An Incident Diagnosis of Primary Hyperaldosteronism in A Case with Acute Atrial Fibrillation

AKUT ATRİYAL FİBRİLASYONLU BİR OLGUDA PRİMER HİPERALDOSTERONİZM TANISI

Ahmet KAYA, MD,[a] Yasemin KAYA, MD,[b] Ümran YILDIRIM, MD,[c] İsmet ÖZAYDIN, MD,[d] Hakan ÖZHAN,[a] MD, Mehmet YAZICI, MD[a]

Departments of [a]Cardiology, [b]Internal Medicine, [c]Pathology, [d]General Surgery, Düzce University Faculty of Medicine, DÜZCE

Abstract

Cardiovascular complications are increased in a large group of patients with primary aldosteronism (PA). The complications of primary hyperaldosteronism include coronary artery disease, arrhythmias, myocardial infarction, left ventricular hypertrophy (LVH), and cerebrovascular disease. We report here a case of PA, a 52-year-old female presented with symptomatic paroxysmal atrial fibrillation, who had hypertension and LVH in echocardiographic examination.

Key Words: Hyperaldosteronism; atrial fibrillation

Özet

Primer aldosteronizmli (PA) hastaların büyük bir kısmında kardiyovasküler komplikasyonlarda artış görülmektedir. Primer hiperaldosteronizmde görülen bu komplikasyonlar arasında koroner arter hastalığı, aritmiler, miyokard infarktüsü, sol ventrikül hipertrofisi ve serebrovasküler hastalık sayılabilir. Biz 52 yaşında, bayan, semptomatik atriyal fibrilasyonu olan, hipertansif ve ekokardiyografik olarak sol ventrikül hipertrofisi bulunan bir primer hiperaldosteronizm olgusunu sunmak istedik.

Anahtar Kelimeler: Hiperaldosteronizm; atriyal fibrilasyon

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Primary aldosteronism (PA) is caused by bilateral idiopathic hyperplasia in approximately two-thirds of cases and aldosterone-producing adenoma in one-third. Most patients with primary aldosteronism are normokalemic. Hypertension associated with PA is most of the time considered mild and readily controlled as well as rarely complicated.[1,2] Prevalence of primary aldosteronism among non-selected hypertensive population was found to be 5-12%.[3] Among patients with resistant hypertension, the prevalence of primary aldosteronism has been reported to be 17-20%.[4,5] The aldosterone-producing adenoma (aldosteronoma) is the most important cause of hyperaldosteronism and represents one of the few curable causes of secondary arterial hypertension.[6] Hypertensive heart disease associated with left ventricular hypertrophy (LVH) is known to be associated with an increase of plasma aldosterone and an increase of cardiac collagen volume fraction and fibrosis.[7,8] Excess aldosterone may be a risk factor for arrhythmic disorders occurring either via LVH or cardiac fibrosis or a combination of both.[9,10] In addition, hypokalemia is associated with ventricular arrhythmias in patients with cardiac ischemia, heart failure, or left ventricular hypertrophy. However, little is known about the possible increased susceptibility to atrial fibrillation (AF) in patients with primary hyperaldosteronism.[11]

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Yazışma Adresi/*Correspondence:* Ahmet KAYA, MD
Düzce University Faculty of Medicine
Department of Cardiology, DÜZCE
drkayaahmet@yahoo.com

Case Report

A 52-year-old white female presented to the emergency clinic with the symptom of sudden onset palpitation. She decided to seek medical attention since her symptoms did not resolve spontaneously after one hour of wait. The patient's past medical history revealed uncontrolled hypertension for the last 4 years. She did not smoke or use alcohol and her family history was negative for cardiac arrhythmias including AF.

On initial presentation her pulse rate was irregular at 150 beats/min and her blood pressure was 220/130 mmHg. Her heart auscultation did not reveal any murmurs and cardiac sounds were normal. Other physical examination findings were completely normal. However, laboratory findings revealed serum potassium of 3.1 mEq/L (Reference range: 3.5-4.5 mEq/L). The remainder of her serum electrolytes was normal. All other routine laboratory tests were within the normal range (glucose, creatinine, total cholesterol, and urinary sediment). Additionally, thyroid function tests were within the normal range. Her ECG revealed AF. She had another ECG in her wallet, recorded 3 mounts ago, which showed normal sinus rhythm. The transthoracic echocardiogram showed left ventricular hypertrophy (interventricular septum thickness was 12.5 mm and posterior wall 12 mm), grade 2 diastolic dysfunction, left atrial (diastolic diameter was 45 mm) and ventricular dilatation (systolic and diastolic diameters were 39 mm and 58 mm, respectively), moderate mitral regurgitation and a left ventricular ejection fraction of 62%.

Based on these initial observations, intravenous nitrate infusion of 20 mcg/min was started promptly in order to regulate her arterial blood pressure. Fifteen mg of metoprolol was administered within 15 minutes for heart rate control that caused a heart rate of 120/min. Two hours later, her blood pressure dropped to 140/90 mmHg. Amiodarone was started (150 mg intravenous infusion in five minutes followed with 900 mg infusion for 24 h, during which normal sinus rhythm was restored).

PA was decided in differential diagnosis in further evaluation of her hypertension, due to the history of uncontrolled hypertension and incident hypokalemia. The measurement of urinary potassium collected in the 24-hour daily period was 51, 8 mEq/L (normal range 20/L to 80 mEq). The incident plasma renin activity was 0, 4 ng/mL/h. (normal range 0.20 to 3.40 ng/mL/h) and aldosterone level was 280 pg/mL (normal range 20 to 240).

The patient underwent computed tomography examination of the abdomen, which showed a nodular mass in the right adrenal topography, measuring approximately 2X1.5X1.5 cm in diameter (Figure 1). The patient was referred to the surgery and the mass was successfully excised (total adrenalectomy). Microscopic evaluation of the mass concluded the diagnosis of adrenal adenoma. The tissue was composed of uniform large cells arranged in nests and trabeculae surrounded by capsules. The cells have abundant lipid-filled cytoplasm and small uniform nuclei (Figure 2). The patient recovered and was very well in her first month visit. Her blood pressure was under control with single drug therapy; an angiotensin converting enzyme inhibitor.

Discussion

Our patient had a history of long-term uncontrolled arterial hypertension with hypokalemia. PA produces high levels of aldosterone, which in turn have negative effects on non-epithelial tissues. These effects include increased oxidative stress

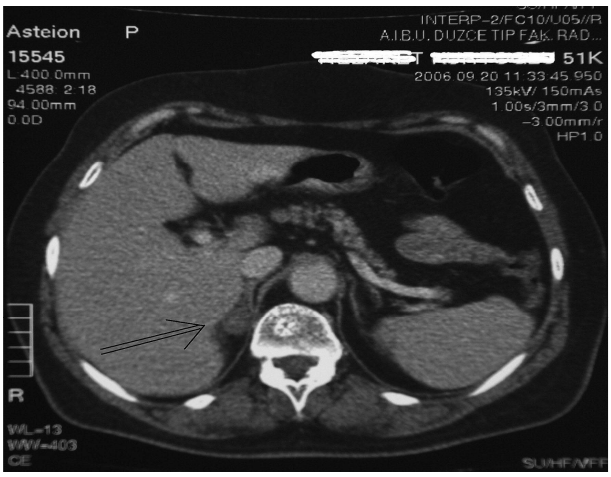

Figure 1. Computed tomography of abdomen showing suprarenal mass (arrow).

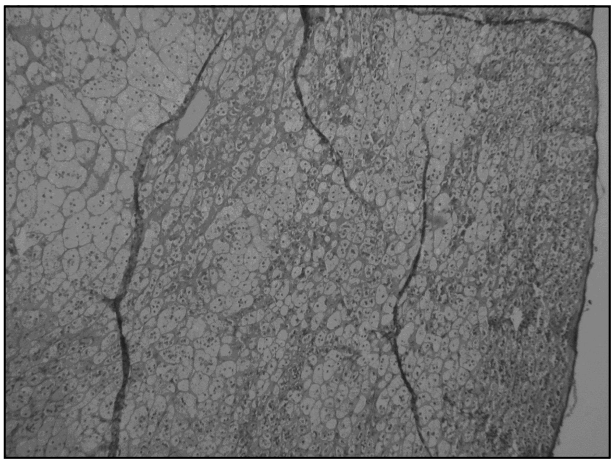

Figure 2. Microscopic appearance of adrenal adenoma (hematoxylen eosin stain, 100X).

and collagen remodeling, which result in endothelial dysfunction, left ventricular hypertrophy and fibrosis in the kidney, heart and blood vessels.[12] In the present case, the development of symptomatic paroxysmal AF was closely associated with cardiac changes including LVH and atrial dilatation. A recently published case report by Aloul et al. also suggested hypokalemia as a potential etiologic factor for AF in PA patients.[11] The risk was especially higher for serum potassium levels of ≤3.3 mEq/L and normal rhythm was restored after potassium infusion in their case. A similar case had also been reported recently by Prodko et al.[13]

In the past, experimental models of hypertension have shown that excess aldosterone induces severe injury in the heart, brain, and kidneys independent of BP level and that pharmacological antagonists of aldosterone or adrenalectomy markedly reduced myocardial injury, cerebral hemorrhage, and renal vascular disease.[14] The negative effect of circulating aldosterone on cardiac function was documented recently by Stowasser and colleagues.[15] These authors reported that in young, non-hypertensive subjects with glucocorticoid-remediable aldosteronism, left ventricular wall thickness is increased and diastolic function is reduced compared with age- and sex-matched controls. Indeed, cardiovascular events (stroke, myocardial infarction and atriyal fibrillation) are more common in patients with primary aldosteronism than in subjects with essential hypertension, a finding that is independent of blood pressure.[3]

Hypertensive heart disease associated with LVH is known to be associated with an increase of plasma aldosterone and an increase of cardiac collagen volume fraction and fibrosis, as derived from experimental and clinical works.[7,8] Aldosterone excess and LVH are known to independently increase fibrosis within the heart.[16,17] It is clear, however, that plasma aldosterone concentration has a role; there is a positive correlation between cardiac collagen content (measured by ultrasonic backscatter) and plasma aldosterone levels in humans.[8]

It seems logical to suggest that aldosterone and/or cardiac fibrosis might play a role on the occurrence of LVH and possible resulting cardiac complications.[16,18] Excess aldosterone might be a risk factor for arrhythmic disorders occurring either via LVH or via cardiac fibrosis or a combination of both.[1]

Finally, one should be vigilant about PA in cases of uncontrolled hypertension presented with hypokalemia. Atrial fibrillation may well be a complication of PA, possibly related to LVH, cardiac fibrosis and electrolyte disturbances caused by excess amount of circulating aldosterone. In case of a acute atrial fibrillation, first of all serum potassium should be maintained > 3 mEq/L and than medical cardioversion should be decided with proper anti arrhythmic agents. In that case, amiodarone can be the drug of choice, since most of these patients had left ventricular hypertrophy.

REFERENCES

1. Milliez P, Girerd X, Plouin PF, Blacher J, Safar ME, Mouard JJ. Evidence for an increased rate of cardiovascular events in patients with primary aldosteronism. J Am Coll Cardiol 2005;45:1243-8.
2. Relman AS. Diagnosis of primary aldosteronism. Am J Surg 1964;107:73-7.
3. Mattsson C, Young WF Jr. Primary aldosteronism: diagnostic and treatment strategies. Nature Clinical Practice 2006;2:198-208.
4. Calhoun DA, Nishizaka MK, Zaman Mai Thakkar RB, Weissmann P. Hyperaldosteronism among black and white subjects with resistant hypertension. Hypertension 2002;40:892-6.
5. Gallay BJ, Ahmad S, Xu L, Toivola B, Davidson RC. Screening for primary aldosteronism without discontinuing hypertensive medications: Plasma aldosterone-renin ratio. Am J Kidney Dis 2001;37:699-705.

6. Martin JF, Vicente AR, Cury PM, Dib JA, Cipullo JP. Conn's Adenoma. A Cause of Hypertension and Hypokalemia. Arg Bras Cardiol 2004;83:87-90
7. Rossi GP, Di Bello V, Ganzaroli C, Sacchetto A, Cesari M, Bertini A, et al. Excess aldosterone is associated with alterations of myocardial texture in primary aldosteronism. Hypertension 2002;40:23-7.
8. Kozakova M, Buralli S, Palombo C, Bernini G, Moretti A, Favilli S, et al. Myocardial ultrasonic backscatter in hypertension: Relation to aldosterone and endothelin. Hypertension 2003;41:230-6.
9. Ramires FJ, Mansur A, Coelho O, Maranhão M, gruppi CJ, Mady C, et al. Effect of spironolactone on ventricular arrhythmias in congestive heart failure secondary to idiopathic dilated or to ischemic cardiomyopathy. Am J Cardiol 2000;85:1207-11.
10. Yee KM, Pringle SD, Struthers AD. Circadian variation in the effects of aldosterone blockade on heart rate variability and QT dispersion in congestive heart failure. J Am Coll Cardiol 2001;37:1800-7.
11. Al-Aloul B, Li JM, Benditt D, Tholakanahalli V. Atrial Fibrillation Associated with Hypokalemia Due to Primary Hyperaldosteronism (Conn's Syndrome). Pacing Clin Electrophysiol 2006;29:1303-5.
12. Brown NJ. Aldosterone and end-organ damage. Curr Opin Nephrol Hypertens 2005;14:235-41.
13. Porodko M, Auer J, Eber B. Conn's syndrome and atrial fibrillation. Lancet 2001;21:1293-4.
14. Rocha R, Stier CT. Pathophysiological effects of aldosterone in cardiovascular tissues. Trends Endocrinol Metab 2001;12:308-14.
15. Stowasser M, Sharman J, Leano R, Gordon RD, Ward G, Cowley D, et al. Evidence for abnormal left ventricular structure and function in normotensive individuals with familial hyperaldosteronism type I. J Clin Endocrinol Metab 2005;90:5070-6.
16. Devereux RB, Roman MJ. Cardiac structure and function in hypertension. In: Zanchetti A, Mancia G, eds. Pathophysiology of Hypertension. Amsterdam: Elsevier; 1997. p.58-116.
17. Assayag P, Carre F, Chevalier B, Delcayre C, Mansier P, Swynghedauw B. Compensated cardiac hypertrophy: arrhythmogenicity and the new myocardial phenotype. I. Fibrosis. Cardiovasc Res 1997;34:439-44.
18. Brilla CG, Weber KT. Reactive and reparative myocardial fibrosis in arterial hypertension in the rat. Cardiovasc Res 1992;26:671-7.