

Primary hyperaldosteronism treated by radiofrequency ablation

Abdulrahman A. Al-Shaikh, ABIM, FRCP, Mohamed M. Al-Rawas, MD, FRCPC, Mirvat A. Al-Asnag, ABIM, MRCP.

ABSTRACT

This is a report of a 57-year-old Jordanian man who had uncontrolled hypertension and hypokalemia. He was diagnosed to have primary hyperaldosteronism with left adrenal adenoma. Traditionally, surgical resection of the adrenal gland whether by laparotomy or laparoscopic procedures would have been considered at this point. However, the treating team elected radiofrequency ablation of the left adrenal in view of the fact that this facility and the expertise was available in the hospital; in addition, this procedure required a shorter duration of hospitalization, was less expensive, and was less invasive. Subsequently, the patient's blood pressure improved to 120/75mm Hg and his anti-hypertensive medications were reduced. Serum aldosterone and computed tomography scan of adrenals improved. We are reporting this case as it is the first time such modalities in the treatment of adrenal adenoma was used.

Saudi Med J 2004; Vol. 25 (11): 1711-1714

Primary hyperaldosteronism is a recognized cause of hypertension that accounts for approximately one percent of all secondary causes of hypertension.¹ Usually, the hypersecretion of aldosterone is due to adrenal hyperplasia and only occasionally is an isolated adenoma found. Traditionally, the disorder was managed medically with anti-hypertensive drugs that included a potassium-sparing diuretic such as spironolactone or triamterene. Only, patients who had refractory hypertension, hypokalemia, or symptoms were referred for surgical excision whether by laparotomy or laparoscopy. In the patient described below with Conn's syndrome, radiofrequency (RF) ablation of the adrenal gland, a novel modality of treatment, was attempted as it was readily available, safe, effective, cheap, and less invasive, therefore, requiring a shorter in-hospital stay.

Case Report. A 57-year-old Jordanian man presented to the emergency room of King

Abdul-Aziz University Hospital in April 2002 with a 3-day history of progressive shortness of breath. He also complained of paroxysmal nocturnal dyspnea, orthopnea, and ankle swelling. He had not experienced any cough, hemoptysis, fever, chest pain, palpitations, or syncope. There were no symptoms of thyrotoxicosis and any episodic flushing, wheezing, or palpitations. His past history was only significant for an 8-year history of hypertension managed with alpha-methyldopa 250mg po od and atenolol 100mg po od. He gave no history of diabetes mellitus, hyperlipidemia, coronary artery disease, or renal disease. There was no family history of hypertension, renal diseases, cardiac or endocrine disorders. He was an ex-smoker for 7 years. Upon examination, his blood pressure (BP) was 200/115mm Hg, heart rate 95 beats per minute and regular, respiratory rate 32 breaths per minute, and he was afebrile. He had bilateral fine crepitations to mid zones of the lungs. He had a normal first heart sound and a loud second

From the Department of Medicine (Al-Shaikh, Al-Asnag), Department of Radiology (Al-Rawas), King Abdul-Aziz University Hospital, Jeddah, Kingdom of Saudi Arabia.

Received 17th March 2004. Accepted for publication in final form 10th July 2004.

Address correspondence and reprint request to: Dr. Abdulrahman A. Al-Shaikh, Department of Medicine, Faculty of Medicine, King Abdul-Aziz University, PO Box 80215, Jeddah 21589, Kingdom of Saudi Arabia. Tel. +966 (2) 6408102. Fax. +966 (2) 6408113. E-mail: joodshaikh@yahoo.com

heart sound with an S4 gallop. The jugular venous pressure was raised approximately 5cm above the angle of Louis. He had bilateral lower limb edema limited to the ankles and there was no sacral edema. His abdominal and central nervous system examinations were within normal limits. The preliminary investigations revealed hypokalemia with potassium of 2.8mmol/L and a sodium level of 146mmol/L. The electrocardiogram showed left axis deviation and left ventricular hypertrophy. Serial cardiac enzymes were normal. The chest x-ray demonstrated pulmonary edema with an increased cardiac size. The remainder of his investigations were normal including the complete blood counts, liver function tests, coagulation profile and thyroid function tests. He was admitted with a diagnosis of congestive heart failure secondary to uncontrolled hypertension. He was initially managed with intravenous furosemide 60mg tid, captopril 50mg po tid, spironolactone 100mg po od, aspirin 100mg po od, isosorbide dinitrate 20mg po bid and oral potassium supplements. Subsequently, furosemide was discontinued and nifedipine retard 20mg po bid along with hydralazine 25mg po tid was added. His heart failure resolved and his BP decreased to 160/90mm Hg. Further investigations in search for secondary hypertension were echocardiogram, which includes 1. normal systolic function, grade I diastolic dysfunction and left ventricular hypertrophy, 2. ultrasound of kidneys with doppler were normal and 3. electrolytes. Sodium are 146, 143, 143 and 147 while potassium are 2.8, 2.6, 3, and 3.1.

In view of his persistent hypokalemia and hypertension a provisional diagnosis of Conn's syndrome was made. A computed tomography (CT) scan of the adrenal glands and renin and aldosterone levels were requested and the results were to be traced in the out-patient department. Accordingly, he was discharged home at the end of April 2002 on the above medications with a BP of 160/90mm Hg and a follow-up appointment in the clinic. Two weeks later, he was seen in the outpatient department and his renin level was low (1.2mcu/ml), carried out by immunoradiometric assay method with normal value of 2.4-2.9mcu/ml and his aldosterone level was high (460pg/ml), carried out by radioimmuno assay with normal value of 240-310pg/ml. A CT scan of the abdomen revealed bilateral suprarenal nodularity more prominent on the left than the right suggestive of hyperplasia (**Figure 1**). He was readmitted in May 2002 for renal vein sampling for renin and aldosterone assays to confirm the diagnosis and localize the tumor. At this point his BP was 160/90mm Hg. He has no heart failure. His serum potassium was 3.9mmol/L and sodium was

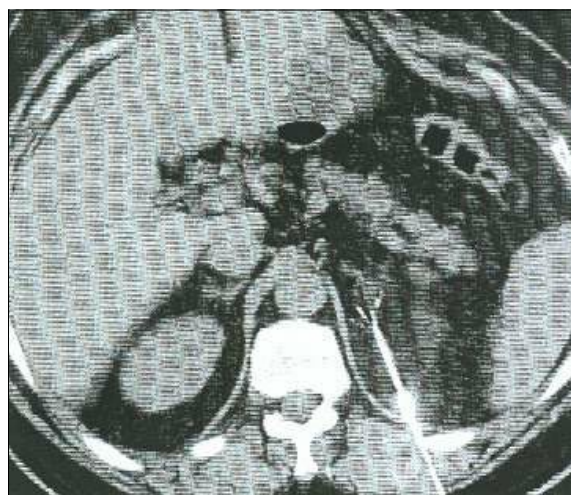


Figure 1 - Computed tomography scan of the adrenal glands pre-ablation.

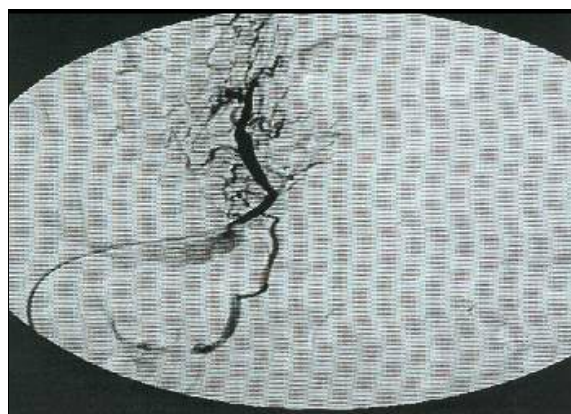


Figure 2 - Venogram of left adrenal gland.

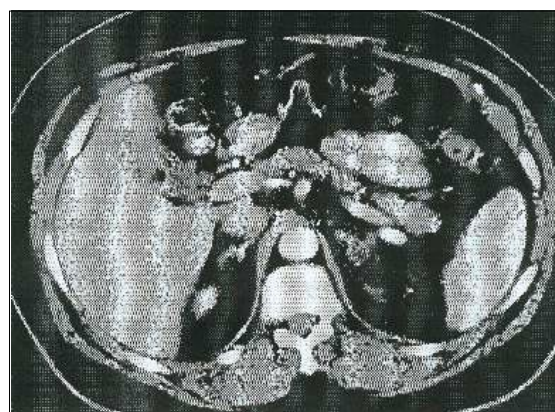


Figure 3 - Computed tomography scan of adrenal glands post-ablation.

141mmol/L. The sampling was performed in June 2002 using a C2 cobra catheter, which was introduced via the right femoral vein to the inferior vena cava (IVC) and 4 samples were collected, one from the IVC above the left renal vein, one from the IVC below the left renal vein, one from each the left and right renal veins, and the last from the left adrenal vein. Left adrenal venography was performed during the same sitting and no masses were visualized on the left side (**Figure 2**). The patient tolerated the procedure well and was subsequently discharged on the same medications to be followed-up in the clinic. In the outpatient department his BP remained high despite 4 anti-hypertensive medications and the renin and aldosterone levels confirmed the diagnosis of Conn's syndrome secondary to aldosterone hypersecretion from the left adrenal gland. Therefore, the option of RF ablation of the left adrenal was discussed with the patient. He was admitted in February 2003 for the procedure. On February 18th 2003 the patient underwent RF ablation of the left adrenal. The catheter was introduced via the right femoral vein to the IVC. A 2cm needle was introduced and a temperature of 80°C and power of 90watts was applied for 4 minutes and 30 seconds. Subsequently, a 3cm needle was used and a temperature of 105°C and power of 90watts was applied for 4 minutes. The patient tolerated the procedure well with no complications. The BP recording was as follows: for 17/2/03, 160/95mm Hg, on 18/2/03, 150/90mm Hg and on 19/2/03, 120/75mm Hg.

He was discharged in February 2003 on nifedipine-retard 20mg po bid, spironolactone 100mg po od, captopril 12.5mg po tid, and atenolol 50mg po od. The patient was reviewed in the clinic 3 weeks later. He was asymptomatic. His BP was 110/80mm Hg. His serum potassium was 3.6 mmol/L. His medications were further adjusted. The spironolactone was discontinued and captopril was further decreased to 12.5mg po bid. A repeat CT scan in April 2003 showed 2 small 1.4x1.3cm and 1.4x1.2cm lesions in the left adrenal (**Figure 3**). In his subsequent visits to the clinic it was noted that his potassium ranged from 3.6-3.8mmol/L, and his BP was 130/80mm Hg. Follow-up aldosterone and renin levels revealed normal renin (2.4mCu/ml) and low aldosterone of (130pg/ml). The last visit to the clinic was in June 2003 at which time he was on captopril 12.5mg po bid, atenolol 50mg po od, and nifedipine-retard 20mg po bid. He remains symptom-free, with a BP of 130/90mm Hg and normal potassium level 3.6mmol/L.

Discussion. Primary hyperaldosteronism is a recognized cause of hypertension that accounts for approximately one percent of all secondary causes of hypertension.¹ It has been suggested that this

prevalence rate may be underestimated. Several reports have noted that adrenocortical adenomas, which are incidentally discovered are seen more commonly in hypertensive than normotensive individuals.² However, the hypersecretion of aldosterone is due to micronodular or macronodular adrenal hyperplasia in up to 30% of cases. The hyperplasia maybe bilateral or unilateral.³ The CT scan of the patient revealed macronodular hyperplasia of both adrenal glands, the left more than the right. Although our patient was a male, primary hyperaldosteronism is more common in females. Patients are usually asymptomatic, but some patients may present with polyuria, muscle weakness or paresthesia, which are attributed to the hypokalemia. The BP elevation may be markedly elevated or resistant to therapy. Eventually patients may develop hypertensive retinopathy or hypertensive heart disease in the form of diastolic dysfunction and left ventricular hypertrophy.⁴ This man did not exhibit symptoms of hypokalemia or retinopathy; however, his echocardiogram confirmed the presence of both diastolic dysfunction and left ventricular hypertrophy. The diagnosis of primary hyperaldosteronism is supported by the presence of spontaneous hypokalemia, metabolic alkalosis and high normal serum sodium. The urinary excretion of potassium is also increased to more than 30mmol per day. Determination of the ratio of plasma renin to aldosterone is a more reliable test to confirm the presence of primary hyperaldosteronism. The assay can be carried out while the patient is in an upright position or following a high sodium diet or infusion of normal saline.⁵ The investigations carried out for this patient revealed persistent hypokalemia despite the discontinuation of furosemide. He gave no history of ingestion of licorice or use of diuretics prior to presentation to the hospital. Furthermore, his aldosterone and renin ratio was carried out before any intervention confirmed the presence of hyperaldosteronism. Localization of the abnormal adrenal gland was achieved by sampling of adrenal venous blood, which indicated that the excess aldosterone was coming primarily from the left adrenal gland.

Traditionally, adrenal hyperplasia is managed medically with anti-hypertensive drugs that include a potassium-sparing diuretic such as spironolactone or triamterene. These agents improve the potassium level and reduce BP. However, doses ranging between 25-400mg are required but side effects including gynecomastia, and impotence are frequently reported.^{6,7} Only, patients who had refractory hypertension, hypokalemia, or symptoms and patients with adenomas were referred for surgical excision whether by laparotomy or laparoscopy. In the patient described above with Conn's syndrome, the left adrenal gland was

identified as the source of hyperaldosteronism; therefore, this was the gland targeted. The treating team elected RF ablation of the adrenal gland as it was readily available, safe, effective, cheap, and less invasive, therefore, requiring a shorter in-hospital stay.

Radiofrequency ablation has been used with success in a number of other areas including the treatment of arrhythmogenic pathways in the heart and primary and metastatic hepatic tumors. Promising results have also been obtained with the use of RF ablation in other solid tumors such as the lung, bone, brain, kidneys, prostate gland, and pancreas. Recently, it has been used in invasive breast carcinoma of patients with locally advanced disease.^{8,9} The advent of using RF ablation in extra-cardiac tissue as in the tumors listed earlier has marked significant medical progress. Furthermore, side effects of this procedure appear to be limited and infrequent. They include skin burns, subcapsular hematomas, renal insufficiency, needle-tract seeding, and pleural effusions. More serious complications were reported in poorly-selected patients; that is with underlying decompensated liver disease or surgical anastomoses distorting the normal anatomy leading to liver failure or viscous perforation. These complications were reported in tumors, which were inaccessible and vascular such as deep-seated hepatocellular carcinomas.¹⁰ With regards to adrenal tumors, they are not known to be vascular and are easily localized by various radiographic techniques including CT scanning. Patients with adrenal hyperplasia or tumors usually have a benign disease and rarely have other comorbidities. Our patient was a middle-aged gentleman with no

complications, his BP improved, and his medications were reduced during his follow-up visits. Considering that this is a novel modality of therapy for hyperaldosteronism, a longer period of follow-up is necessary to document a sustained response and hence declare successful management.

References

1. Gordon RD. Mineral corticoid Hypertension. *Lancet* 1994; 344: 240-243.
2. Russel RP, Masi AT, Richer ED. Adrenal Cortical Adenomas and Hypertension: A Clinical Pathologic Analysis of 690 Cases with Matched Controls and a Review of the Literature. *Medicine* 1972; 51: 211-225.
3. Irony I, Kater CE, Biglieri EG, Shackleton CHL. Correctable Subsets of Primary Aldosteronism: Primary Adrenal Hyperplasia and Renin Responsive Adenoma. *Am J Hypertens* 1990; 3: 576-582.
4. Weiberger MH, Grim CE, Hollifield JW, Kem DC, Ganguly A, Kramer NJ, et al. Primary Aldosteronism: Diagnosis, Localization and Treatment. *Ann Intern Med* 1979; 90: 386-395.
5. Weinberger MH, Fienberg NS. The diagnosis of Primary Aldosteronism and Separation of Two Major Subtypes. *Arch Intern Med* 1993; 153: 2125-2129.
6. Shenker Y. Medical Treatment of Low-Renin Aldosteronism. *Endocrinol Metab Clin North Am* 1989; 18: 415-442.
7. Young WF Jr, Hogan MJ, Klee GG, Grant CS, Van Heerden JA. Primary Aldosteronism: Diagnosis and Treatment. *Mayo Clin Proc* 1990; 65: 96-110.
8. Mirza AN, Fornage BD, Sneige N, Kuerer HM, Newman LA, Ames FC, et al. Radiofrequency Ablation of Solid Tumors. *Cancer* 2001; 7: 95-102.
9. Farrell MA, Charboneau WJ, DiMarco DS, Chow GK, Zincke H, Callstrom MR, et al. Imaging-Guided Radiofrequency Ablation of Solid Renal Tumors. *Am J Roentgenol* 2003; 180: 1509-1513.
10. de Baere T, Risse O, Kuoch V, Dromain C, Sengel C, Smayra T, et al. Adverse Events During Radiofrequency Treatment of 582 Hepatic Tumors. *Am J Roentgenol* 2003; 181: 695-700.