



# Adrenal arterial embolization: a possible new treatment for patients with primary aldosteronism

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**Keyword** Primary aldosteronism · Superselective adrenal artery embolization · SAAE

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Primary aldosteronism (PA), a typical form of secondary hypertension, is caused by autonomous hypersecretion of aldosterone from the adrenal cortex. This condition not only induces hypertension via sodium reabsorption in the kidney, but also increases the risk of developing cardiovascular diseases. According to a study analyzing the prevalence of cardiovascular complications of PA in the Japan Primary Aldosteronism Study (JPAS), a Japanese multicenter registry study of primary aldosteronism, PA patients had a significantly higher prevalence of stroke (7.2% vs. 2.5%), ischemic heart disease (3.8% vs. 0.8%), atrial fibrillation (4.2% vs. 0.8%) and proteinuria (14.7% vs. 5.5%) compared to age-, gender-, and blood pressure-matched EHT patients, suggesting organ damage independent of blood pressure [1]. PA-specific treatments are essential to prevent the development of these complications. The treatment of PA depends on its type. In cases of unilateral aldosterone-producing adenoma (APA), which accounts for approximately 30% of all PA cases [2], surgery is the first choice, whereas treatment with mineralocorticoid receptor antagonists (MRA) is recommended for idiopathic hyperaldosteronism (IHA), another type of PA. Yet, MRA treatment does not always completely prevent complications, especially in cases where renin suppression is not reversed [3].

Recently, alternative treatment modalities for PA have emerged. These include percutaneous adrenal radiofrequency ablation [4] or partial adrenalectomy [5]. Another minimally invasive approach is superselective adrenal artery embolization (SAAE), which involves targeted ablation of

part of the hyperfunctioning adrenal tissue using transcatheter arterial ablation with ethanol. Hokotate et al. reported a success rate of 82% after performing SAAE in 33 patients with APA [6]. Similarly, Dong et al. demonstrated the effectiveness and safety of SAAE in 41 patients with IHA [7]. Subsequently, Zhou et al. conducted a single-center prospective cohort study to compare the efficacy of SAAE with MRA in patients with either APA or IHA and reported that SAAE was a reasonable choice of treatment in mixed patients with either APA or IHA in terms of clinical and biochemical outcomes [8]. However, to date, no comparative studies have exclusively investigated the effectiveness of MRA versus SAAE in patients with IHA alone.

In this study, Yaqiong et al. conducted a prospective randomized and controlled trial with the aim of comparing the safety and effectiveness of SAAE versus MRA in patients with IHA [9]. Sixty-four patients with a confirmed diagnosis of IHA by adrenal venous sampling (AVS) were assigned in a 1:1 ratio to undergo SAAE or MRA treatment. In the SAAE group, embolization was performed on the side with predominant aldosterone synthesis on AVS. After excluding several withdrawals, the analysis included 29 and 30 patients in the SAAE and MRA groups, respectively. At 1, 3, and 6 months, office, home, and 24-h ambulatory blood pressure significantly improved in the SAAE group compared to the MRA group. The aldosterone-to-renin ratio was lower in the SAAE group than in the MRA group at one and three months. None of the patients in the SAAE group experienced serious adverse events during the perioperative or 6-month follow-up periods. These results suggest the utility of SAAE in blood pressure control and correction of biochemical abnormalities in patients with IHA.

Table 1 summarizes the characteristics of each PA treatment. Adrenalectomy is a curative treatment for APA, and improvements in hormones, biochemical data, and blood pressure are generally superior to those of other

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**Table 1** The characteristics of each PA treatment

Treatment	Indication	Correction of physical and biochemical abnormalities	Invasiveness	Prevention of CVD complications	Evidences
Adrenalectomy	· APA	++	++	++	Enough
MRA	· IHA (· inoperable APA)	+	±	+	Enough
Radiofrequency ablation	· APA *Approved only in certain countries	+?	+	?	Not enough
SAAE	· APA · IHA *Not yet approved	+?	+	?	Not enough

APA aldosterone-producing adenoma, IHA idiopathic hyperaldosteronism, CVD cardiovascular disease, MRA mineralocorticoid receptor antagonist, SAAE superselective adrenal arterial embolization

treatments. Furthermore, a number of clinical studies have shown that adrenalectomy reduces the risk of developing PA complications [10–13]. However, adrenalectomy, even when performed laparoscopically, requires general anesthesia and is relatively invasive. In contrast, MRA treatment, indicated for IHA and non-operable APA, is almost non-invasive, except for side effects such as gynecomastia. However, treatment with MRA is sometimes inadequate in controlling disease activity and preventing complications [3, 10, 12, 13]. Recently, Oguro et al. performed a prospective study on percutaneous radiofrequency ablation in patients with APA and reported that the treatment was minimally invasive, effective and safe [14]. SAAE is a minimally invasive treatment that can be performed under local anesthesia. Several previous studies have revealed that SAAE is an effective and safe procedure for the treatment of APA [6, 15]. Yaqiong et al. showed that SAAE also has antihypertensive and hormone-improving effects in patients with IHA. Consequently, SAAE has garnered considerable attention as a new treatment option for both types of PA. However, certain issues require further clarification, such as the long-term outcomes of blood pressure or hormone levels, the long-term safety, and most importantly, whether SAAE reduces the cardiovascular complications of PA. If positive results are obtained, SAAE may be accepted as an alternative treatment for PA.

### Compliance with ethical standards

**Conflict of interest** The author declares no competing interests.

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