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BILATERAL RENAL ARTERY STENOSIS IN A 7-YEAR-OLD CHILD

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Abstract

We present a 7-year-old child with uncontrolled hypertension caused by bilateral renal artery stenosis. He underwent renal angioplasty on both sides. While the right side showed successful dilatation, the left side was unsuccessful, leaving a near total occlusion. Due to the lack of satisfactory control of his blood pressure, he was scheduled for an iliorenal bypass. Following surgery, all antihypertensive medications were withdrawn. Computed tomography angiography performed 18 months after surgery showed patent angioplasty on the right side and patent bypass on the left side. Both endovascular and open surgical treatments are feasible options with good results in this age group.

Introduction

Renovascular hypertension is rare in the pediatric population. Management, whether by endovascular intervention or open surgery, is associated with challenges due to the small-sized arteries and continuous growth of the child. We report a challenging case of bilateral renal artery stenosis (RAS) in the pediatric age group.

Case Report

A 7-year-old child presented with vomiting, headache, nervousness, acute squint and papilledema. Blood pressure was discovered to be 220/170. Opthalmological examination revealed retinal exudates. Renal duplex revealed bilateral RAS. Renal functions were within normal range. Medical treatment with captopril, methyldopa, and nifedipine failed to control his blood pressure. Computed tomography angiography (CTA) revealed right renal artery 40% focal truncal stenotic lesion and left renal artery high-grade stenosis causing near total occlusion (Figure 1). Renal scintigraphy showed relative function of 14% in the left kidney and 86% in the right, with marked reduction in size of the left kidney on dimercaptosuccinic acid scan.

He was scheduled for percutaneous transluminal renal angioplasty (PTRA). On the right side, the lesion was significant as evidenced by slowing of flow and a 30 mm Hg pressure gradient across. It was crossed with 0.014-inch wire (PT2, Boston Scientific, Natick, MA). The lesion was dilated with a 5- x 20-mm balloon (Apex, Boston Scientific, Natick, MA) at 7 atmosphere. Control angiography depicted good dilatation of the lesion with less than 10% residual stenosis.

On the left side, the lesion was crossed with a similar wire. The lesion was dilated using a 3- x 30-mm balloon (Apex, Boston Scientific, Natick, MA) at 8 atmosphere for 30 seconds, but the lesion could not be effaced. Repeat dilatation with a 4- x 20-mm and 5- x 30-mm balloon at 14 atmospheres was also unsuccessful (Figure 2). Control angiography redemonstrated the tight stenotic lesion. The patient's blood pressure improved only partially to 150/100 after left-side angioplasty. Thus, the patient was scheduled for a renal bypass.

Surgical exploration revealed a satisfactory run-off segment distally. An autogenous saphenous vein was used in an iliorenal bypass. The left common iliac artery was chosen as a takeoff vessel instead of the abdominal aorta to avoid aortic clamping and due to ease of dissection and proximity to the hilum. The renal anastomosis was performed in an end-to-side fashion using prolene 6-0, half interrupted and half continuous.

The blood pressure started to decline gradually after 2 weeks, and all antihypertensive medications were withdrawn after 3 months. Follow-up CTA at 14 months after surgery showed patent angioplasty on the right side, patent bypass with good perfusion, and normal sized kidneys (Figure 3). Renal scintigraphy showed equal functions in both kidneys.

Discussion

Systemic hypertension in children is usually secondary to a specific pathology, and RAS is the most common cause in children. Causes of RAS include neurofibromatosis type 1, Takayasu arteritis, middle aortic syndrome, Williams syndrome, Ehlers-Danlos syndrome, congenital aneurysms, Kawasaki syndrome, and polyarteritis nodosa, but fibromuscular dysplasia (FMD) is the most common cause.[1,2]

For a long time, surgical revascularization has been an effective therapy. Studies reported good results even in this age group. The rate of improvement and the rate of cure collectively reach 90%.[1-3]

As in adults, there has been a shift to PTRA in children, too. Few papers described the results of angioplasty of native renal arteries in children. A review of the literature on renal artery angioplasty for pediatric renovascular hypertension shows that the overall success rate of angioplasty is 58%.[4] The rate rises to 65% in cases of solitary stenosis.[5] Studies showed rates of cure and/or improvement ranging between 58% and 96%.[4,5]

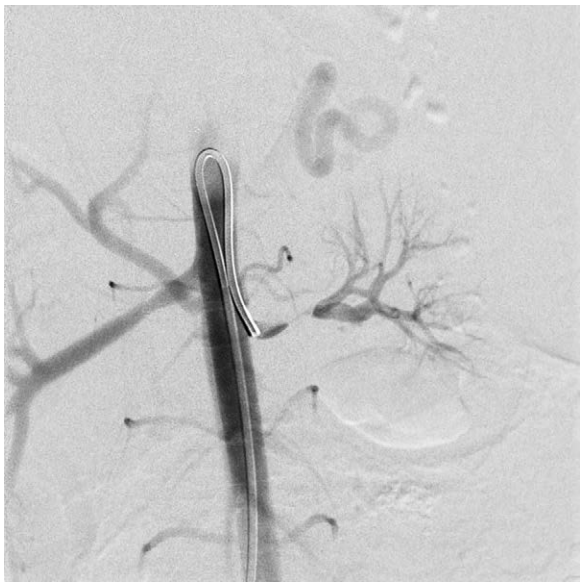

Figure 1. Angiography showing right renal artery 40% stenosis and left renal artery near total occlusion.

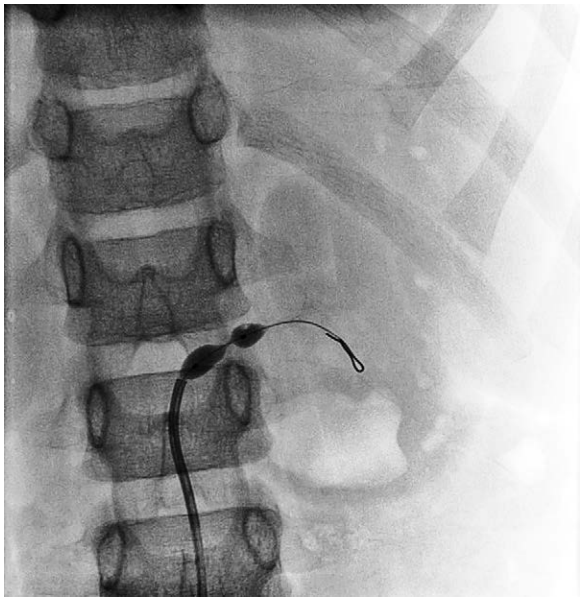

Figure 2. Resistant lesion after repeated dilatations.

These divergent results arise from the fact that different diagnoses were included in the different studies, not only FMD but also inflammatory disease. The studies also differed in the extent of the renal artery disease treated and the presence of intrarenal vascular disease. All these factors meant that more aggressive lesions have been treated.

In the management of RAS, a properly selected balloon may be insufficient to overcome the stenosis, especially in nonarteriosclerotic diseases with tight stenoses. High-pressure and cutting balloons are alternative devices that can help to overcome this problem.[6]

High-pressure balloons improved the results in patients with resistant lesions.[4] However, a significant portion of lesions cannot be dilated despite the use of high-pressure balloons. In such cases the cutting-balloon technique can be used. These may be associated with early restenosis, perforation, and potential loss

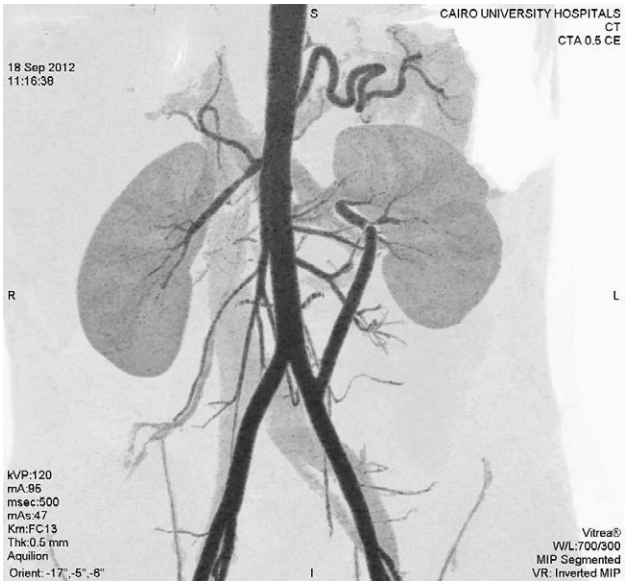

Figure 3. Fourteen months follow-up computed tomography angiography showing patent angioplasty on the right side and patent bypass on the left side.

of the kidney. However, Gumus et al. had no complications and recommended their use in nonarteriosclerotic RAS, especially in FMD, to overcome tight lesions refractory to conventional angioplasty.[6]

In 2009, Giavroglou et al. described a similar case to ours. They had a 5-year-old child with RAS. The stenoses did not respond to PTRA despite repeated inflation to burst pressure. They did not use cutting balloons due to concerns of possible complications. They performed an aortorenal bypass using saphenous graft. Postoperatively, they noticed a distal anastomotic stenosis that was subsequently managed by angioplasty.[4]

In our case, we preferred to use the iliac artery as a takeoff vessel to avoid aortic dissection and clamping in this child with poorly controlled blood pressure.

Iliorenal bypasses were reported in two articles that showed minimal morbidity and mortality; they also showed iliorenal bypass to be an effective means of revascularization in patients not amenable to more conventional open or transluminal procedures. The authors considered it effective for rapid treatment of failures or complications of PTRA. However, neither of the two studies compared it to aortorenal bypasses.[7,8]

Conclusion

Both endovascular and open surgical treatments are feasible and yield good results in this age group. PTRA should be considered as the first-line treatment modality for RAS in children. The use of cutting balloons in nonarteriosclerotic RAS needs to be studied. Iliorenal bypass is an effective treatment. Long-term results of iliorenal bypass need to be compared with anatomic bypasses (aorto-renal) to show if it is associated with less satisfactory results.

Conflict of Interest Disclosure: The authors have completed and submitted the Methodist DeBakey Cardiovascular Journal Conflict of Interest Statement and none were reported.

Funding/Support: The authors have no funding disclosures.

Keywords: renal artery stenosis, renovascular hypertension

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