



BMH Med. J. 2026;13(4):86-91. **Case Series**

## Secondary Hypertension - A Kaleidoscopic View From a Tertiary Centre in South India

Priya Padmanabhan Mavoor<sup>1</sup>, Jayameena P<sup>1</sup>, Niya Narayanan<sup>1</sup>, Neena Mampilly<sup>2</sup>

<sup>1</sup>Department of Nephrology, BMH Calicut.

<sup>2</sup>Department of Pathology, BMH Calicut.

**Address for Correspondence:** Dr. Priya Padmanabhan Mavoor, BMH Calicut, Kozhikode, Kerala, India. Email: priyapadmanabhanm@gmail.com

### Abstract

According to data published by WHO, an estimated 1.4 billion adults aged 30-79 years worldwide had hypertension in 2024; this represents 33% of the population in this age range. Two-thirds of adults aged 30-79 years who have hypertension live in low- and middle-income countries. An estimated 600 million adults with hypertension (44%) are unaware that they have the condition. Approximately 630 million adults with hypertension (44%) are diagnosed and treated. Only approximately 320 million adults with hypertension (23%) have it under control. It is estimated that at least one in four adults in India has hypertension [1] but, only about 12% of them have their blood pressure under control [2]. Most patients with hypertension have no clear etiology and are classified as having primary hypertension. However, 5% to 10% of these patients may have secondary hypertension, which indicates an underlying and potentially reversible cause. The prevalence of secondary hypertension is close to 30% in those hypertensives 18 to 40 years of age, and it varies by age [3]. In the cross-sectional survey study of Indian adults by Varghese JS et al, more than 1 in 4 people had hypertension, and of these, only 1 in 3 received a diagnosis, less than 1 in 5 were treated, and only 1 in 12 had blood pressure control [4]. We present a series of 9 patients that illustrates how 'hypokalemia - hypertension duo', at presentation in the emergency department offers an important cue to proceed with work up for hyperaldosteronism, no matter with what system involvement the patient presents (eg: be it a cerebrovascular accident, periodic palsy or seizure.)

**Key Words:** Secondary Hypertension, Primary Hyperaldosteronism, Adrenal Adenoma, Hyperaldosteronism, Renovascular Hypertension

### Case 1

A male in fourth decade presents with asymmetric areflexic quadriparesis. Blood work up significant for hypokalemia with ECG changes. ABG pH 7.48 HCO<sub>3</sub> 27.6meq/L. Hormonal assay levels shown below.

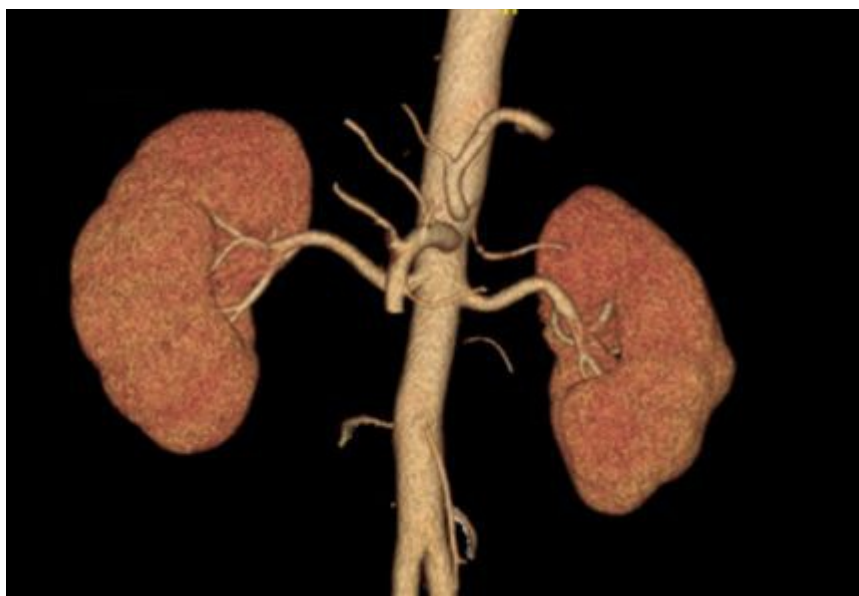
| Serum Aldosterone levels<br>(ng/dl)<br>Normal levels-<br>(Upright 2.21—35.30,<br>Supine 1.17—23.60) | Renin direct: (milli IU<br>/L)<br>Normal levels-<br>(Upright 4.4—46.10,<br>Supine 2.8—39.90) | Aldosterone renin ratio (ARR):<br>ng/milli IU<br>Normal levels-<br>(<20.6) |
|-----------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------|----------------------------------------------------------------------------|
| 23.3                                                                                                | 0.49                                                                                         | 47.55                                                                      |

Magnetic Resonance Imaging (MRI) abdomen 14x 13x 13 mm lesion isointense arising from the inferior margin of lateral limb of left adrenal gland- lipid rich left adrenal adenoma. **Diagnosis: Left adrenal adenoma**

### Case 2

Male in fourth decade with previous history of Type 2 Diabetes Mellitus and difficult to treat Systemic hypertension on irregular treatment presented with occipital headache and neck pain. Examination showed BP of 180/100mmHg. ABG: pH 7.4 K 3.1 meq/L, HCO<sub>3</sub> 32meq/l. Contrast Enhanced Computed Tomography (CECT) abdomen: Extrinsic compression of left superior accessory renal artery by diaphragmatic areas causing moderate stenosis.

**Diagnosis: Extrinsic compression of left superior accessory renal artery**



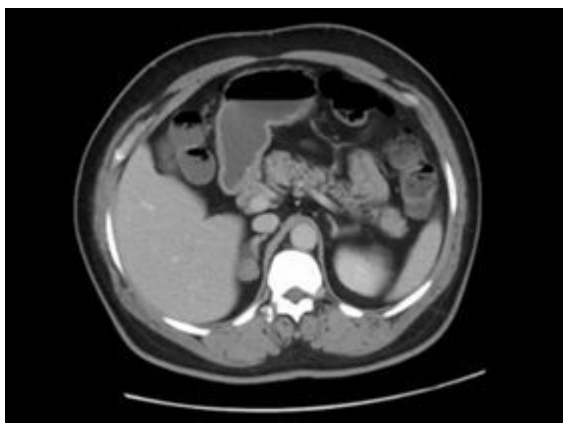
### Case 3

Male in second decade, with no comorbidities, presented with acute onset headache and generalised tonic clonic seizures. Evaluation showed BP 180/120mmHg. MRI brain - Posterior reversible encephalopathic syndrome. Urine routine showed active sediments. Creatinine 1.55mg/dl K 3.1meq/L C3, C4 complement levels normal. Plasma renin and aldosterone levels were high. Aldosterone: 67.3ng/dl, Renin 50.0milli IU /L, ARR 0.135. CT aortogram unifocal tubular stenosis of right renal artery - s/o fibromuscular dysplasia. Angioplasty was done to right renal artery done with good results and renal recovery. Cerebral DSA and CAG normal vessels. **Diagnosis: Right renal artery fibromuscular dysplasia**



#### Case 4

Male in fourth decade with history of systemic hypertension presented with hypokalemic periodic palsy and found to have BP 190/102mmHg. Hormonal assay Aldosterone 10ng/dL, renin 10.66 milliIU/mL, ARR 1. Right hyperechoic suprarenal lesion detected in USG abdomen was confirmed to be right adrenal adenoma in Computed Tomography (CT) scan. **Diagnosis: Right adrenal adenoma**



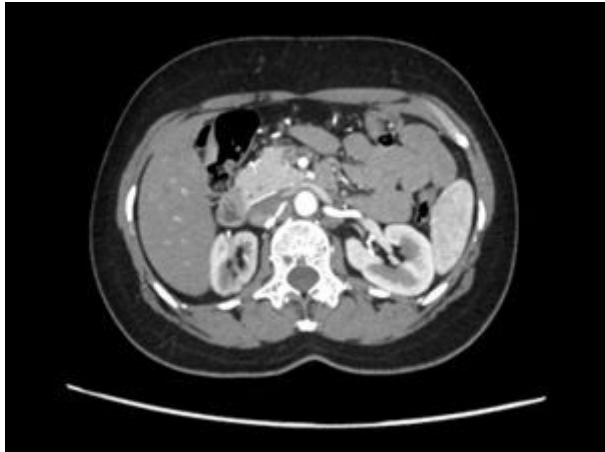
#### Case 5

Female in fourth decade on evaluation for recurrent headaches was diagnosed to have new onset systemic hypertension requiring multiple medications. USG abdomen showed small right kidney (8.3cm versus 9.6cm on left side) and further evaluation with CT renal angiography showed small (3.5mm diameter) ostioproximal segment of right renal artery compared to opposite side (4.3mm)

with mild beaded appearance of the mid segment and focal severe stenosis (90%) about 16mm away from origin. Post stenotic dilatation (5.4mm) in the distal segment upto renal hilum. She underwent renal angioplasty.

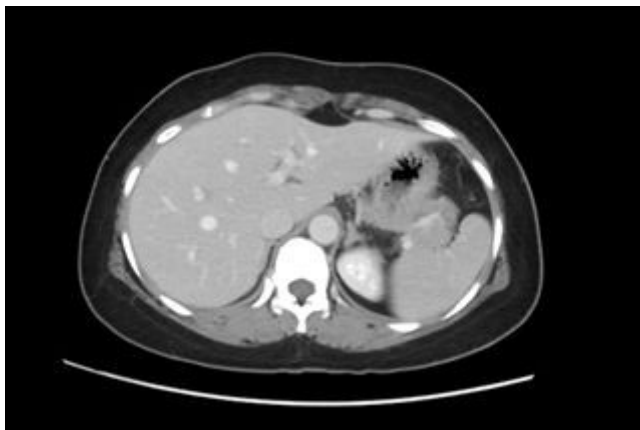
Doppler parameters mentioned below:

Right main renal artery PSV 122cm/sec AT 0.03sec AI 1563cm/s<sup>2</sup> RI 0.62 at diagnosis. Right main renal artery PSV 31cm/sec AT 0.04sec RI 0.57 after right renal artery stenting. **Diagnosis: Fibromuscular dysplasia right renal artery**



#### Case 6

Female in fourth decade with newly detected difficult to control systemic hypertension. Hormonal assay showed Plasma Aldosterone levels 14.30ng/dL. Plasma Renin 4.45milliIU/mL. Aldosterone renin ratio 32.106ng/milli IU. CECT abdomen showed subtle nodularity of medial limb of left adrenal gland. **Diagnosis: Adrenal hyperplasia with primary hyperaldosteronism**



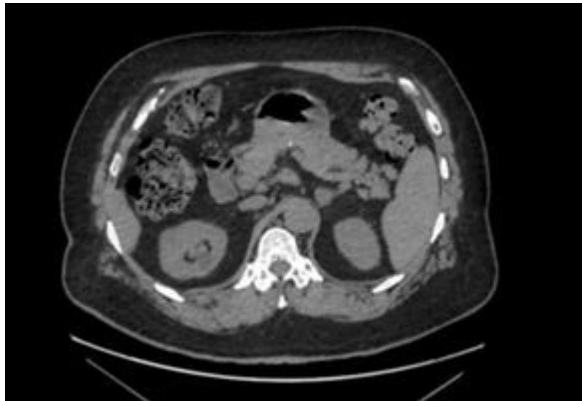
#### Case 7

Male in seventh decade with previous history of Type 2 diabetes mellitus, systemic hypertension and Obstructive sleep apnea, admitted with left middle cerebral artery ischemic stroke was detected to have accelerated hypertension (170/104mmHg) and hypokalemia. Hormonal assay: Plasma Aldosterone 17.80 ng/dl, Plasma Renin 1.84 milli IU /L, Aldosterone renin ratio- 96.687ng/mIU.

CECT sure showed 17mm into 14mm left adrenal adenoma in the body closely abutting the splenic

vessel 2.5 centimeters above the renal artery in the interpolar and anterior to upper polar of kidney right adrenal gland is normal.

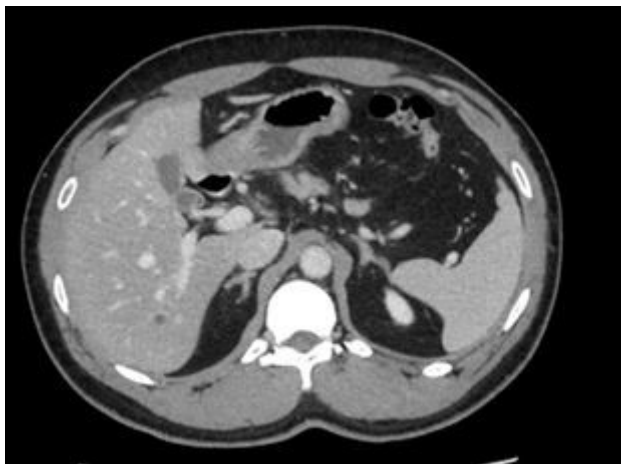
**Diagnosis: Left adrenal adenoma**



### Case 8

Male in fourth decade evaluated for incidentally detected elevated creatinine of 1.4mg/dl on repeated occasions, was noted to have low normal potassium levels. Hormonal assay Aldosterone 13.90 ng/dl , Plasma renin activity 0.63 ng/mL/hr, Aldosterone renin ratio- 22.06 ng/mIU. CT adrenal showed bilateral bulky adrenals.

**Diagnosis: Primary hyperaldosteronism. Bilateral adrenal hyperplasia**



### Case 9

Male in fifth decade hospitalised for malignant hypertension presenting as visual disturbances and evaluation showing hypertensive retinopathy with Left occipital stroke and PRES. Creatinine was 2.5mg/dl with proteinuria 5g/day. Further evaluation revealed APLA profile positive for Lupus anticoagulant. Hormonal assay :Aldosterone 29 ng/dl, Renin direct 78 milli IU /L, Aldosterone renin ratio- 96.687ng/mIU. CT scan abdomen showed bilateral bulky adrenals.

**Diagnosis: Primary hyperaldosteronism. Bilateral adrenal hyperplasia**

## Discussion

Clinical presentations as described in the cases are likely to be missed as chronic kidney disease and hypertension; and left untreated, would have led to progression of renal disease. Most of these cases come to the emergency department and it is important to be aware of how hypokalemia and hypertension can be an important indicator warranting a renal doppler or renin aldosterone hormonal assay with Aldosterone renin level ratio, after treating the presenting complaints, which is mostly accelerated hypertension or seizures or periodic palsy from hypokalemia. To be able to avoid the confounding drugs while evaluating for hormonal levels is another matter of concern, just as hypokalemia can affect renin levels.

**Table1:** Reference values of Plasma Aldosterone concentration, Plasma Renin levels and Aldosterone renin ratio and units, followed by patient values.

|        | Aldosterone: ng/dl                         | Renin direct: milli IU /L                | Aldosterone renin ratio: ng/milli IU |
|--------|--------------------------------------------|------------------------------------------|--------------------------------------|
|        | (upright 2.21-35.30,<br>supine 1.17-23.60) | (upright 4.4-46.10, supine<br>2.8-39.90) | (<20.6)                              |
| Case 1 | 23.3                                       | 0.49                                     | 47.55                                |
| Case 3 | 67.3                                       | 50.0                                     | 0.135                                |
| Case 4 | 10                                         | 10.66                                    | 1                                    |
| Case 6 | 14.30                                      | 4.45                                     | 32.10                                |
| Case 7 | 17.80                                      | 1.84                                     | 96.687                               |
| Case 8 | 13.90                                      | 0.63                                     | 22.06                                |
| Case 9 | 29                                         | 78                                       | 96.687                               |

## References

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