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Successful percutaneous transluminal angioplasty for treatment of renovascular hypertension in a 15-month-old child

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Abstract In young children with renal artery stenosis the applicability of percutaneous transluminal angioplasty is limited by the small vessel size. We report our experience in a 15-month-old girl with severe hypertension, who underwent successful balloon dilatation of a tight renal artery stenosis caused by fibromuscular dysplasia. The procedure was performed using the guided co-axial balloon catheter technique with a 6 F right coronary Judkins catheter, a 0.014″ guidewire and a 2 mm coronary artery balloon dilatation catheter. Antihypertensive medication was discontinued 6 weeks after the procedure. During a follow up period of 11 months, Doppler sonography revealed no evidence of recurrent renal artery stenosis.

Conclusion Percutaneous transluminal angioplasty of renal artery stenosis can be performed safely in young children using equipment originally designed for treatment of coronary artery stenosis in adults.

Key words Renal artery stenosis · Renovascular hypertension in children · Percutaneous transluminal angioplasty

Introduction

Percutaneous transluminal angioplasty is widely used in the treatment of renal artery stenoses [9]. Follow up studies have shown a very high success rate in the treatment of stenoses caused by fibromuscular dysplasia [1, 3, 5]. In older children the procedure can be performed using balloon catheters originally designed for adults [2], however, due to the small size of the vessels, application of this technique is limited in young children and requires different equipment.

Case report

Our patient was the first child of healthy parents. Arterial hypertension was detected in the asymptomatic girl at the age of 13 months during a routine examination. On admission we found a 15-month-old girl in good general condition (weight 9 kg, length 72 cm). Physical examination was normal and there were no clinical signs of neurofibromatosis. Blood pressure was 180/100 mmHg in all limbs.

Laboratory examination showed normal electrolytes and normal serum levels of creatinine and urea. Abdominal sonography revealed a moderately diminished size of the right kidney and a normal left kidney. On scintigraphy with ^{99m}Tc mercaptoacetyltriglycine the relative function of the right kidney was decreased to 27% with a further reduction following administration of 4 mg captopril to 18%. Pulsed Doppler sonography demonstrated an accelerated blood flow velocity in the right renal artery with a maximum of 5.63 m/s (Fig. 1). Colour Doppler sonography showed a stenosis of the right renal artery about 2 cm distal to the aortic origin. Since the stenosis appeared poorly accessible for a reconstructive surgical procedure we decided to attempt percutaneous transluminal angioplasty.

Antihypertensive medication with propranolol was stopped 24 h prior to the procedure. The procedure was performed under general anaesthesia. Entry was gained percutaneously in the right femoral artery using a 6 F sheath. For anticoagulation the child received 50 IU heparin/kg intravenously. The blood pressure in the aorta was 200/120 mmHg. Following a midstream aortogram the right renal artery was entered selectively using a 6 F right Judkins

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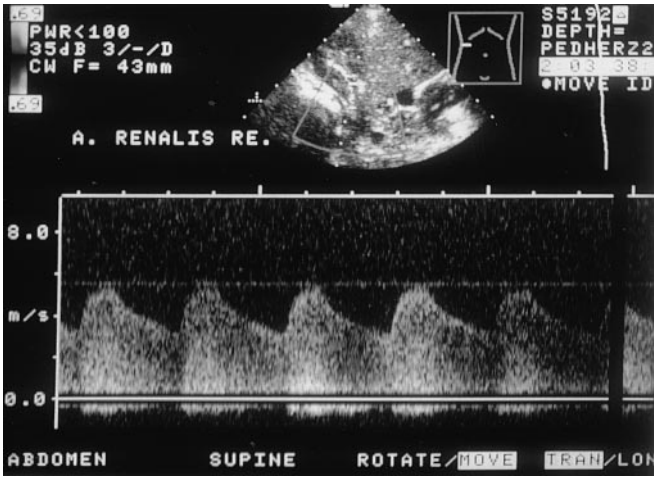
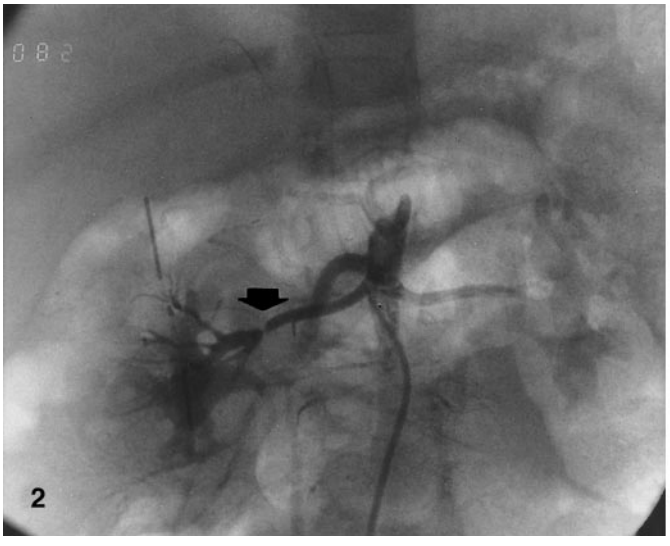


Fig. 1 Continuous wave Doppler sonography of the distal right renal artery reveals an increased flow velocity of 5.56 m/s corresponding with a peak instantaneous pressure gradient of 126 mmHg

catheter (Pink Power, Schneider). Selective injection into the right renal artery demonstrated a tight distal stenosis probably due to fibromuscular dysplasia (Fig. 2). The diameter of the renal artery proximal to the stenosis was 2.3 mm. The stenosis was crossed with a 0.014″ nitinol guidewire (Microvena). To avoid bleeding, the wire was introduced into the catheter over a rotating y-connector with an adjustable valve (Microvena). Using the Judkins catheter as a guiding catheter we advanced a 2 mm coronary balloon dilatation catheter (shaft 2.4 F, balloon length 20 mm, Goldie Monorail, Schneider) over the guidewire into the stenosis. The balloon catheter was inflated once until the waist disappeared. Selective injection into the renal artery following balloon angioplasty demonstrated a normal diameter of the vessel without evidence of intimal tear (Fig. 3). The blood pressure decreased within several minutes to 120/64 mmHg. Following removal of the sheath, heparin was administered continuously at a dosage of 10 IU/kg per hour for 24 h. Normal pulses returned in the right leg after 2 h. On the following day oral nifedipine (1.5 mg/kg) was started. In addition the child received acetylsalicyclic acid (5 mg/kg) and dipyridamole (1.5 mg/kg) for thrombosis prophylaxis. She was discharged from hospital 5 days after the procedure with a blood pressure of 96/58 mmHg. Following normalization of the blood pressure the antihypertensive medication was discontinued 6 weeks later. During the follow up period of 11 months, Doppler sonography revealed no evidence of recurrent renal artery stenosis (last blood pressure 95/60 mmHg).

Discussion

Renovascular disease is involved in 4.4%–11.5% of children with hypertension [5]. Renal artery stenosis can be diagnosed noninvasively as in our patient by Doppler sonography [5, 6]. Fibromuscular dysplasia is the most frequent cause of isolated renal artery stenosis. Several studies have shown that renal artery stenosis caused by fibromuscular dysplasia can be treated with good long-term results by percutaneous transluminal angioplasty [1, 2, 3, 8, 9], however, the applicability of this technique is limited in young children by the small size of their vessels. There are only few children reported in the literature who were treated at an age of less than 4 years [1, 2, 4, 10]. To the best of our knowledge, our patient is the youngest child who underwent successful balloon angioplasty of renal artery stenosis. Since the renal artery of our patient had a diameter of 2.3 mm proximal to the stenosis, we decided to use catheters designed for coronary artery stenosis dilatation in adults. The procedure was performed using the guided co-axial balloon catheter technique [9]: to obtain optimal guidance, the low profile (2.4 F) coronary artery balloon dilatation catheter was advanced through a 6 F right coronary Judkins catheter. The passage of the balloon catheter across the tight stenosis was facilitated by a nitinol guidewire. Subsequent angiography showed a very good result and we were able to discontinue the antihypertensive medication 6 weeks after the procedure. Our case shows that the use of low profile coronary artery balloon dilatation catheters facilitates percutaneous transluminal angio-



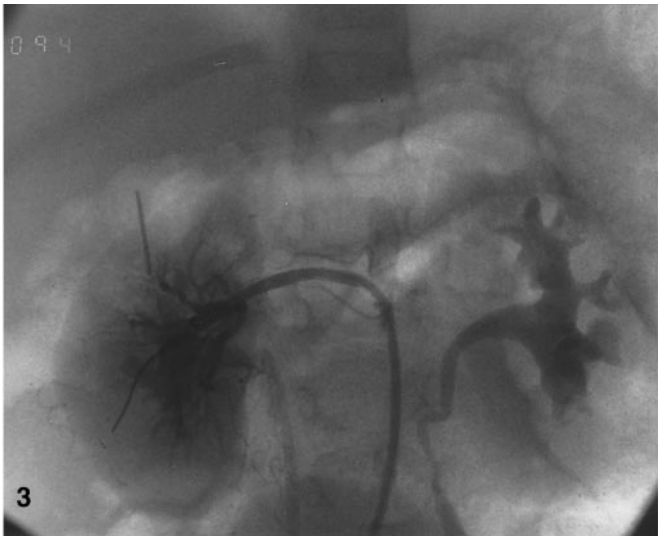


Fig. 2 The arteriogram of the right renal artery shows a short stenosis (*arrow*) of the distal main renal artery
Fig. 3 The arteriogram following balloon angioplasty demonstrates complete relief of the stenosis

plasty of renal artery stenosis in children below the age of 2 years. Although surgical techniques certainly have improved during recent years [7, 10], balloon angioplasty seems to be a promising alternative in the treatment of these children.

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