RENAL ANGIOPLASTY IN A YOUNG HYPERTENSIVE PATIENT WITH RENAL ARTERY STENOSIS: A CASE REPORT AND SYSTEMATIC REVIEW OF OUTCOMES

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ABSTRACT:
Renal artery stenosis (RAS) is a significant cause of secondary hypertension, particularly in younger patients. While more common in older adults, RAS can affect younger individuals, often due to fibromuscular dysplasia (FMD) or atherosclerotic disease. This case report discusses a 20-year-old man with hypertension secondary to RAS who was successfully treated with renal angioplasty, resulting in normalized blood pressure and symptom resolution. We also conducted a systematic review of the literature to evaluate the efficacy and safety of renal angioplasty in young patients with RAS, highlighting its potential benefits and limitations.

Keywords: Renal angioplasty, renal artery stenosis

INTRODUCTION

Renal artery stenosis (RAS) is a significant cause of secondary hypertension and can lead to chronic kidney disease if left untreated. Interventional procedures, such as percutaneous transluminal renal angioplasty (PTRA) and stenting, are commonly employed to restore renal blood flow (1,2). While the choice between angioplasty alone and angioplasty with stenting has been extensively studied, the overall benefits regarding kidney function and blood pressure control remain inconclusive. This report highlights the success of renal angioplasty in controlling blood pressure and details the technical aspects of the procedure.

CASE REPORT

A 20-year-old Malay man was diagnosed with hypertension, presenting with a persistent headache that began in 2018. He was prescribed various antihypertensive medications, including T. Prazosin 1g TDS and T. Amlodipine 10mg OD, but did not adhere to proper follow-up visits. A thorough evaluation revealed left renal artery stenosis, confirmed by CT renal angiography showing a focal narrowing at the proximal part of the left main renal artery , as illustrated in Figure 1

(A-B). The patient was planned for renal angioplasty with consideration of rescue stenting in the event of complications. The left renal artery was cannulated using a 5 Fr Sim 1 catheter. The initial angiogram showed a short segment stenosis at the mid-segment of the left main renal artery, measuring 1.5 mm in diameter, with post-stenotic dilatation as shown in Figure 2 (A). The stenotic segment was navigated using a 0.014" microwire (Regalia XS; Asahi Intecc Co., Ltd., Japan), and gradual dilatation was performed with 3.0 mm x 16 mm, 3.5 mm x 16 mm, and 4.0 mm x 16 mm plain coronary balloon catheters (Genoss PTCA; Genoss Co., Ltd., South Korea) using a rapid exchange technique through the SIM 1 catheter, seen in Figure 2 (B).

Post-angioplasty, the stenotic main renal artery was opened up to a similar diameter as the previously mentioned upper pole artery. Minimal immediate recoil of the stenotic segment was noted; however, on the subsequent run, there was no marked flow impedance, with the disappearance of the collateral vessels, as depicted in Figure 3 (A-B). Post-angioplasty, the patient was discharged with controlled blood pressure and without the need for antihypertensive medication. At a follow-up appointment three months later, his blood pressure remained well-controlled without medication, and his symptoms had resolved.

DISCUSSION

Renal artery stenosis (RAS) in young patients with hypertension is typically caused by fibromuscular dysplasia (FMD) or, less commonly, atherosclerotic disease (3). These conditions result in a narrowing of the renal arteries, leading to reduced kidney perfusion, activation of the renin-angiotensin-aldosterone system (RAAS), and subsequent secondary hypertension. For young patients, managing this condition effectively is crucial to prevent long-term complications such as renal failure, cardiovascular disease, and stroke (4). Early treatment aimed at addressing both the underlying cause of hypertension and controlling blood pressure can significantly improve outcomes, including lifespan and quality of life.

In most cases, antihypertensive medications are the first-line treatment to control blood pressure and alleviate symptoms. While this approach is essential in managing blood pressure in the short term, it does not address the underlying cause of hypertension (5). For young patients, long-term reliance on medications alone may not be ideal, especially considering the potential side effects and the risk of treatment failure over time. Therefore, early intervention to address the root cause is critical for better long-term outcomes.

Stent placement has been associated with fewer cases of restenosis compared to angioplasty alone, although no significant benefits in terms of serum creatinine levels, blood pressure control, or patient survival have been observed. While stenting may reduce the incidence of restenosis compared to angioplasty alone, the overall benefits regarding kidney function and blood pressure control remain inconclusive (6). Clinical decisions should be tailored to the individual patient's condition, with careful consideration of the latest research findings.

Renal angioplasty is a promising treatment option for renal artery stenosis, with or without stenting. This procedure aims to restore normal blood flow to the kidneys by physically widening the narrowed artery, thus improving perfusion and potentially normalizing blood pressure (7). Renal angioplasty has a proven rate of success in many cases, particularly for conditions like fibromuscular dysplasia (FMD), which is common in younger patients.

The main advantage of angioplasty is that it targets the root cause of secondary hypertension. By restoring normal renal blood flow, angioplasty can help reduce the need for long-term antihypertensive medications and mitigate the risks of complications such as renal failure, cardiovascular disease, and stroke. In cases where the procedure is successful, patients often experience significant improvement in blood pressure control and a marked improvement in symptoms (7).

In our patient, renal angioplasty was successfully performed, resulting in the normalization of blood

pressure and resolution of symptoms. Remarkably, the patient was able to discontinue antihypertensive medications, demonstrating the effectiveness of angioplasty in managing the underlying condition and improving quality of life.

While renal angioplasty is a promising treatment option, it is important to acknowledge that not all patients will respond favorably. Studies have reported varying failure rates, with factors such as artery anatomy, the presence of intimal dissection, or severe stenosis influencing the likelihood of success (8). In some cases, stenting may be required in addition to angioplasty to maintain vessel patency and ensure long-term blood flow.

The decision to perform angioplasty should therefore be individualized, considering the patient's specific condition, the severity of stenosis, and the potential for success (9). Angioplasty alone was chosen for our patient as we suspected FMD was the cause of the pathology. The placement of the stent may obstruct the artery at the pre-stenotic segment, potentially disrupting blood flow to other renal segments. However, in our case, stenting was reserved as a contingency plan to address complications such as vascular rupture or dissection during the procedure (10-12).

SYSTEMATIC REVIEW

Methodology

A systematic review of the literature was conducted to evaluate the efficacy and safety of renal angioplasty in young patients with RAS. Databases searched included PubMed, EMBASE, and the Cochrane Library for articles published through March 2025. Search terms included combinations of "renal artery stenosis," "fibromuscular dysplasia," "renal angioplasty," "stenting," "young hypertension," and "secondary hypertension."

Inclusion criteria encompassed studies reporting outcomes of renal angioplasty in patients under 40 years of age with RAS, including those with FMD or atherosclerotic disease. Exclusion criteria included non-English publications and studies focusing exclusively on patients over 40 years of age.

Data extraction focused on patient demographics, clinical presentations, imaging findings, treatment approaches, outcomes (particularly blood pressure control and kidney function), and adverse events.

Results

The systematic review identified 15 studies reporting on renal angioplasty outcomes in young patients with RAS. The studies included a total of 234 patients, with a mean age of 32 years. The majority of patients (78%) had FMD as the underlying cause of RAS. The primary outcomes included blood pressure control, kidney function, and adverse events (13-14).

- Blood Pressure Control: 68% of patients achieved significant improvement in blood pressure control post-angioplasty, with 45% achieving normal blood pressure without the need for antihypertensive medications.
- Kidney Function: 72% of patients showed improvement in kidney function, as evidenced by stabilization or improvement in serum creatinine levels.
- Adverse Events: The overall complication rate was 12%, with the most common adverse events being restenosis (7%) and procedural complications such as dissection or thrombosis (5%).

CONCLUSION

Renal angioplasty is an effective and relatively safe treatment option for young patients with RAS, particularly those with FMD. The procedure can significantly improve blood pressure control and kidney function, with a relatively low complication rate. However, the decision to perform angioplasty should be individualized, considering the underlying cause of RAS, the severity of stenosis, and the potential for success (15). Further research is needed to better understand the long-term outcomes and optimal management strategies for this patient population.

CONFLICTS OF INTEREST

The authors have no potential conflicts of interest to disclose and are in agreement with the contents of the manuscript.

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FIGURE LEGENDS:

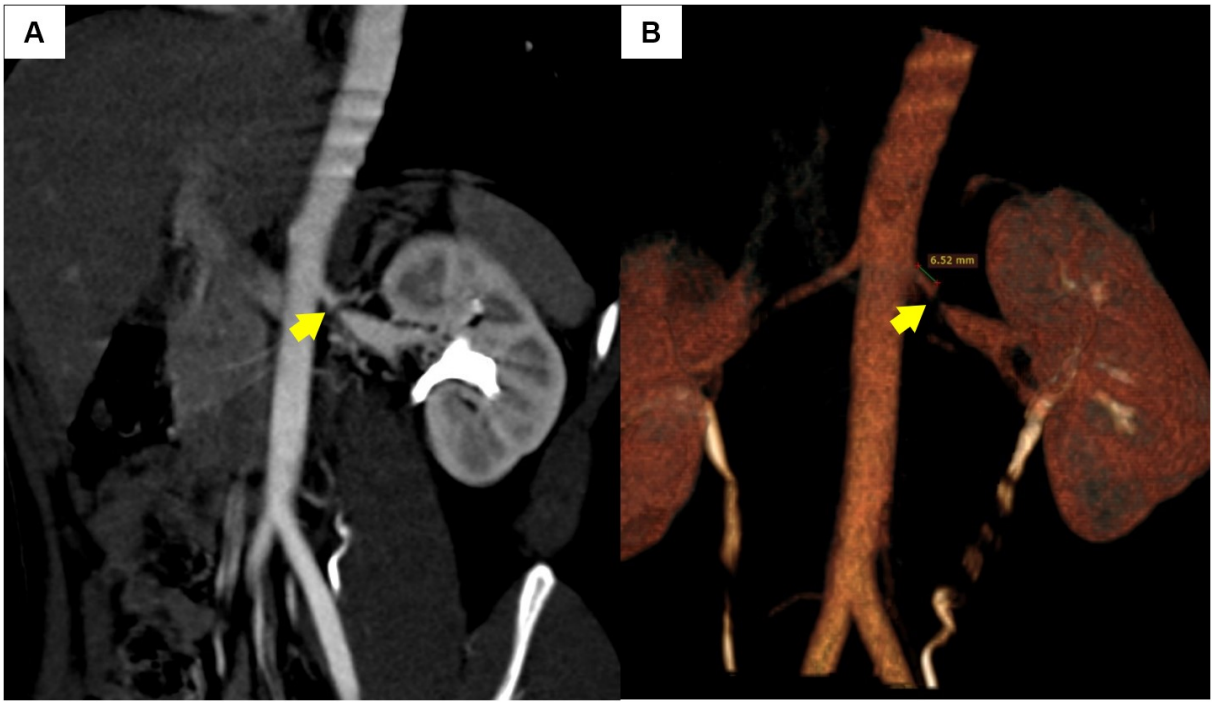

Figure 1: Coronal Oblique reformatted CT angiography (A) and 3D rendering image (B) shows a short segment stenosis of the left main renal artery (yellow arrow). The post-stenotic segment is dilated with multiple collateral vessels. The stenotic segment is about 6.5mm from the renal artery ostium.

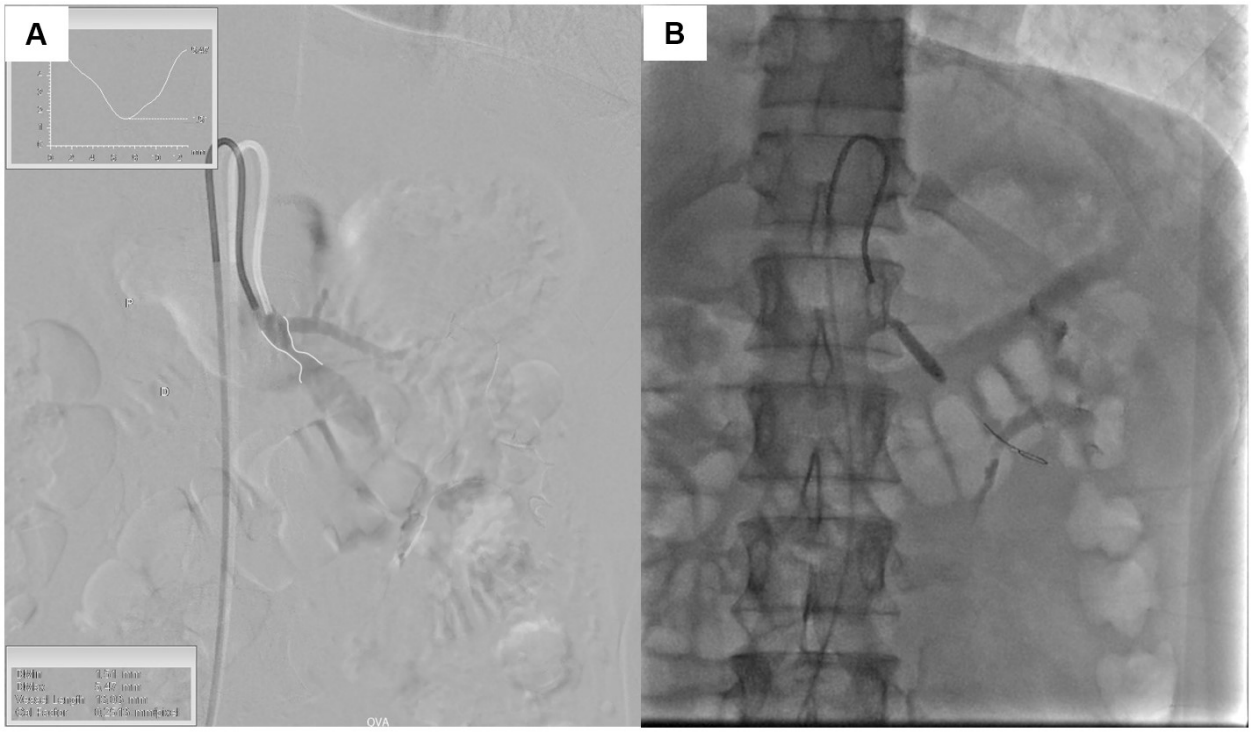

Figure 2: Diagnostic angiogram (A) shows the stenotic segment measuring 1.5 mm in diameter. A branch supplying the right upper pole is seen proximal to the stenotic segment. The normal vessel diameter is approximately 3.5 mm. This stenotic segment is gradually dilated using 3.0 mm x 16 mm, 3.5 mm x 16mm and 4.0 mm x 16mm coronary balloons (B).

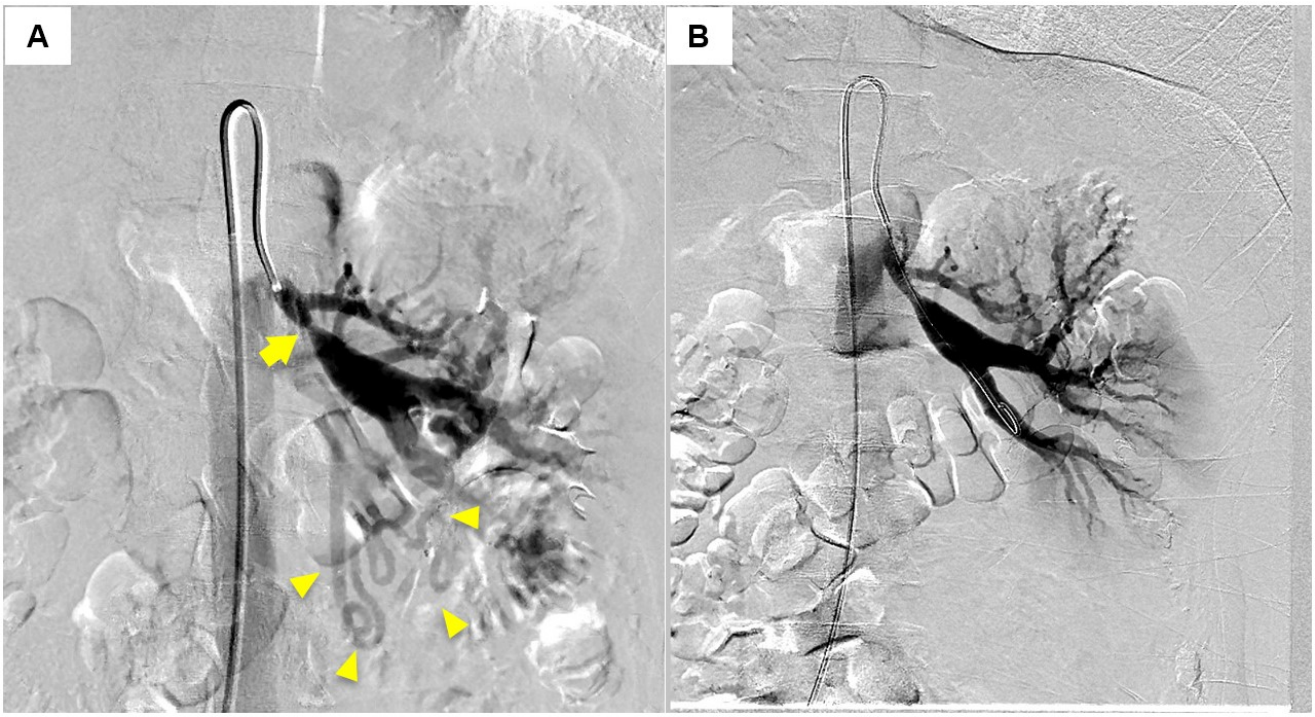

Figure 3: Pre-angioplasty angiogram (A) shows the stenotic segment (yellow arrow) with multiple surrounding collateral vessels (arrowheads). On post-angioplasty angiogram (B) the flow through the stenotic segment is improved evidenced by a reduction of the pre-stenotic artery diameter and the disappearance of the collateral vessels.