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Case report

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Learning from an AVS in a tertiary centre in Bangladesh: Lateralization of primary aldosteronism despite inconclusive imaging

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Abstract

Primary hyperaldosteronism (PA) is a leading & treatable cause of secondary hypertension, yet many cases remain undiagnosed. Adrenal venous sampling (AVS) is the gold standard for subtype classification of PA when imaging is inconclusive, yet it remains underutilized due to technical difficulty and limited expertise. We report the first case of AVS performed at any medical college hospital in Bangladesh in a middle-aged woman with resistant hypertension and normal imaging, ultimately diagnosed with PA, supported by an elevated aldosterone-renin ratio (ARR 184) on screening and confirmed by a saline suppression test. Subtype classification was confirmed by adrenal venous sampling demonstrating a significant lateralization index of 4.22 (≥4), consistent with unilateral aldosterone excess. Reporting early institutional experience facilitates quality improvement, and skill development in emerging endocrine centres. *[J Assoc Clin Endocrinol Diabetol Bangladesh,* July 2026; 5 (2): e89445*]*

Keywords: Primary hyperaldosteronism; Resistant hypertension; Normokalemia; Aldosterone-renin ratio; Adrenal venous sampling; Micronodular disease

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Introduction

Primary hyperaldosteronism (PA) is one of the most common causes of secondary hypertension, accounting for approximately 5-10% of hypertensive patients in primary care and up to 20% of those with resistant hypertension.[1,2] Despite its prevalence, PA remains underdiagnosed, highlighting the necessity for enhanced screening protocols.[2] Early identification and accurate subtyping are essential, as unilateral disease can be cured surgically, while bilateral disease is treated medically, improving blood pressure, reducing cardiovascular risk and reversing aldosterone-mediated target-organ damage.[3]

Adrenal venous sampling (AVS) is considered the gold

standard for differentiating unilateral from bilateral aldosterone excess.[1] However, AVS is a technically demanding procedure that requires expertise in interventional radiology and specialized hormonal assays, resulting in its limited use in many regions.[4] Many centres where AVS is not available, rely on the cross-sectional imaging alone, which may be misleading and misclassifies aldosterone-producing adenomas and shows poor concordance with AVS results.[5] Emerging evidence suggests that the lateralization index (LI) and contralateral suppression index (CSI) can improve diagnostic confidence and guide surgical decisions even when selectivity criteria are not fully met.

We report the first AVS performed at any medical college hospital in Bangladesh in a patient with biochemically confirmed primary hyperaldosteronism, and non-lateralizing adrenal imaging. This case report aims to describe the feasibility, procedural challenges, and clinical impact of performing AVS in a resource-limited setting that might guide its future establishment.

Case report

Our patient, a 35-year-old housewife hailing from Madaripur Sadar, was admitted to Dhaka medical college hospital through OPD with complaints of HTN for last 15 years, which was associated with occasional headache and vomiting. on query she gave history of one episode of unconsciousness 15 years back during which she was first diagnosed with hypertension. After that, she did not seek medical advice for hypertension or take any antihypertensive drugs. One year prior to admission, her blood pressure was 170/100 mmHg on routine preoperative assessment for right-sided tympanoplasty due to CSOM, after which antihypertensive treatment was started. Since then, her blood pressure has fluctuated between 160-180/100-120 mmHg despite having several antihypertensive drugs. She denies any history of polyuria, polydipsia, weight gain, flushing, hyperhidrosis, visual changes, palpitation, menstrual abnormality, hirsutism or nose bleeds. Her bowel and bladder habits were normal. There was no family history of cardiovascular or renovascular disease. She was taking 4 antihypertensive drugs, which included methyldopa, labetalol, amlodipine and olmesartan. Her BMI was 28.4 kg/m², and the rest of the general examination was normal. A soft systolic murmur was heard at the tricuspid area with a loud P2 on cardiovascular examination. The rest of the systemic examination was unremarkable. Regarding the investigation ECG, Chest X-ray and Doppler Renal USG were normal. Echocardiography showed jerky motion IVS with mild TR with mild pulmonary HTN (PASP 45 mmHg). Routine haematological, biochemical and hormonal evaluations are summarized in **Table I**.

With elevated aldosterone, suppressed renin, and a high ARR, the Saline Suppression Test (SST) was performed after overnight fasting in the supine position with 2 L normal saline infused over 4 hours. Post-infusion serum aldosterone of < 5 ng/dL was considered normal, while > 10 ng/dL confirmed Primary Aldosteronism **Table II**.

CT abdomen with adrenal protocol showed normal adrenal glands (right 2 mm, left 3.4 mm) with no definite nodules or mass. AVS was performed following a standard procedure. She was managed with an alpha blocker and a dihydropyridine calcium channel blocker, along with supportive therapy. The patient underwent left adrenalectomy in the Urology department, and the excised gland was sent for histopathological examination.

Histopathology revealed micronodular disease consistent with aldosterone-producing micronodules

Table-I: Hematological, biochemical and hormonal investigations

Test	Results	Reference range
Hb%	11.03 gm/dl	12-15.5 g/dL
S. Creatinine	0.93 mg/dl	0.59-1.04 mg/dL
S. Electrolytes	Na^+ 141, K^+ 4.2, Cl^- 101 mmol/L	Na^+: 136-145mmol/L, K^+: 3.5-5.1mmol/L, Cl^-: 98-107 mmol/L
Random Blood Sugar	6.2mmol/L	< 7.8 mmol/L
Basal Cortisol (fasting)	605.47 nmol/l	138-690nmol/L
24-hours-urinary Metanephrine	890.51 nmol/day	<1775 nmol/day
24-hours-urinary Nor Metanephrine	1999.34 nmol/day	<3276 nmol/day
TSH (Thyroid Stimulating hormone)	1.7 µIU/ml	0.47-5.01 µIU/ml

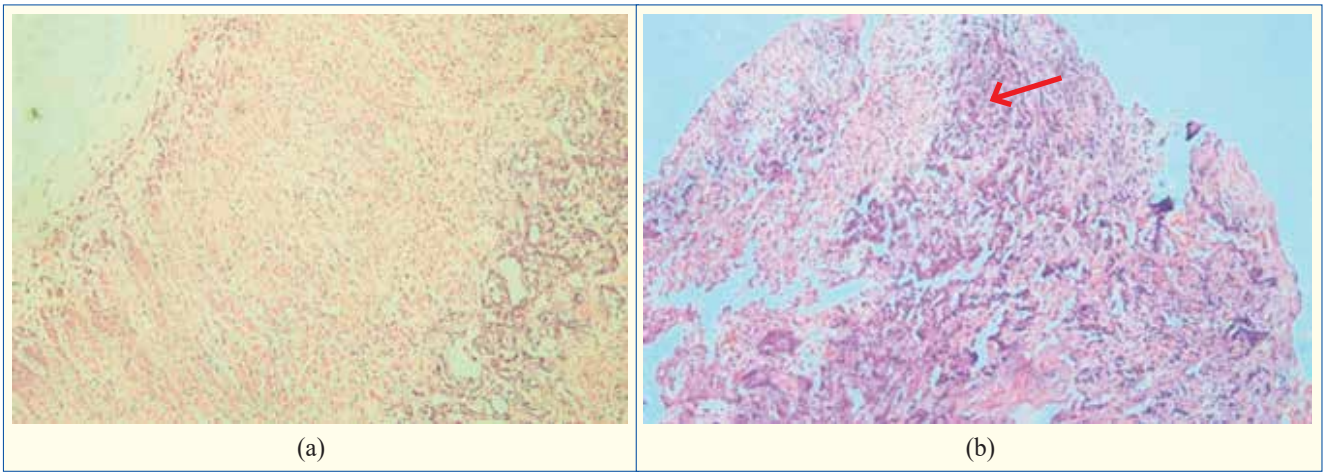
Table-II: Investigations for Primary Aldosteronism

Test	Results	Reference range
S. Aldosterone(fasting)	153.60 pg/ml Or 15.3 ng/dl	30-180 pg/ml 3-16 ng/dl
Plasma Renin(fasting)	1.38 pg/ml Or 0.138 ng/dl	4.0-37.52 pg/ml .4-3.75 ng/dl
Aldosterone: Renin Ratio (ARR)= $\frac{(Sreum\ Aldosterone\ (pmol/l)}{(Plasma\ Renin\ (miu/l))}$	184	<70
S. Aldosterone after saline suppression test	15.1 ng/dl (0 Hour) 14.28 ng/dl (4 Hour)	<5 ng/dl (4 Hour)

(**Figure-1**). Follow-up testing on the 4th postoperative day showed normal serum aldosterone, confirming biochemical cure **Table III**. Blood pressure is controlled on a reduced dose of a single alpha blocker (130/85–110/70 mmHg), suggesting partial clinical cure; long-term biochemical and blood pressure follow-up is planned to better assess sustained remission.

Adrenal Venous Sampling Procedure:

AVS was performed by an experienced interventional radiology team with endocrinology support using a standardized Endocrine Society–based protocol with Long-Acting Porcine Sequence Corticotrophin (Acton Prolongatum) stimulation, and unilateral disease was defined by LI ≥4 with CSI ≤1 with Selectivity index ≥5.



(a) (b)

Figure-1: Histopathology of the left adrenal gland (H&E stain); (a) low (4X) magnification shows no nodular lesions are identified. Representative sections are submitted in three cassettes, the layers of adrenal gland.
(b) medium (10X) magnification showing ill-defined nodules composed of zona fasciculata cells. Some cells are eosinophilic, showing lipofuscin pigment. No malignancy is seen.

Table-III: Serum Aldosterone and plasma Renin before and after left sided adrenalectomy

Investigations	Before Adrenalectomy	After Adrenalectomy	Reference range
S. Aldosterone(fasting)	153.60 pg/ml Or 15.3 ng/dl Or 425.47 pmol/L	51.12 pg/ml Or 5.11 ng/dl Or 141.60 pmol/L	20-180 pg/ml 1-16 ng/dl
Plasma Renin(fasting)	1.38 pg/ml Or 0.138 ng/dl Or 2.30 mIU/L	2.12 pg/ml Or 212 ng/dl Or 3.54 mIU/L	4.0-37.5 pg/ml 0.4-3.75 ng/dl
Aldosterone Renin Ratio (ARR)= $\frac{(Sreum\ Aldosterone\ (pmol/L))}{(Plasma\ Renin\ (mIU/L))}$	184.6	40	<70 (normal)

Table-IV: Adrenal venous sampling report

Investigations	Peripheral vein (IVC)	Right Adrenal vein	Left Adrenal vein
Cortisol	1870 nmol/L or 67.75 µg/dl	2170 nmol/L or 78.62 µg/dl	2340 nmol/L or 84.78 µg/dl
Aldosterone	455.30 pg/ml or 4.53 ng/dl	213 pg/ml or 2.13 ng/dl	970.10 pg/ml or 9.70 ng/dl
$\frac{Aldosterone/Cortisol}{Aldosterone/Cortisol}$	4.553/67.75=0.0672	2.13/78.62 =0.02709	9.70/84.78 =0.1144
Lateralization index (LI)= $\frac{A/C\ Lt\ Adrenal\ vein}{A/C\ Rt\ Adrenal\ vein}$	$=\frac{4.553}{67.75}=0.0672$ **=Lt sided lateralization**		
Contralateral suppression index(CSI) $=\frac{A/C\ non\ Dominant}{A/C\ Peripheral}$	$=\frac{0.02709}{0.0672}$ *= 0.403 (<1)* **= Contralateral Lateralization (left side)**		

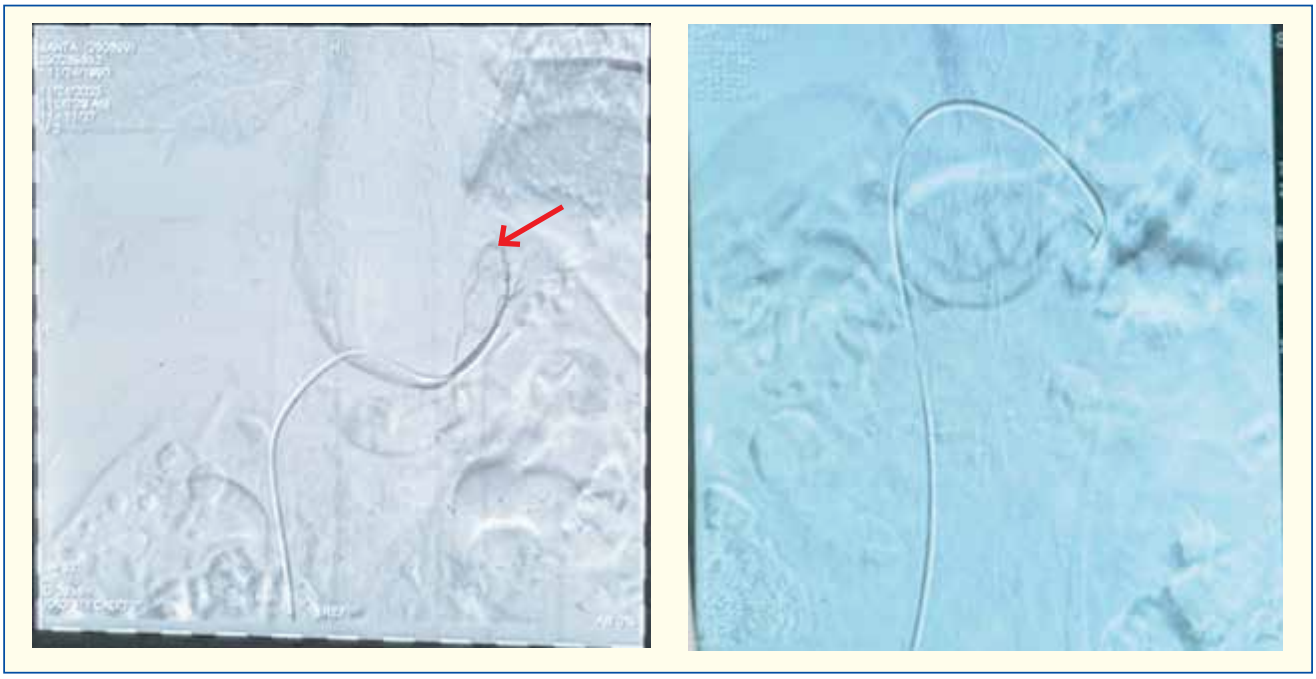


Figure-2: Adrenal venous sampling: arrow showing the left adrenal vein during the procedure

ARB and amlodipine were discontinued for 4 weeks, with unrestricted sodium intake and overnight fasting before testing. Two doses of injection Acton Prolongatum, 30 IU each, were given intramuscularly, 1 hour apart (second dose was given 30 minutes before the procedure). Catheters were inserted into the inferior vena cava and both adrenal veins, and blood samples were collected from each site.

Selectivity index (adrenal/peripheral cortisol) were 1.25 right and 1.16 left side. LI was 4.22 (≥4) and CSI 0.403 (≤1), supporting unilateral aldosterone excess. AVS results are summarized in **Table IV**.

Discussion

PA is increasingly recognized as a major cause of secondary hypertension, particularly in patients with resistant blood pressure.[1,3] Our patient had long-standing resistant hypertension with normal potassium, reflecting the common presentation in >70% of PA cases.[6] This highlights the need for diagnostic vigilance even in the absence of hypokalemia. Primary aldosteronism is screened by ARR, confirmed with suppression testing, commonly with the SST and then subtyped into unilateral or bilateral disease.

Although CT scan is routinely used in the evaluation of PA, its diagnostic accuracy is limited. Nonfunctioning adrenal nodules increase with age, and small aldosterone-producing adenomas or micronodular hyperplasia may be radiologically invisible.[7] Multiple studies demonstrate poor concordance between CT imaging and AVS findings, with misclassification rates reaching up to 38–39%.[1,8] Patients with PA who have bilateral or normal-appearing adrenal glands on CT are often found to have unilateral disease on AVS.[8] As a result, relying on imaging alone may lead to incorrect management and missed curative surgery. In our case, CT imaging did not reveal any definitive lateralizing lesion, so imaging alone was insufficient for treatment planning which consistent with CT-AVS discordance in the existing literature.

As our patient preferred a definitive curative treatment over long-term medical therapy and had a high Aldosteronoma Resolution Score (ARS 4; ~75% BP cure probability), adrenal venous sampling was performed, as it is the most accurate method to distinguish unilateral from bilateral aldosterone excess.[1,9] Despite its importance, AVS is technically challenging due to small adrenal veins, particularly the right adrenal vein.[10] Technical success rates vary widely between centres, ranging from 30% to over 96%, depending on operator experience.[11]

A major limitation was the low SI, suggesting incomplete cannulation. Although a low SI is usually unreliable for surgical decision-making, a marked CSI, when combined with a high LI, may still indicate unilateral disease despite suboptimal selectivity.[12,13] A retrospective cohort study demonstrated that CSI can serve as a reliable diagnostic value, particularly when catheterization is suboptimal or failed.[12] Another study showed that CSI ≤0.5 has extremely high specificity (~99%) and positive predictive value (~98%) for unilateral disease, even in scenarios suggestive of partially successful or incomplete AVS cannulation.[13] This closely aligns with our findings; despite low SI, a high LI (>4) with marked CSI (<0.5) supported adrenalectomy, resulting in biochemical and clinical cure and suggests that such a threshold can identify unilateral aldosterone excess despite suboptimal SI. This finding provides strong support for the AVS-based functional diagnosis. In many centres, repeat AVS is not feasible due to cost, expertise limitations, or patient factors. In such contexts, reliance on combined indices, especially LI >4 with CSI <0.5, may allow clinicians to confidently proceed with adrenalectomy without unnecessary delay.

Patients with AVS-confirmed unilateral disease who undergo adrenalectomy show better blood pressure control, need fewer antihypertensive drugs, and have improved biochemical results compared to those managed medically.[14] Adrenalectomy cures unilateral PA by removing the source of aldosterone excess and offers superior outcomes to MR antagonists.[15] The favourable clinical and biochemical response observed in this case further supports the validity of AVS.

This case highlights the importance of expanding access to AVS, particularly in regions where it has not been available. The successful implementation of AVS in our institution demonstrates that this complex procedure can be established in emerging endocrine centres with appropriate training and protocol standardization. By adopting AVS, patient outcomes in PA are expected to improve through more accurate diagnosis and individualized therapy. Although several AVS was done at University Hospital level in Bangladesh with similar results with suggestive CSI, our successful implementation of the first use of AVS in a Medical College provides a model for building local expertise and improving PA management pathways.

Conclusions

This case highlights the critical role of AVS in the accurate subtype classification of PA, particularly in patients with resistant hypertension, and non-diagnostic imaging. Despite its technical challenges, AVS provides definitive lateralization data that cannot be reliably obtained from cross-sectional imaging alone. This case also highlights contralateral suppression as a strong marker of unilateral disease, especially when combined with a high lateralization index despite suboptimal selectivity. The post-adrenalectomy biochemical and clinical cure confirms that AVS was functionally

successful despite not meeting classical technical criteria. Completion of our first AVS demonstrates opportunity in new settings through multidisciplinary collaboration; expanding access will improve diagnosis, guide treatment, improved interventional technique, and enhance long-term cardiovascular outcomes. This experience serves as an important milestone in enhancing diagnostic capabilities and improving patient care in our institution.

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Disclosure

The authors have no conflicts of interest to disclose.

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Declaration of Generative AI and AI-assisted Technologies

During the preparation of this work, the authors used ChatGPT in order to improving readability, language and assist in information gathering. After using this tool, the authors reviewed and edited the content as needed and take full responsibility for the content of the published article.

Data Availability

Any queries regarding this study should be directed to the corresponding author, and supporting data are available from the corresponding author upon reasonable request.

Consent to Participate

Written informed consent was obtained from the legal guardian of the patient. All methods were performed following the relevant guidelines and regulations

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