Percutaneous Transluminal Adrenal Ablation for Aldosteronism: Report of Initial Three Cases

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Patients with adrenocortical tumors or hyperplasia, comprising Cushing's syndrome, hyperaldosteronism and pheochromocytoma, may suffer from secondary hypertension. Current treatment includes open or laparoscopic adrenalectomy. We attempted percutaneous transluminal adrenal ablation (PTAA) on three patients with primary aldosteronism diagnosed by serum potassium/aldosterone levels, 6-B-iodomethyl-19-norcholesterol (NP-59) and adrenal computerized tomography (CT)/magnetic resonance imaging. The first patient with a right adrenal tumor was successfully ablated and no hypertension was noted during the 1-year follow-up period. The second patient with left adrenal tumor was incompletely ablated and hypertension persisted. She received surgical adrenalectomy 2 months later. The right adrenal tumor in the third patient could not be ablated due to failure to locate the major feeding artery. Instead, he received CT-guided needle ablation. The PTAA procedure was uneventful. Our initial experience suggests that PTAA is a minimally invasive alternative to surgical adrenalectomy and may become a safe and effective approach for the treatment of benign adrenal tumors in selected patients.

Key Words: Percutaneous transluminal adrenal ablation • Aldosteronism • Secondary hypertension

INTRODUCTION

Patients with adrenocortical tumors, comprising Cushing's syndrome, hyperaldosteronism and pheochromocytoma, suffer from secondary hypertension. Current treatment includes open or laparoscopic adrenalectomy.[1, 2] Open adrenalectomy requires a surgical incision, often large and traumatic, with notable morbidity. Laparoscopic adrenalectomy requires expanded knowledge and experience in minimally invasive surgery. Recently, percutaneous transluminal adrenal ablation (PTAA) with ethanol has been attempted, with optimistic results.[3, 4] We report our initial experience of PTAA performed on three patients with primary aldosteronism who were diagnosed by serum potassium and aldosterone levels, 6-B-iodomethyl-19-norcholesterol (NP-59) and adrenal computerized tomography (CT)/magnetic resonance imaging (MRI).

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CASE REPORTS

Case 1

A 45-year-old woman was admitted because of poor hypertension control. On physical examination, the patient appeared well. Vital signs were normal except for an elevated blood pressure (BP). Lungs were clear bilaterally; heart rhythm was regular and a grade 1–2 systolic murmur was heard over the left sternal border. Neurologic examination was unrevealing, and chest radiograph and electrocardiogram (ECG) were normal. Blood chemistry was as follows: potassium, 2 meq/L; aldosterone, 101.72 pg/mL; and plasma renin activity, 0.13 ng/mL/hr. Captopril test, urine vanillylmandelic acid (VMA) and catecholamines were normal. Subsequent CT and NP-59 adrenal imaging showed enlargement of the right adrenal gland, thought likely to be a functional adenoma. The patient agreed to PTAA.

Under fluoroscopy, initial angiography was performed to identify the specific arteries that fed the adenoma (Figure, A). An aortogram and selective arteriograms of the inferior phrenic, superior, middle and inferior adrenal arteries, and renal arteries were obtained to analyze the target branches that fed into the adrenal adenoma, which was located in the middle adrenal artery. A Cook RLA angiocatheter (Bloomington, IN, USA) was used to catheterize the target artery for infusion with 95% ethanol. The volume of ethanol infusion was approximately the same as

the volume of contrast medium used to opacify the adenoma and produce tumor staining. Repeat angiography was then performed after adrenal arterial infusion of ethanol to confirm the status of occlusion of the target artery at the same catheter position. There were no untoward events and ablation was successful, as feeding vessels were occluded and the dense tumor stain diminished following the procedure (Figure, B). After discharge, the patient was followed up every month at our Outpatient Department. She was not on any antihypertensive medication and no hypertension was noted for 1 year. Follow-up captopril test was normal, and serum potassium and aldosterone were 3.8 meq/L and 54.84 pg/mL, respectively. MRI showed a right adrenal gland with normal appearance with post-ablation fibrosis.

Case 2

A 30-year-old woman was admitted for control of hypertension. Physical examination was normal except for an elevated BP. Chest radiograph was normal; ECG showed sinus rhythm with nonspecific ST-T changes. Laboratory studies disclosed the following values: potassium, 2.7 meq/L; aldosterone, 268.93 pg/mL; plasma renin activity, 0.36 ng/mL/hr; and cortisol, 8.18 ug/dL. Subsequent CT, MRI and NP-59 adrenal imaging confirmed a 1.3-cm tumor in the left adrenal gland, thought likely to be a functional adenoma. The patient refused surgical resection of the tumor and preferred PTAA.

A 4 Fr Cordis SIM 1 angiocatheter (Miami, FL, USA) was used to catheterize the target artery (in this case, a lateral branch of the middle adrenal artery) for infusion of 95% ethanol. Repeat angiography was then performed after infusion of ethanol to confirm the status of the occlusion of the target artery at the same catheter position. There were no untoward events and the ablation was successful, as feeding vessels were occluded and the dense tumor stain diminished following the procedure. However, hypertension persisted and she underwent open adrenalectomy 2 months later in another hospital and was lost to follow-up.

Case 3

A 78-year-old hypertensive man with right adrenal adenoma, diagnosed previously by CT scan, was scheduled for PTAA. Blood chemistry values were: potassium, 1.9 meq/L; aldosterone, 143 pg/mL; and plasma renin activity, 4.13 ng/mL/hr. During catheterization, the target artery could not be located and, therefore, occlusion could not be made. CT-guided obliteration of the tumor by infusion of ethanol through a 22G spinal needle was performed instead. The procedure was smooth and uneventful. However, hypertension persisted and the patient was maintained with antihypertensive medication for 10 months thereafter. The patient was later lost to follow-up for subsequent CT scanning or laboratory test to evaluate the results of ablation.

DISCUSSION

The clinical manifestation of primary aldosteronism is not distinctive and additional studies are warranted in certain hypertensive patients, such as those with hypokalemia or those with refractory hypertension without an obvious secondary cause. Major etiologies of primary aldosteronism are adrenal adenoma, requiring excision or ablation, and bilateral hyperplasia, usually managed with medical therapy. In our experience, biochemical tests (especially potassium, aldosterone and plasma renin activity) together with CT/MRI and NP-59 adrenal imaging are useful to increase the diagnostic reliability of primary aldosteronism.

Current therapy for adrenocortical tumors includes open or laparoscopic adrenalectomy.[1,2] Open adrenalectomy requires large and traumatic surgical incisions. Laparoscopic

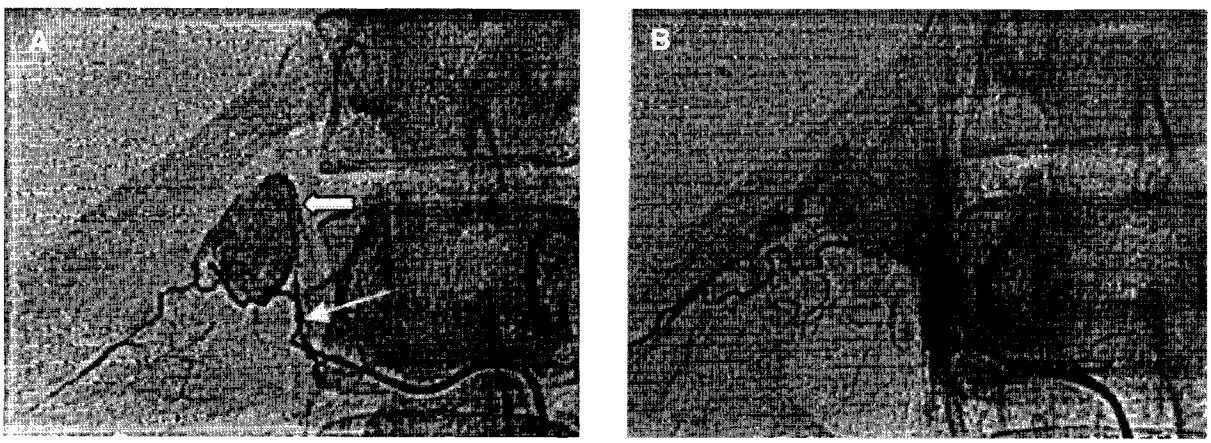

Figure. *Case 1. Arteriogram before embolization (A) showing feeding vessels (thin arrow) arising from middle adrenal artery and dense tumor stain (thick arrow) and after embolization (B) showing that feeding vessels were occluded and the dense tumor stain diminished.*

adrenalectomy requires experience in minimally invasive surgery. Both approaches are tedious, with long operating times, high bleeding volume and a high level of postoperative care. Morbidity and mortality are also notable. In our experience with PTAA, no serious complications occurred during the procedure and all patients returned to normal activity in a few hours. The postoperative course of our patients was uneventful.

The optimal volume of absolute alcohol to obtain an adequate effect of PTAA on aldosteronomas is still to be determined. We used 3 mL to 7 mL of ethanol, which was similar to the volume of contrast media needed to fill the adenoma to produce tumor staining. Although further comparative study among the three approaches is required, we are of the opinion that PTAA may be a safe and useful alternative to laparoscopic and open surgery in well-selected cases, especially in patients who either refuse or are inappropriate candidates for surgery. Moreover, further studies are needed to compare outcomes between PTAA and percutaneous CT-guided ablation, as reports of adrenal arterial embolization have been infrequent. We do not, however, recommend laparoscopic adrenalectomy or PTAA for known primary or metastatic malignant tumors of the adrenal glands because of the risk of tumor implantation, or for large tumors, where the chance of malignancy is high.

It has been reported that, after open or laparoscopic adrenalectomy, BP returns to normal in approximately 50% of cases.[5, 6] Inoue et al reported that, after PTAA, normotension and a reduction in hypertension were achieved in 39% and 44% of patients, respectively.[4] Although a larger number of patients is needed to confirm our results, our initial experience shows remission of hypertension following successful PTAA.

In conclusion, PTAA is feasible and safe and may become the procedure of choice for primary aldosteronism in selected patients.

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經皮下腎上腺燒灼術治療醛類酯醇過多症－三病例報告

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腎上腺腫瘤患者包括 Cushing's syndrome、hyperaldosteronism 及 pheochromocytoma 及常有次發性高血壓現象。現今外科治療包括腎上腺切除或腹腔鏡腎上腺切除術。我們給予 3 位醛類酯醇過多症 (primary aldosteronism) 患者實施經皮下腎上腺燒灼術。第 1 位患者燒灼成功，而於一年後並無復發高血壓發生。第 2 位患者因 feeding artery 不明顯而燒灼不全，數月後改以手術治療。第 3 位患者因 feeding artery 找不到而改以 CT-guided needle ablation 治療。以上初步經驗指出，經皮下腎上腺燒灼術是具輕微侵襲性的方法，對治療選擇適當之腎上腺腫瘤患者可能是安全且有效的方法。

關鍵詞：經皮下腎上腺燒灼術，醛類酯醇過多症，繼發性高血壓