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SURGICAL TREATMENT OF RENOVASCULAR HYPERTENSION IN CHILDREN*

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Hypertension of renovascular origin in pediatric patients is frequently encountered. Herein, we review our experience, as well as that of others, with this type of patient, and discuss the characteristic features of renovascular hypertension and the favourable response to reconstructive vascular surgery. *Key words: renovascular hypertension, renal artery stenosis, arterial hypertension.*

Hypertension is being increasingly recognized in pediatric patients. Although essential or primary hypertension occurs in children, in 70-80 percent of the cases of hypertension found in this age group, a secondary cause is involved[1]. Renovascular hypertension is the second most frequent secondary cause of arterial hypertension reported in children after thoracic aortic coarctation, which is also surgically correctable[1-3]. Recent improvement in diagnostic modalities and operative techniques have markedly enhanced the recognition and management of this entity. In this report, we present four children with renovascular hypertension treated surgically at our clinic.

Case Reports

Case 1

A six-year-old boy who had been diagnosed as having hypertensive encephalopathy was referred to Hacettepe University Children's Hospital on March 30, 1985. He had had a cerebrovascular accident. It was learned that he had been admitted to another university hospital in February 1985, for evaluation of fever, headache, vomiting and irritability. Physical examination on admission revealed a blood pressure of 230/170 mm Hg, left peripheral facial paralysis and hemiparesis

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on the left extremities. On auscultation, the second heart sound was accentuated and a grade II/6 systolic ejection murmur was heard along the left sternal border. Blood pressure readings ranged from 170/120 to 230/170 mm Hg, despite the administration of antihypertensive therapy. The ECG showed severe left ventricular strain. Serum creatinine and blood urea nitrogen levels were within normal limits.

On the intravenous rapid sequence urogram the left kidney appeared hypoplastic and pyelographic density on the left side was delayed. Digital subtraction angiography showed severe stenosis of the right renal artery, diagnosed as fibromuscular hyperplasia. The captopril test was positive. Selective renal vein catheterization showed increased serum renin levels in the right renal vein. The medical treatment administered during a two-month period proved to be only moderately effective, and the reduction in hypertension achieved could not be maintained.

On May 2, 1985, a polytetrafluroethylene graft (Gore-tex), 6 mm in diameter, was inserted between the infrarenal aorta and the distal right renal artery where an end-to-side anastomosis was made.

The post-operative course was uneventful, and the blood pressure was slightly decreased. The arterial hypertension was easily controlled and the medication was reduced. Control arteriography performed five years after the aorto-renal bypass revealed that the graft and distal vessels were patent (Fig. 1).

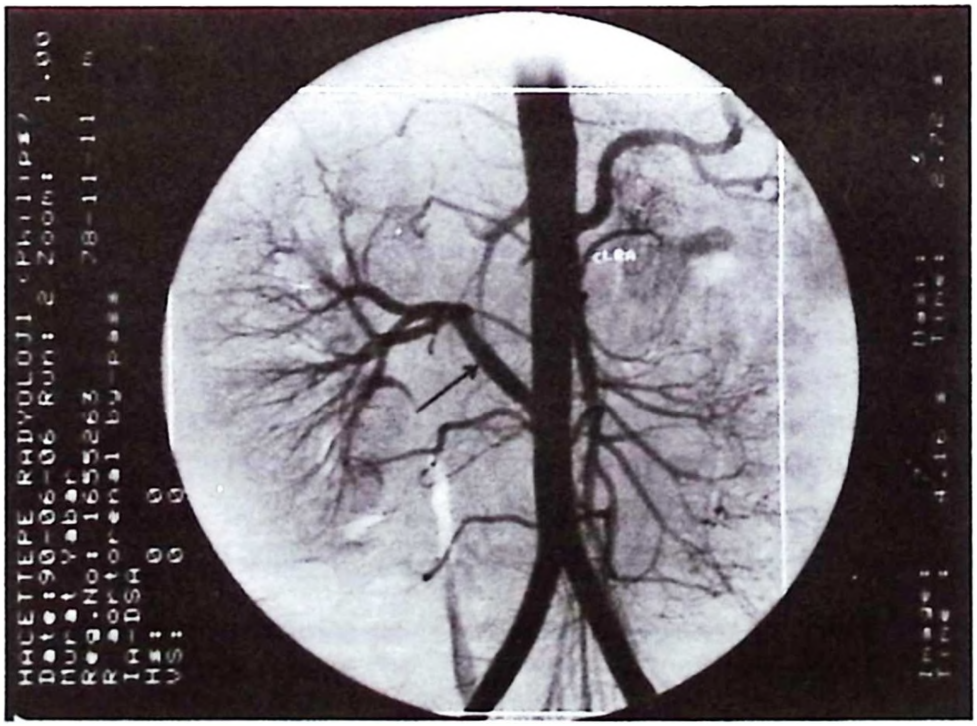

Fig. 1: Postoperative aortogram showing patent Gore-tex interposition graft (arrow) with excellent anatomic results.

Case 2

A nine year-old-boy was first seen at Hacettepe University Children's Hospital on December 16, 1982, with the main complaints of occipital headache, vomiting, and abdominal pain of one year's duration. Physical examination on admission revealed a blood pressure of 160/120 mm Hg. On auscultation there was a grade I/6 systolic ejection murmur, best heard along the left sternal border and apex, and the first heart sound was accentuated. The ECG showed a left ventricular systolic strain pattern. Serum creatinine, blood urea nitrogen, and electrolyte levels were found to be within normal limits. Funduscopy disclosed grades I-II alteration. He was placed on antihypertensive medication. However, the blood pressure readings ranged from 170/120-130/90 during a five-year follow-up.

The intravenous rapid sequence urogram showed the left kidney to be 1.5 cm smaller than the right, and there was a delay in washout of contrast medium. Selective renal arteriography revealed segmental abdominal aortic hypoplasia, severe ostial stenosis of the left renal artery and poststenotic dilatation. Selective renal vein catheterization revealed increased serum renin levels on the left side.

On November 23, 1987, the patient underwent surgery. A polytetrafluroethylene graft (Gore-tex), 5 mm in diameter, was used as an interposition graft between the abdominal aorta (end-to-side) and the main left renal artery distal to the stenosis (end-to-side). The post-operative course was uneventful, and the patient has been normotensive for two years. Aortograms taken two years postoperatively showed a patent interposition graft (Fig. 2).

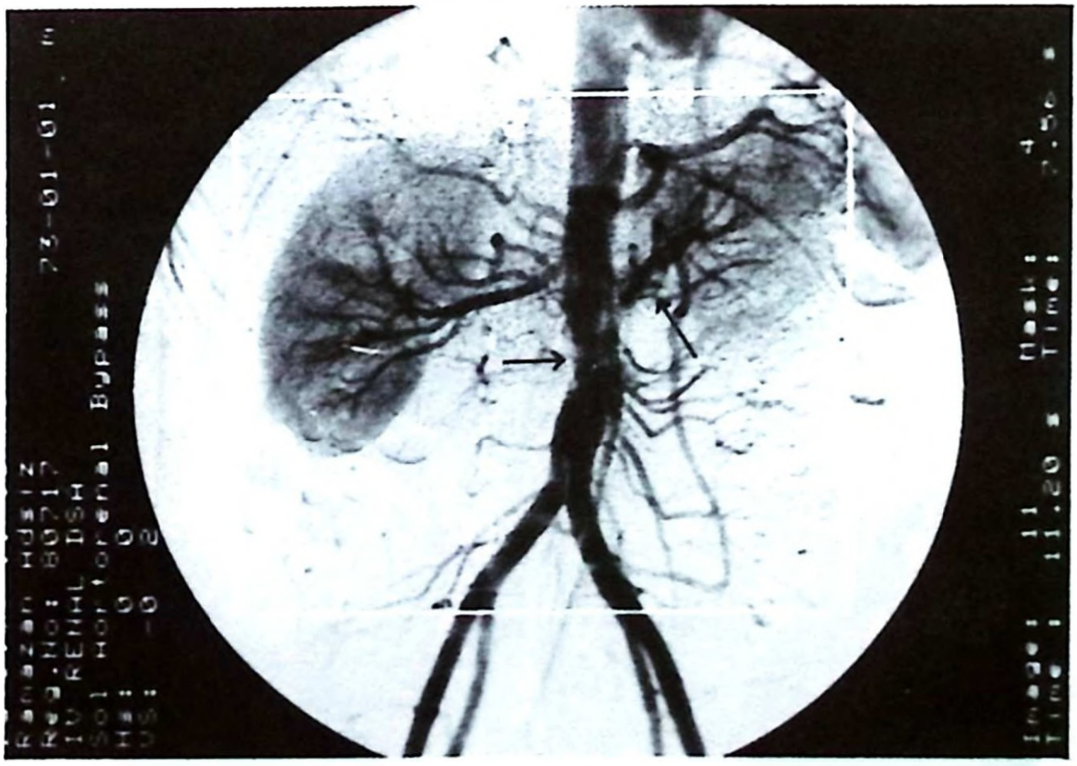

Fig. 2: Postoperative aortogram showing segmenter hypoplasia of the abdominal aorta and patent Gore-tex interposition graft (arrow).

Case 3

A seven-year-old-girl was admitted to Hacettepe University Children's Hospital on January 14, 1990, with a two-day history of vomiting, weakness, headache and convulsions. Physical examination revealed a stiff neck. The Brudzinski, Kernig, and Babinski signs were positive bilaterally. A lumbar puncture was performed and yielded cerebrospinal fluid, diagnostic of meningitis. The patient was then hospitalized. On auscultation, a grade I-II/6 ejection murmur was heard over the precordium. The blood pressure was 170/110 mm Hg, and funduscopy disclosed grade I-II alterations. After the initiation of an antibiotic regimen, the patient's clinical course rapidly returned to normal, but she was still being treated for the arterial hypertension with captopril, a beta-blockade agent and prazosin.

Normal serum creatinine and blood urea nitrogen levels and urinalysis were within normal limits which excluded the possibility of renal parenchymal disease. Intravenous rapid sequence urography showed calyceal clubbing on the right kidney. The right kidney appeared to be one cm smaller than the left, with a delayed and increased pyelographic density on the right side. Renal arteriography showed right-sided, severe, renal artery stenosis with poststenotic dilatation (Fig. 3a).

On February 2, 1990, the patient underwent aorto-renal bypass surgery in which the saphenous vein was grafted. The patient's postoperative course was uneventful, and the blood pressure returned to normal levels within a few days. One month post-operatively, a control arteriography showed a well-functioning right kidney (Fig. 3b).

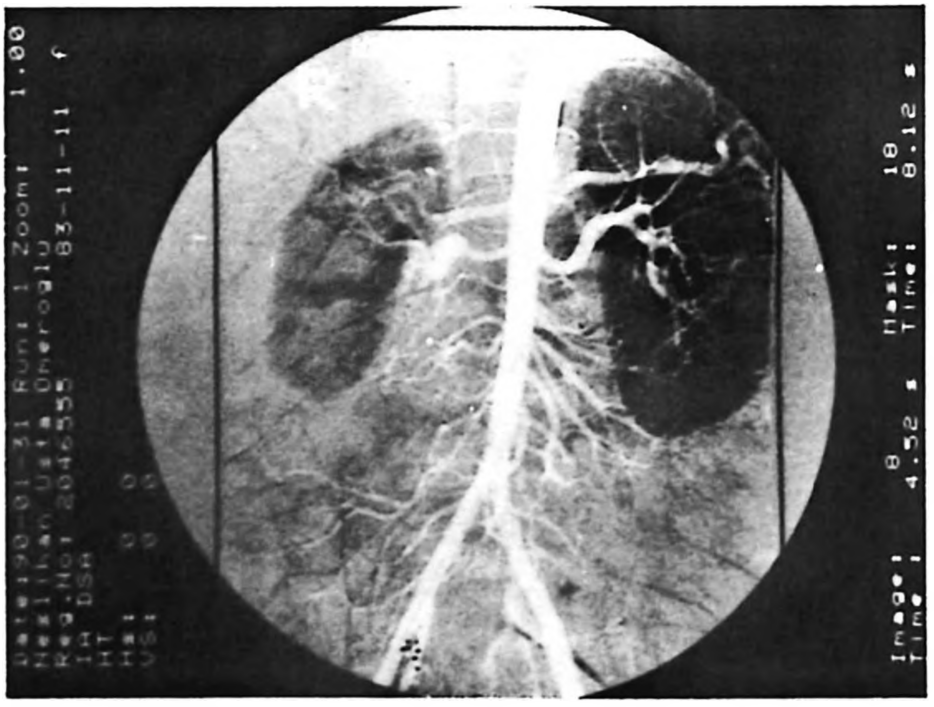

Fig. 3a: Preoperative aortogram shows fibromuscular disease of the right renal artery with poststenotic dilatation.

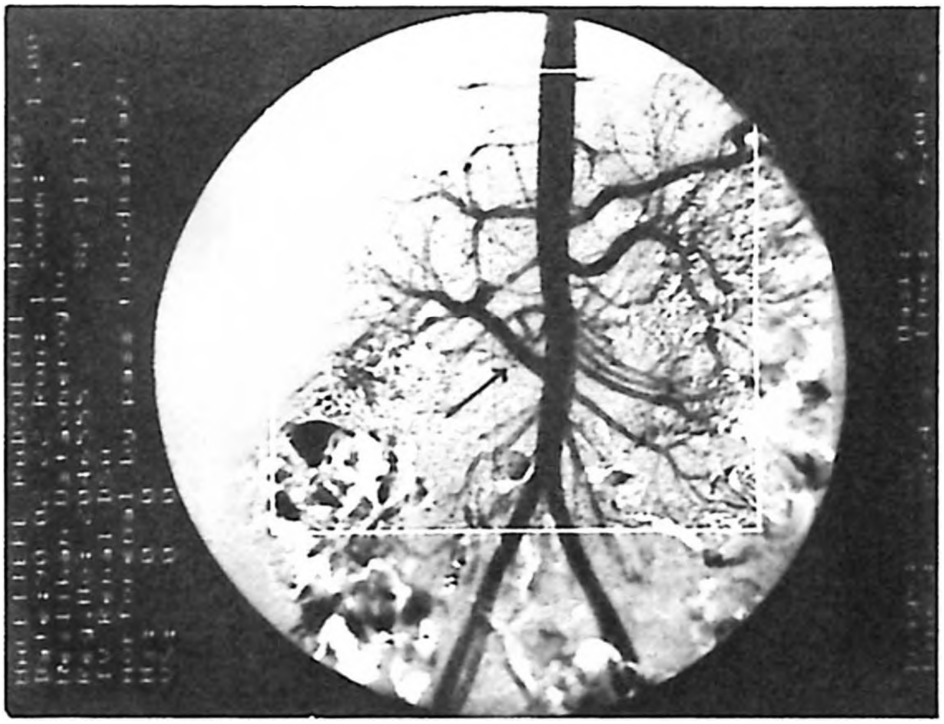

Fig. 3b: Postoperative arteriogram shows patent autogenous saphenous vein graft (arrow).

Case 4

A nine-year-old-boy was admitted to Hacettepe University Children's Hospital in April 1990, with a two-year history of headache and hypertension which could not be controlled by medical treatment. Physical examination revealed a blood pressure of 200/150 mm Hg, with grade I alterations at funduscopy. The ECG showed left ventricular hypertrophy and a strain pattern. Serum creatinine and blood urea nitrogen levels were elevated and the rate of glomerular filtration was found to be decreased.

The intravenous urogram showed the right kidney to be slightly smaller than the left, with a delayed and increased pyelographic density on the affected side. Selective intraarterial digital subtraction angiography showed that the right kidney had two separate renal arteries with severe proximal stenosis (Fig. 4a), and an aortogram revealed localized narrowing of the abdominal aorta.

On May 15, 1990, the patient underwent surgery in which both renal arteries were repaired by two separate aorto-renal bypasses employing saphenous vein grafts. After the operation, the blood pressure decreased slightly. The blood pressure reached normal levels as a result of treatment with lower dosages of prazosin and captopril compared to the doses used preoperatively. Control arteriography showed good revascularization with some dilatation of the vein graft (Fig. 4b).

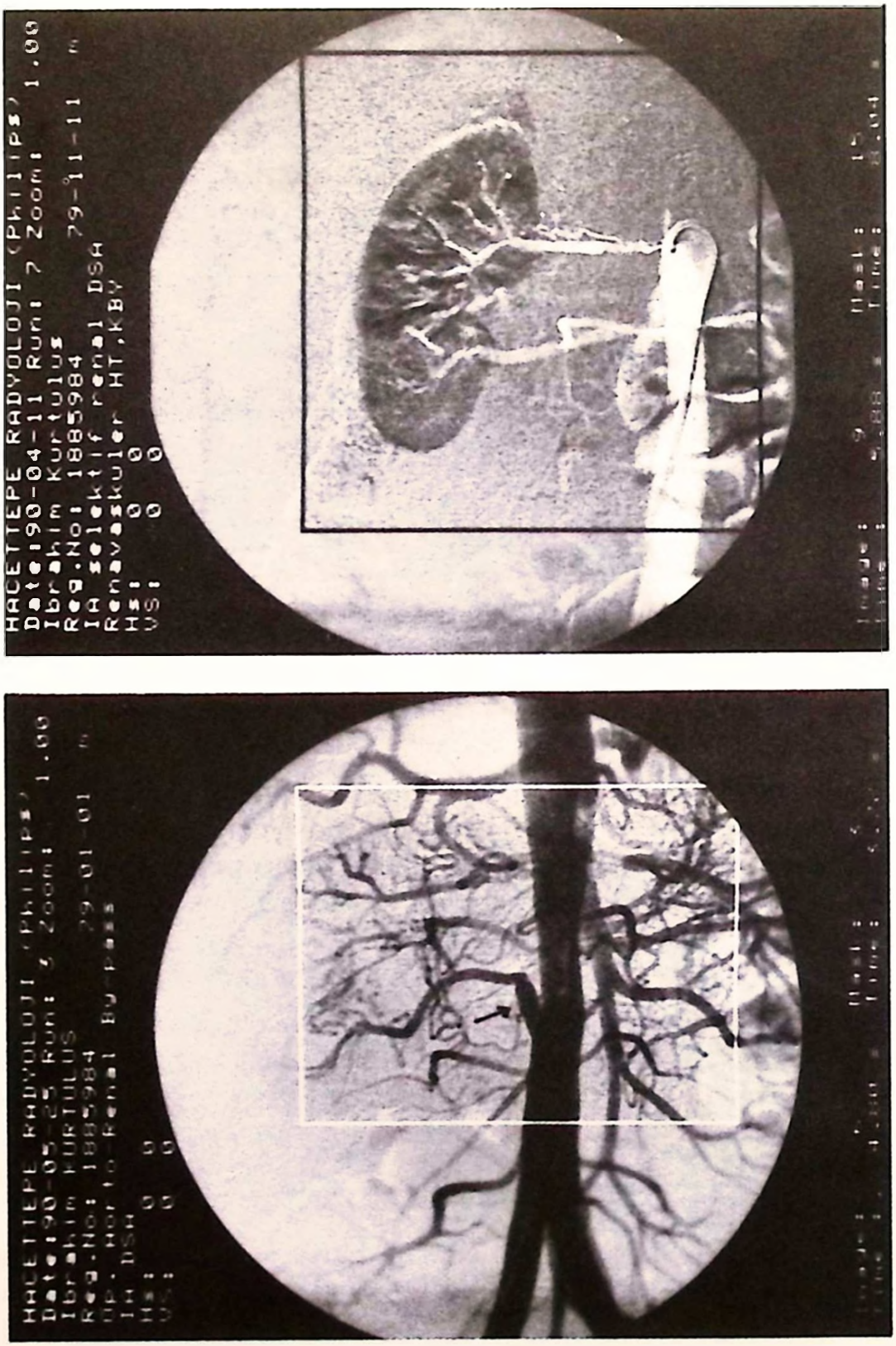

Fig. 4a: Preoperative selective right renal arteriography shows proximal stenosis of both upper and lower artery branches. b.- After aortorenal bypass, aortogram shows saphenous vein graft dilatation (arrow), and segmenter narrowing of the abdominal aorta is also present preoperatively.

Discussion

Approximately 1-2 percent of children have hypertension, and 15-20% of this group will have renovascular pathology[4,5]. Intimal and medial-paramedial fibrodysplasias are the most common histologic forms of renal artery disease in pediatric renovascular hypertension, affecting 95 percent of patients[3].

The clinical presentation of pediatric renovascular hypertension is often deceiving. Although most of the children with this disease are asymptomatic, the most common complaints are hyperexcitability, occipital headache, fatigability, and failure-to-thrive, which are not specific. Less than half of patients have hypertension diagnosed during a routine physical examination. Several patients seek medical attention only after developing convulsions. Hypertensive encephalopathy and irreversible deterioration of cerebral function secondary to uncontrolled hypertension generally carry a poor prognosis[6].

Although intravenous rapid sequence urography has been widely used in the past, it has been documented that urograms have a limited diagnostic value, and that they can be very misleading when employed to diagnose pediatric hypertensive patients. In three separate series, the incidences of renovascular hypertension in children have been reported as 52 percent[7,8], 54 percent[9], and as low as 24 percent[10]. In our limited series, all the patients showed lateralization.

Excessive production of renin in pediatric hypertension often reflects underlying renal vascular disease. This may be evident either in high peripheral or renal venous renin activity[7,11,12]. Elevation of plasma renin activity in the renal vein has been used to identify patients with unilateral renal disease causing hypertension, and to predict surgical curability[13,14]. Renal vein renin ratios which compare the effluent activity of each kidney have been suggestive of functionally important renovascular disease when greater than 1.5. Lateralization has been found in 82-93 percent of cases[7,10,12]. Although there are many useful screening tests, the only accurate method of diagnosis is the arteriogram.

The choice of surgical therapy depends on the morphology of the lesion, the natural history of the disease, and the surgeon's experience. The ideal surgical treatment is revascularization. Continued improvement in macro-and microvascular techniques has lessened the incidence of primary nephrectomy and has increased the success rate of renovascular reconstructive surgery. Although the autogenous saphenous vein is the most preferred graft material, in recent years the hypogastric artery has been accepted to be an excellent prosthesis for children[8,15,16,17].

In conclusion, we are convinced that the results of surgery for treating renovascular hypertension are quite favorable. Long-term use of medication to treat hypertension for the purpose of facilitating surgical therapy by dilating the

arteries might be dangerous, and therefore, may reduce the possiblity of a cure. Therefore, patients with renal occlusive disease should undergo surgery as early as possible.

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