Case Report: Adrenalectomy for Primary Hyperaldosteronism; Not the Final Step

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Research Article

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Case Report: Adrenalectomy for Primary Hyperaldosteronism; Not the Final Step

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Abstract:

Background: Aldosterone-induced glomerular hyper-filtration leads to masked renal dysfunction and profound hypokalemia which will affect the outcome post adrenalectomy.
Description of the case: We report a case of a middle-aged man presenting for Primary Aldosteronism, managed by unilateral adrenalectomy, complicated by acute kidney injury and hyperkalemia, treated initially by intravenous hydration and then by Fludrocortisone as maintenance therapy. Patient has noticeably improved.
Conclusion: Post-adrenalectomy, the association of acute kidney injury and hyperkalemia in patients with PA is not rare but underestimated. Serum potassium and creatinine must be cautiously monitored in patients with long-term hypertension and kidney disease.

Keywords: Primary Aldosteronism, hyperkalemia, acute kidney injury, Fludrocortisone.

Conflict of interest statement

Authors declare no conflicts of interest.

Introduction:

Primary aldosteronism (PA) is characterized by inappropriate aldosterone production leading to hypertension and normo-hypo-kalemia (1). PA is evident in 5-10% of hypertensive patients (2) who usually suffer more from cardiovascular diseases (5), organ dysfunction, and albuminuria (3) (5). Several studies had reported a decline in kidney function and hyperkalemia post adrenalectomy (1)(2)(3). This is attributed to excess aldosterone secretion which induces sodium and water reabsorption leading to hypertension increasing the renal perfusion pressure and enhancing the glomerular filtration (1). Moreover, chronic exposure to high levels of aldosterone leads to endothelial dysfunction and small vessel resistance (1). It will induce contraction of the efferent arterioles increasing the glomerular capillary pressure (2). In addition; aldosterone enhances the release of cytokines as transforming growth factor-beta and fibronectin which causes fibrosis. Consequently, chronic PA will induce structural damage with decline in function which is masked by the glomerular hyperfiltration and aldosterone escape phenomenon (2).
We herein report a case of acute kidney injury and hyperkalemia post adrenalectomy requiring long-term treatment.

Case Presentation:

This is a 42-year-old man, heavy smoker, occasional alcohol drinker, overweight, known to have hypertension since 2004 on 4 different anti-hypertensives {Calcium Channel Blocker (CCB), Beta-blocker (BB), Angiotensin receptor blocker (ARB), central acting drug} and hypokalemic on potassium per oral (PO), was first encountered in the nephrology clinic in 2004 at Saint Georges University Hospital Medical Center in Beirut, Lebanon for uncontrolled hypertension. He has a strong family history of hypertension. Blood pressure (BP) was 160/100 mmHg. He claims that his systolic BP range from 150-220 mmHg. His primary workup revealed Na 145 mEq/l, creatinine 1mg/dl, K+ 3.1 mEq/l, Urine microalbumin/creatinine ratio (UACR) 4.4 mg/g. His aldosterone level being 1769 pmol/l, renin < 0.5 mIU/l and aldosterone/renin ratio 354 (high).
CT scan of the abdomen showed a kidney cyst, 2cm enhancing left adrenal gland, >50% washout representing a benign adenoma. He was started on eplerenone 25 mg daily and advised to undergo adrenalectomy but he preferred to wait. Few months later, he presented again due to his remaining high BP readings, eplerenone

increased to 50 mg in the morning and 25 mg in the evening and he was referred to an endocrinologist for further workup. 17-hydroxyprogesterone, cortisol level, TSH, IGF somatomedin, and Metanephrines were all in the normal range. In addition, a repeated CT scan showed same adrenal mass. Adrenalectomy was requested but he lost follow-up and then came up after 4 years. In 2018, again his BP was poorly controlled, during his visit it was 150/100 mmHg.

Labs showed creatinine 1.2 mg/dl, UACR: 110mg/g and urine protein/creatinine ratio: 0.19(normal).

And the CT scan showed an increase in the size of left adrenal nodule to 2.5*2 cm (previously 2*1.8cm) with a density of 20HU on the non-enhancing phase, homogenous vivid enhancement post intravenous contrast with a density of 130 HU, and washout of about 50% on the delayed phase **(Fig1).** Also, workup was repeated and creatinine was 1.2 mg/dl, Aldosterone 1032 pmol/l, and renin <2.3 mIU/l. He was still taking his medications as before.

In December 2020 (at the age of 58 years), a left adrenalectomy was done. Labs post-op revealed creatinine of 2.4mg/dl, potassium 5.7mEq/l, and bicarbonate 16.4 mEq/l. 2 weeks after adrenalectomy, his BP was better off ARBs and aldosterone antagonist. His labs showed creatinine of 2.2mg/dl after reaching a peak of 3 mg/dl and k+ 6.3 mEq/l. To note that in the operating room, BP was maintained all the time. Complete vasculitis workup and CPK were all within the normal range. Post-op cortisol level was 12.4 microg/dl and aldosterone was 23pmol/l.

His medications were CCB and BB (lowest dose) and his BP 170/100 mmHg.

Repeated CT scan status post left adrenalectomy showed surgical clips in the left suprarenal space. There is an 8.5*7.5*7.5 cm (transverse*AP*CC) retroperitoneal collection in the left adrenalectomy bed abutting the posterior aspect of the pancreas showing surrounding fat stranding. It has a density between 30 and 50 HU likely presenting a hematoma, including a small central focus of spontaneous hyper-density suggesting a recent bleed. Normal right adrenal gland. **(Fig 2)**

The Ultrasound of renal arteries showed normal resistivity.

DMSA scan, to assess for possible renal vascular compression by the hematoma, showed normal and symmetrical blood flow to the kidneys, symmetrical cortical uptake in a slightly sluggish manner. No evidence of obstruction was evident at the level of the collecting system.

The patient was started on fludrocortisone 0.1mg 1.5 tablets 2 weeks after surgery.

In his recent follow-up visit, BP was 170/110mmHg, so his CCB dose increased. Creatinine was 2.2 mg/dl and k 5.3 mEq/l. He was feeling better.

To our knowledge, this is one of the few reported cases of AKI and hyperkalemia post adrenalectomy requiring long-term follow-up.

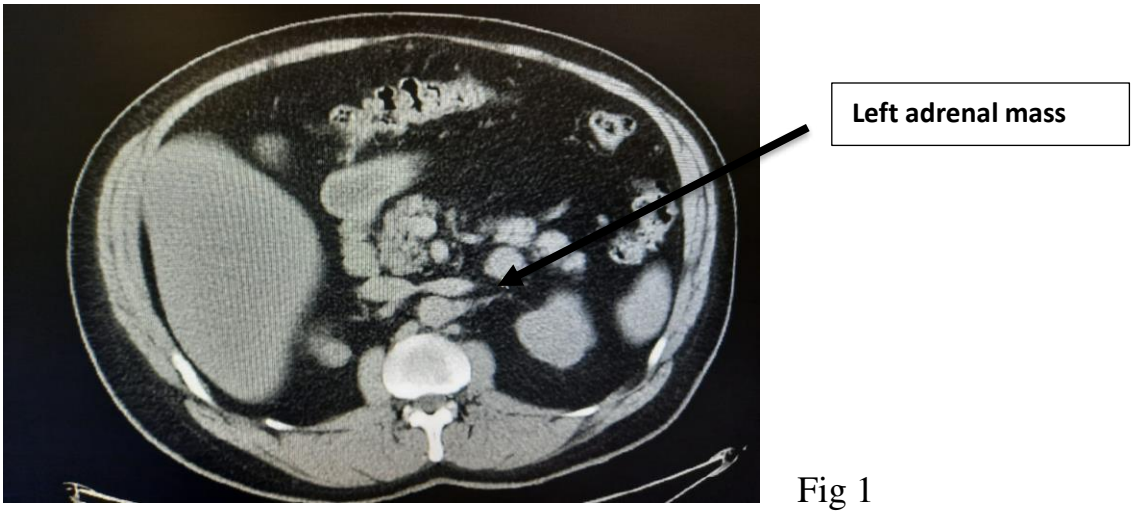

Fig 1

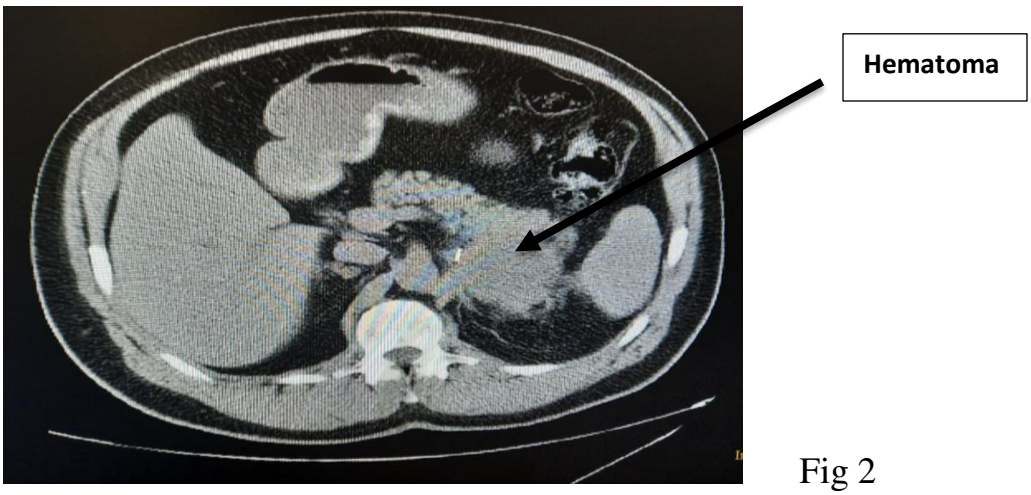

Fig 2

Discussion:

Post adrenalectomy, acute kidney injury (AKI) and hyperkalemia are well-documented entities. 40% of patients develop >25 % decrease in eGFR, and the prevalence of CKD was significant (1). Risk factors for post-op renal impairment include old age, long-standing hypertension, low body mass index, hypokalemia, hyperuricemia, impaired cholesterol level, and low pre-eGFR (1)(2). Utsumi et al. reported 16% decline in eGFR with preoperative eGFR ≥90 mL/min/1.73 m2, 15% decline with eGFR 60–89 mL/min/1.73 m2, and 11% decline with eGFR <60 mL/min/1.73m2(7). "Unmasked kidney function," refers to kidney function impairment that is masked by hyper-filtration due to high aldosterone levels before surgery (2). Median eGFR>50 mL/min/1.73 m2 did not significantly change in patients with age >50 years (3). However, those showed higher preoperative aldosterone/renin ratios, lower potassium and chloride levels, lower body mass

index, higher incidence of cardiovascular events and KCNJ5 mutation rates (3). Thus early intervention could reverse this effect (1). The rapid decline in aldosterone unmasks the renal impairment revealed within 2 weeks up to one year (1). The earlier the eGFR decline, the more it persists (1). Our patient developed AKI within 2 weeks. High aldosterone levels cause extracellular volume expansion leading to secondary hypertension, increase in renal perfusion and glomerular hyper-filtration (1) (2) (3). Furthermore, aldosterone enhances the release of cytokines resulting in renal fibrosis (2). Our patient had a prolonged history of uncontrolled hypertension. It's known that chronic hypokalemia induces CKD through tubulointerstatial fibrosis (2). Our patient's potassium level was low pre-op for multiple years while on maintenance therapy. After adrenalectomy, the urinary excretion of albumin, β2 microglobulin, and effective renal plasma flow decrease (5). Our patient UACR was 110 mg/gr pre-op and post-op 22.2 mg/gr. Hyperkalemia was evident in 29% of patients post-adrenalectomy within 1-3 weeks, mostly resolved by 2 months but some persisted for longer than 9 months(5). Predisposing factors for hyperkalemia are old age, prolonged hypertension, impaired pre-op and post-op eGFR, and high pre-operative aldosterone level (5). Our patient developed hyperkalemia after 2 weeks and had most of the listed risk factors.

The suppression of the zona glomerulosa is examined by measuring post-operative aldosterone (undetectable if <97pmol/l), serum potassium (>5mEq/l), and trans-tubular potassium gradient (TTKG). TTKG, a kidney aldosterone bioactivity indicator, predicts kidney function impairment and resolution of hypertension post-op. Liao et al, demonstrated that TTKG ⩾4.9 could predict concealed CKD and clinical success at 12 months after adrenalectomy, correlated with pre-operative end-organ damage in terms of high proteinuria and cardiac hypertrophy(6). Our patient post-op aldosterone level was 23pmol/l and potassium was 6.3 mEq/l/. We ddn't measure TTKG. PA leads to chronic suppression of the adjacent and contralateral adrenal glands which goes undetectable with its progression. This exhibits the low aldosterone level and the hyperkalemia seen.

Treatment of hyperkalemia is well demonstrated by Tahir et al. (5). After assessing the risk factors, patients are classified into low risk whereby the recommendations are to stop spironolactone and order for post-op creatinine and electrolytes on days 2 and 14. However, for patients at high risk, the management plan requires to halt spironolactone, NSAIDs, and ACEI/ARBs, encourage hydration and follow a low potassium diet (5). These measures were all applied to our patient's treatment plan. Then after measuring potassium days 2, 14, and 27, if k+ <5.5 mEq/L, the same management remains.

If k>5.5 mEq/l and the patient is hypovolemic/hypotensive then replenish with fluids, initiate fludrocortisone, and sodium bicarbonate if needed. While if normotensive/ hypertensive with eGFR>50, initiate furosemide and add sodium bicarbonate if needed. Whereas, if normotensive/hypertensive with eGFR<50, initiate sodium bicarbonate, and fludrocortisone if necessary. If the K+ level is >5.5mEql and drugs are not tolerated, add potassium binders (5).

Our patient was given a trial of fluids first with no marked improvement. Potassium binders were added as needed due to potassium levels reaching >6 mEql/l. His bicarbonate level was as low as 18 mEq/l thus given sodium bicarbonate. He was finally initiated on fludrocortisone 0.1 gram (1.5 tablet) then decreased to 1 tablet daily. Upon his last clinic visit, his creatinine was stable at 2.2 mg/dl and his potassium level was 5.3 mEq/l.

Patient fells that he is better. His blood pressure is controlled and his quality of life improved.

Conclusion:

Clinicians should be alert to the possibility of post-operative AKI and hyperkalemia post adrenalectomy. The diagnostic approach of this case led us to the significant detection of the risk factors pre adrenalectomy to decide on the proper prevention which could be assessed by estimating the actual renal function and TTKG calculation to provide maximal management.

Declarations:

- Funding: Not applicable
- Conflicts of interest/Competing interests: Authors declare no conflicts of interest
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- Consent for publication an informed consent is obtained
- Availability of data and material: all data is available and accessible (transparent)
- Code availability: Not applicable
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