widespread and accepted method of screening for primary hyperaldosteronism is an elevated ratio of plasma aldosterone to plasma renin concentration, which should be greater than 30:1 to confirm the diagnosis.
Confirmatory investigations are then required to demonstrate autonomous secreting adenoma.

The first open adrenalectomy for Conn’s syndrome was performed in December 1954.\(^7\) Since that time, laparoscopic adrenalectomy, first performed in 1992,\(^8\) is becoming the preferred surgical technique. Laparoscopic unilateral adrenalectomies for primary hyperaldosteronism have been shown to result in reduced blood loss, shorter hospital stays and fewer post-surgical complications.\(^9\)–\(^12\) Recent studies indicate that cure rates for short and long-term follow-up periods have ranged from 34% to 58%.\(^13\)–\(^18\)

The purpose of this study was to examine the long-term outcomes for laparoscopic adrenalectomies for patients referred with a diagnosis of primary hyperaldosteronism, with particular focus on whether there had been a reduction in hypertension and medication use.

**Method**

We conducted an observational review of the hospital clinical records and general practitioner case notes of all consecutive patients (n=33) who underwent a laparoscopic unilateral adrenalectomy for diagnosed primary hyperaldosteronism performed by one surgeon (RH) during the period 1999 to 2006. The data collected from the clinical and general practitioner records was supplemented by a patient questionnaire. Of the 33 patients, there were 16 males and 17 females with an average age of 49 years.

**Data collection and analysis**—Preoperative and postoperative blood pressure, electrolyte/aldosterone/renin concentrations and medications were recorded from a review of hospital clinical notes, general practitioner records and patient questionnaires.

In particular, preoperative blood pressure readings, electrolyte concentrations and medications were obtained from the anaesthetic pre-admission data of each patient. Preoperative aldosterone/renin concentrations were obtained from a review of the investigations conducted upon admission or prior to admission.

Postoperative data was collected from three sources: discharge records, outpatient clinic notes (either surgical or endocrine specialist follow-up) and general practitioner records. As well as blood pressure, electrolyte/aldosterone/renin concentrations and medications, the histopathology of the adrenal gland was also recorded.

Postoperative data was also supplemented by a patient questionnaire which requested details of current medication regime and patient “satisfaction” subsequent to surgery.

The results recorded for each preoperative and post operative observation were then collated and analysed. Results have been presented as mean and percentages and t-tests were used to identify statistically significant differences.

The study was approved by the Health and Disability Ethics Committees, Ministry of Health New Zealand.

**Results**

**Patient characteristics**—During 1999 to 2006, 33 patients underwent a unilateral laparoscopic adrenalectomy for primary hyperaldosteronism. The mean operative time was 138 minutes. Long-term follow-up data was available for 28 of the patients and the mean follow-up time was 38.4 months (range 12 – 86.4 months). 5 patients were lost to long-term follow-up.

A summary of preoperative patient characteristics is at Table 1.
Table 1. Patient characteristics

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>Number</td>
<td>33</td>
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<tr>
<td>Male</td>
<td>16</td>
</tr>
<tr>
<td>Female</td>
<td>17</td>
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<tr>
<td>Age (yrs)</td>
<td></td>
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<td>Mean</td>
<td>49</td>
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<tr>
<td>Range</td>
<td>25–67</td>
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<td>Tumour size (mm)</td>
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<td>Mean</td>
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<tr>
<td>Range</td>
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<tr>
<td>Preoperative blood pressure (mm/Hg)</td>
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<tr>
<td>Mean systolic</td>
<td>147</td>
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<tr>
<td>Mean diastolic</td>
<td>91</td>
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<tr>
<td>Preoperative number of blood pressure medications</td>
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<tr>
<td>Mean</td>
<td>2.5</td>
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<tr>
<td>Range</td>
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<tr>
<td>Preoperative number of potassium medications</td>
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<tr>
<td>Mean</td>
<td>1.4</td>
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<td>Range</td>
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<tr>
<td>Aldosterone/renin ratio</td>
<td></td>
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<tr>
<td>Mean</td>
<td>176.68 (46–542)</td>
</tr>
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</table>

**Histology**—Histology revealed that two patients had adrenal hyperplasia, with the remaining 31 confirmed as having adrenocortical adenomas.

**Postoperative complications**—Postoperative complications in the population included: one ileus; one episode of atelectasis; one port site haematoma and one liver and spleen capsular tear. None of these complications required return to theatre. There were no conversions to an open procedure and there was no mortality associated with the operations.

**Blood pressure**—The mean preoperative blood pressure was 147/91 mmHg. Postoperatively, blood pressure information was recorded both at discharge (“immediate postoperative blood pressure”) and then the most recent recorded blood pressure from general practitioner notes (“recent postoperative blood pressure”), at a mean follow-up time of 38.4 months. The mean recent postoperative blood pressure was 130/82 mmHg. Average preoperative blood pressure was significantly higher than the average recent postoperative blood pressure on follow-up (p<0.00005) (see Figure 1).

**Medications**—There was a significant decrease in the requirement for postoperative blood pressure medications. Medication use was recorded preoperatively, immediate postoperatively and at most recent follow-up (mean most recent follow-up time was 38.4 months).

Prior to surgery, patients were taking a mean of 2.5 types of blood pressure medication, compared to an average of 1.1 types of blood pressure medication at most recent follow-up (p<0.00005).
Potassium—Only one patient required potassium medication postoperatively. Originally they were on 9.6g of slow K which was reduced to 1.2g. This patient was requiring frusemide prescribed by the general practitioner for peripheral oedema.

Clinical cure rate—Patients were categorised into three separate groups based on most recent follow-up blood pressure and medication usage, as follows:18

Clinical cure, being systolic $\leq 140$ mm/Hg and diastolic $\leq 90$ mm/Hg and no antihypertensive medications;

Improved management: being systolic $\leq 140$ mm/Hg and diastolic $\leq 90$ mm/Hg and equal or fewer antihypertensives postoperatively OR hypertensive but on fewer antihypertensive medications;

No improvement or worse management: being hypertensive with the same or more antihypertensive medications postoperatively.

Figure 3 shows that 86% of patients at most recent follow-up had at least some improvement in the management of their hypertension. Only 14% had no improvement or worse management. Thirty six percent of patients had a clinic cure requiring no blood pressure management and were normotensive.

The two patients with hyperplasia on histology were included in the improved management group.
**Patient satisfaction**—The questionnaire sent to patients asked patients to respond to the following question:

*(4) Do you think this surgery has been beneficial to you? (Please circle)*

- No benefit at all 1
- A little benefit 2
- Somewhat beneficial 3
- Very beneficial 4
- Extremely beneficial 5

Of the 15 patients who responded to this question, the mean rating was 4.5.

**Discussion**

Since the first open adrenalectomy in 1954, laparoscopic adrenalectomies are now becoming the accepted form of treatment for benign primary hyperaldosteronism due to secreting adrenal adenomas. Laparoscopic surgery is safer and reduces complications and length of patient stay.9–12

Our study has shown that this surgery, in general, has significant benefit for the patient and is safe. In both the short and longer term, the majority of the population studied had a reduction in blood pressure and the number of medications prescribed post-surgery. The clinical cure rate at a mean follow-up of 38.4 months was 36% of patients. A further 50% had some form of improved management of hypertension, with either reduced blood pressure equal to or below 140/90 mm/Hg and equal or fewer antihypertensives postoperatively, or if still hypertensive, being on fewer antihypertensive medications (see figure 3).

Only one patient required potassium replacement postoperatively. The amount in this case had been reduced and the patient was also noted to be on diuretic treatment.

Recent studies are consistent with the above, showing relatively significant reductions in hypertension in patients undergoing laparoscopic adrenalectomy over the medium
to longer term. A study by Pang et al\textsuperscript{18} has shown a clinical cure rate of 34\% (with clinical cure being defined as normal blood pressure with no medications) and with 51\% of participants showing some improvement in blood pressure control over a median follow-up period of 59 months. Only 5.6\% of patients required potassium replacement.

Meria et al found, from 212 cases, a cure rate (defined as normal blood pressure with no medications) of 58\% over a mean 44 month follow-up period.\textsuperscript{14} None of the patients in this study required a postoperative potassium replacement.

Gockel et al’s study showed that 36.8\% of patients had completely discontinued the intake of hypertensive medications at a mean of 45 months postoperatively.\textsuperscript{17}

Interestingly, from our questionnaire, patient satisfaction with the surgery ranked extremely highly. Patients who responded to the question had a good perception about the benefit of the surgery to themselves and their quality of life, with an average ranking of 4.5 out of 5 (with 4 being “very beneficial” and 5 being “extremely beneficial”).

Some limitations of this study are the relatively small size of the population and the fact that the only available data for some patients at follow-up was not as recent as others, as well as a small number of patients being lost to follow-up. In addition, there may have been some recall bias in the questionnaire, although we attempted to alleviate this by asking for general practitioner input so as to confirm patient recollection. However, overall, we have been able to achieve a good duration of follow-up over a relatively long time frame and the study has had sufficient numbers to give statistically significant results.

This study has shown that, for the majority of the patients reviewed, the surgery was beneficial. There were minimal complications and no mortality associated with the surgeries analysed for the study. Eighty-six percent of patients had some or much improvement in their blood pressure and medication use and quality of life resulting directly from the surgery.

In conclusion, laparoscopic unilateral adrenalectomy, appears to be a relatively safe and effective method of treatment of benign primary hyperaldosteronism caused by secreting adenomas.

\textbf{Competing interests:} None.

\textbf{Author information:} Andrew Herd, Registrar, General Surgery, North Shore Hospital, Auckland; Richard Harman, Consultant General Surgeon, North Shore Hospital, Auckland; Eletha Taylor, Fellow, General Surgery, Auckland Hospital, Auckland

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\textbf{Correspondence:} Dr Andrew Herd, 11 Cooper Street, Grey Lynn, Auckland, New Zealand. Fax: +64 (0)9 3630631; email: andyherd1@hotmail.com

\textbf{References:}