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Concordance of Cross-Sectional Imaging and Adrenal Venous Sampling Results for Patients with Surgically Treated Primary Hyperaldosteronism

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Concordance of Cross-Sectional Imaging and Adrenal Venous Sampling Results for Patients with Surgically Treated Primary Hyperaldosteronism

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Research Program

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Background

Adrenal venous sampling (AVS) is used to distinguish unilateral from bilateral aldosterone hypersecretion as a cause of primary hyperaldosteronism (PHA). This distinction is critical because unilateral disease is treated, and often cured, by adrenalectomy, whereas bilateral hypersecretion should be managed medically.

Introduction

- Primary hyperaldosteronism (PHA) is a treatable etiology of secondary hypertension with a prevalence of up to 13% among hypertensive patients¹⁻².
- The most common causes of PHA include aldosterone producing adenoma (APA) in 35% and bilateral adrenal hyperplasia (BAH), and less commonly unilateral adrenal hyperplasia³.
- Compared to BAH, patients with an APA generally have higher aldosterone secretion with more severe hypertension and hypokalemia⁴⁻⁵.
- In patients with PHA, the aldosterone to renin ratio (ARR) is generally greater than 20². Diagnostic imaging with computed tomography (CT) or magnetic resonance imaging (MRI) is recommended to assess for adrenal abnormalities⁶.
- The presence or absence of adrenal lesions on cross-sectional imaging can be discordant with AVS in up to 37.8% of patients⁷.
- The Endocrine Society recommends AVS in all patients with PHA who are candidates for adrenalectomy to determine if the etiology is bilateral or unilateral⁶.
- At our institution, AVS is performed with synthetic adrenocorticotropic hormone (ACTH) stimulation.
- In this study, we sought to determine the concordance of cross-sectional imaging findings with AVS results for patients undergoing adrenalectomy for PHA at a single institution.

Methods

- We performed a retrospective cohort review of adult patients undergoing index adrenalectomy for PHA at the University of Nebraska Medical Center from July of 2013 to June of 2022.
- Clinical and pathologic variables were assessed including patient age at surgery, sex, race or ethnicity, body mass index, systolic and diastolic blood pressure, number and type of antihypertensive medications pre- and post-operatively, potassium level and supplementation, PAC, PRA, ARR, imaging findings, adrenal venous sampling results and concordance of imaging findings with AVS and surgical outcomes.
- Statistical analysis was performed with Mann Whitney U and chi-squared Fisher's exact using STATA version 17.

Figure 1. Patient Characteristics by Imaging and Adrenal Venous Sampling

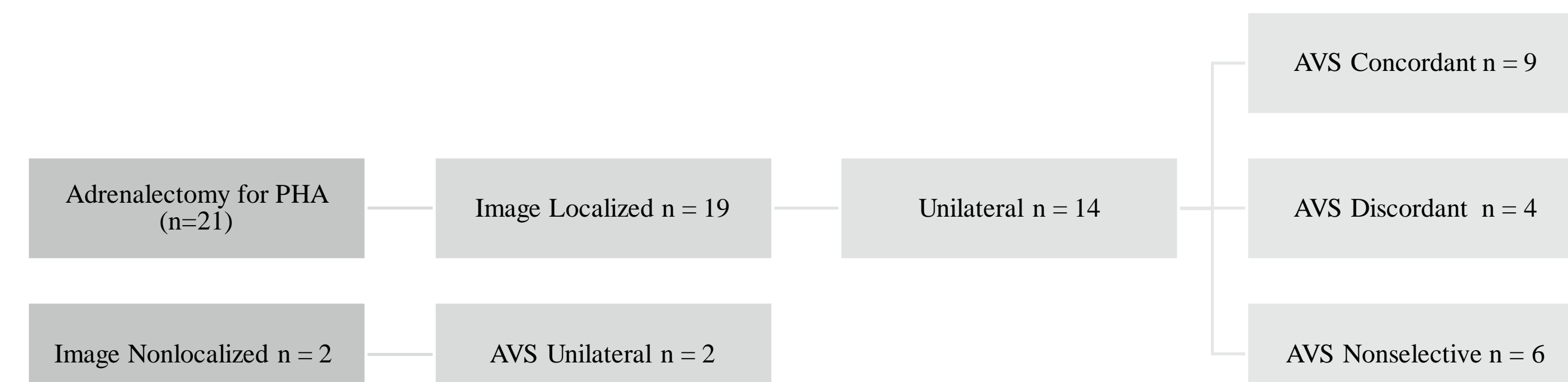


Table 1. Clinical Factors by Concordance of Imaging with AVS

Variable	Entire Cohort	Discordant	Concordant	p value
Sample size	21	6	9	
Age years, mean (SD)	54 (13)	54 (13)	59 (8.5)	0.48
BMI kg/m ² , mean (SD)	35 (4.8)	34 (5.2)	36 (5.1)	0.64
Male sex, n (%)	14 (66.7)	4 (66.7)	8 (89)	0.29
Race				0.40
White, n (%)	17 (81)	6 (100)	8 (89)	
Black, n (%)	2 (9.5)	0 (0)	0 (0)	
Hispanic, n (%)	2 (9.5)	0 (0)	1 (11)	
Preoperative Aldosterone ng/dL, mean (SD)	39 (23)	23 (9.0)	58 (19)	0.0022
Preoperative Renin ng/mL/hr, mean (SD)	0.3 (0.3)	0.3 (0.3)	0.3 (0.4)	0.85
Preoperative Aldosterone to Renin Ratio, mean (SD)	245 (250)	147 (126)	398 (311)	0.10
Image Size cm, mean (SD)	1.4 (0.8)	2.2 (1.4)	1.2 (0.3)	0.16
Preoperative Antihypertensive Medications, mean (SD)	3.2 (1.3)	3.2 (1.5)	3.6 (0.5)	0.70
Postoperative Antihypertensive Medications, mean (SD)	1.2 (1.0)	1.5 (1.2)	1.1 (0.9)	0.56
Pathology nodule size cm, mean (SD)	1.6 (0.8)	1.9 (0.9)	1.5 (1.0)	0.51
Follow up time, years, mean (SD)	2.2 (2.5)	1.0 (0.8)	2.1 (2.6)	0.41

Figure 2. Aldosterone Levels by Concordance of Imaging with AVS

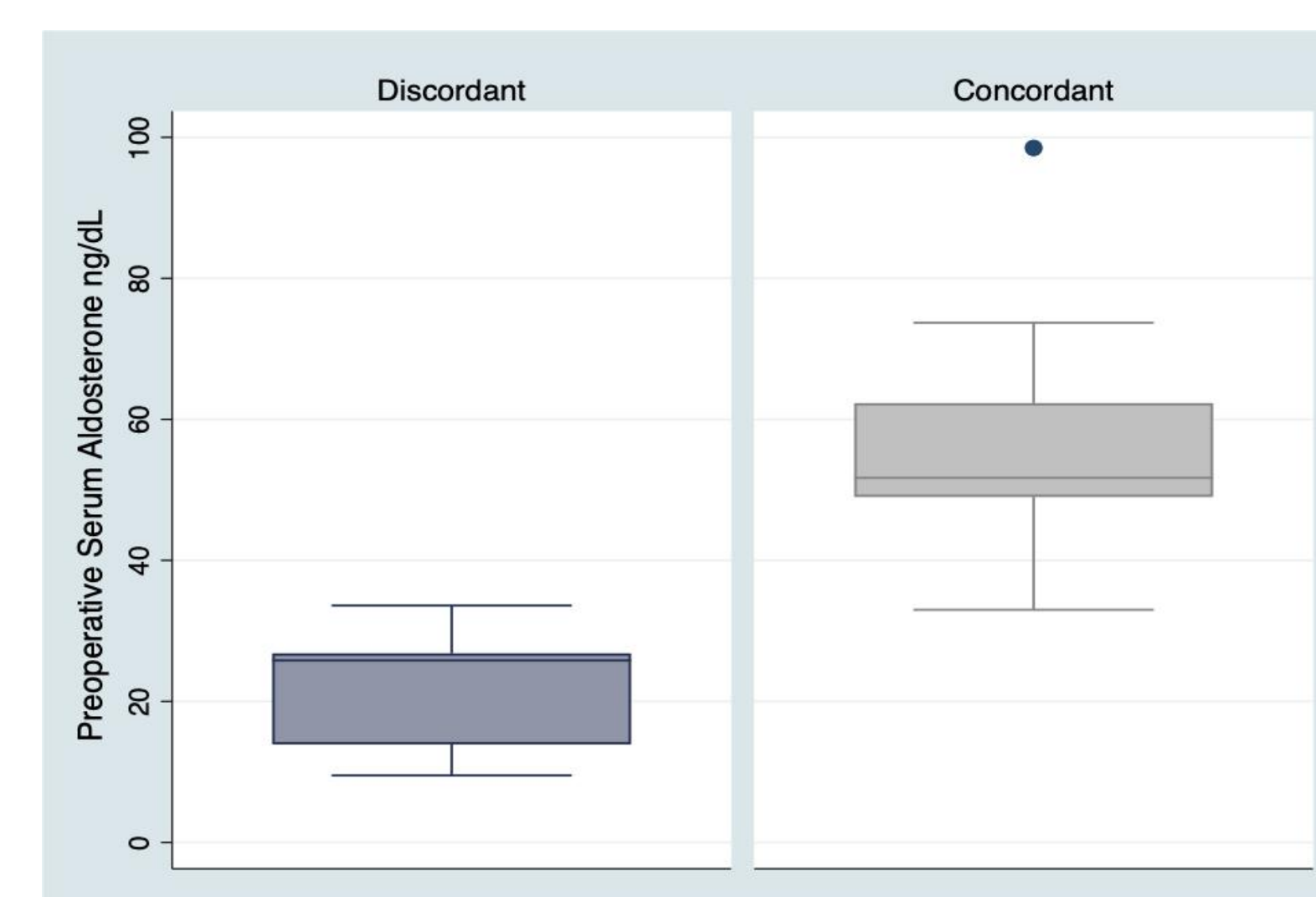


Table 2. Pre- and Postoperative Medications

Antihypertensive Medication	Preoperative	Postoperative
Aldosterone Antagonist, n (%)	13 (62)	1 (4.8)
Beta Blocker, n (%)	12 (57)	6 (29)
Alpha Blocker, n (%)	6 (29)	1 (4.8)
ACE/ARB, n (%)	14 (67)	9 (43)
Calcium Channel Blocker, n (%)	15 (71)	6 (29)
Thiazidediuretic, n (%)	3 (14)	1 (9.5)
Potassium Sparing Diuretic, n (%)	10 (48)	1 (4.8)
Vasodilator, n (%)	4 (19)	1 (4.8)
Number of Antihypertensive Medications, mean (SD)	3.2 (1.3)	1.2 (1.0)

Conclusion and Future Directions

- In this cohort, 40% of patients with selective AVS had discordant imaging and AVS results. Preoperative plasma aldosterone concentration was positively associated with concordance, with higher PAC more likely to have imaging and AVS concordance.
- Overall, hypertension was significantly improved following adrenalectomy for PHA with a median decrease of 2 antihypertensives. Our results support the recommendation to perform AVS on all candidates for adrenalectomy for PHA. Further study is warranted to identify factors associated with discordance.

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