PERCUTANEOUS TRANSLUMINAL ANGIOPLASTY AND WALL STENT PLACEMENT IN THE TREATMENT OF TRANSPLANTED RENAL ARTERY STENOSIS.

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ABSTRACT

PURPOSE: We report our experience with percutaneous transluminal angioplasty (PTA) and endoluminal stent placement in the treatment of transplanted renal artery stenosis (TRAS).

MATERIALS AND METHODS: From February 1998 to February 1999, we performed PTA in 3 patients who were affected by TRAS and besides; 1 Wall stent was successfully implanted in 1 patient affected by transplanted renal artery stenosis. All transplanted kidneys were procured from cadaver donors. The patients were routinely evaluated with color Doppler ultrasonography (CDUS), and when there was the patient in whom the CDUS showed evidence of transplanted renal artery stenosis, the magnetic resonance imaging/angiography (MRI/MRA) and renal angiography would be performed. The mean interval between transplantation and stenosis detection was 9 months (range 4 to 12 months). When serious renal stenosis was diagnosed (stenosis greater than 50%), selected transplanted renal angiography, and endoluminal renal angioplasty had been performed in 3 patients. In 1 patient, an endoluminal metallic Wall stent was placed in the site of stenosis at the anastomotic site.

RESULTS: Clinical outcome was improved in all 3 patients (100 %), the patients became normotensive and there was large amount of urine flow after PTA. The mean residual renal stenosis after PTA was less than 25%. There was no major complication, only in 1 patient there was minor complication, that was a small false aneurysm occurred at the contralateral femoral artery punctured site, which was treated with US probe compression technique.

CONCLUSION: Percutaneous transluminal angioplasty and stent implantation is the initial interventive treatment of choice for high grade transplanted renal artery stenosis, with good clinical outcome, and low complication rate.

Key words: Transplanted renal artery stenosis, kidney transplantation, renal angioplasty, balloon, stent.

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Transplanted renal artery stenosis (TRAS) is known to be a cause of severe hypertension, renal allograft dysfunction, or both. TRAS is a serious vascular complication following kidney transplantation. The incidence of TRAS has been reported to be 1.5% - 16 %, which is due to the heterogeneity of the population evaluated. In the large study of 377 patients the incidence was 6.6%. TRAS may be the consequence of arterial damage during donor nephrectomy or kidney perfusion, kinking of a long renal artery, discrepancies of arterial diameter and thickness between donor and recipient vessels, chronic rejection, and immunological factors. The clinical presentations include: poorly control hypertension, serious compromised function of the allograft, a bruit in the iliac fossa over the graft. Intraarterial angiography is the gold standard for diagnosis and is the first step of an angioplasty procedure. However, the color Doppler ultrasonography (CDUS), magnetic resonance imaging/angiography (MRI/MRA) have proved to be simple, noninvasive methods for depiction of vascular complications in the renal transplantation. Percutaneous transluminal angioplasty is currently the first choice of treatment, when transplanted kidney perfusion is reduced by a stenosis greater than 50% or when hypertension is refractory to multidrugs treatment. Chan et al performed the first treatment of an anastomotic ostial transplanted renal artery stenosis by percutaneous placement of an expandable metallic Palmaz stent. We report a series of 3 patients of percutaneous transluminal angioplasty for treatment of transplanted renal artery stenosis and 1 Wall stent placement for the prevention of recurrence renal artery stenosis.

MATERIAL AND METHODS

From February 1998 to February 1999, 2 female and 1 male patients, average age is 36 years (range 31 to 43) were treated with percutaneous transluminal angioplasty with balloon dilatation. The diagnosis of their transplanted renal artery stenosis was confirmed by color Doppler ultrasonography, magnetic resonace angiography, captopril renogram and renal angiography studies. In 1 patient endoluminal Wall stent was implanted. The mean interval between transplantation and transplanted renal artery stenosis detection was 9 months (range 4 to 12). All of the 3 patients presented with poorly control hypertension, 1 patient with leg edema and oliguria and 1 patient with rising of serum creatinine. All kidneys were procured from cadaver donors. Anastomoses were performed end-to-side to the left external iliac artery in 1 patient, end-to-side to the right external iliac artery in 1 patient, and end-to-end to the left hypogastric artery in 1 patient. During follow up, the patients were evaluated routinely by noninvasive screening methods using color Doppler ultrasonography and magnetic resonance imaging and magnetic resonance angiography (MRA). When a serious transplanted renal artery stenosis (greater than 50 %) was diagnosed, selective angiography and percutaneous transluminal renal angioplasty were performed.

The stenosis was located at the site of anastomosis in 2 patients,at the intra-renal arterial branch that supply to the lower pole of transplanted kidney in 1 patient (patient #3 in the table #1). Angiography was performed via contralateral femoral artery puncture site and via left axillary artery in 1 patient. We used the non-ionic contrast medium, and limited the amount of contrast medium, as lower as possible less than 4 ml/kg, for prevention of its side effect to the transplanted kidney. The diagnostic catheter was cobra-shape tip, and the size of catheter was 5 Frence. The size of uninflated balloon catheter was also 5 Frence. The outer diameter of dilatation balloons were 6 mm. x 2 cm. long in 2 patients (patient #1,2), and 4 mm. x 2 cm. long in 1 patient (no.#3). The transplanted renal artery angioplasty was performed, by

exchange catheter technique across the 0.032 inch conventional guided wire, under fluorosocopy. After the balloon was placed across the stenostic site,the balloon was inflated up to 8-10 atmospheric pressure or until the "waist" of the balloon or stenotic part of the transplanted renal artery disappeared under fluoroscopy for 1 minute x 3 times.

Fig. 1A Pelvic angiography (case # 2 S.NM.) showed 53 % stenosis of the transplanted renal artery at anastomosis of end-to-side to the left iliac artery.

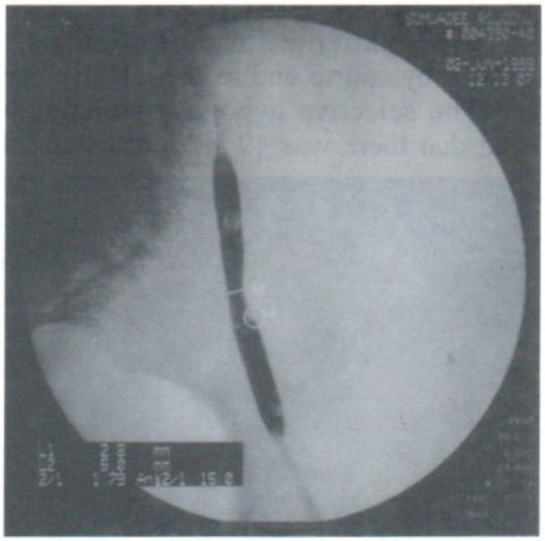

Fig. 1B During angioplasty, there was the narrowed segment or "waist" of the balloon catheter at the stenosis of transplanted renal artery.

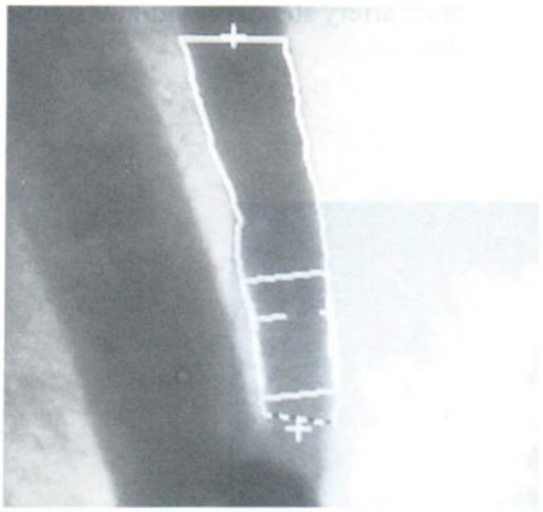

Fig. 1C Magnified angiogram showed stenosis of transplanted renal artery, before angioplasty.

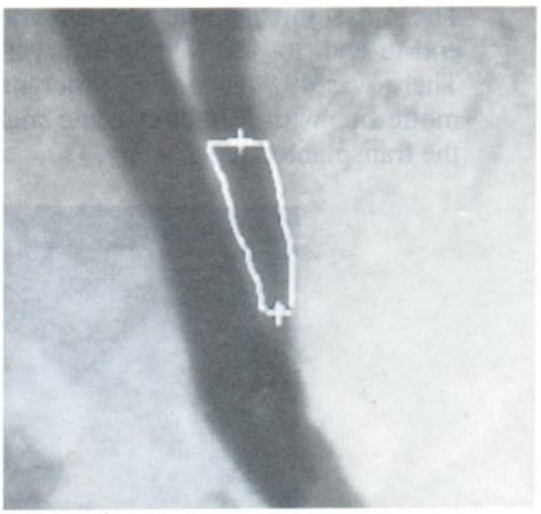

Fig. 1D Magnified angiogram showed no significant stenosis after angioplasty of transplanted renal artery.

During percutaneous transluminal renal angioplasty, 3,000 units of heparin were slowly administered intra-renal artery via the lumen of the balloon catheter. The degree of renal artery stenosis was shown in the table # 1.

In 1 patient, the anastomosis was performed by end to end to the left hypogastric artery. The selective hypogastric angiography showed that there was 49 % stenosis and there was acute angle and kinking of anastomotic vessel. So after renal balloon angioplasty was performed successfully, the Wall stent, size 8 mm. x 6 cm. was implanted at the anastomosis for reduction of kinking of vascular angle and for prevention of re-stenosis of transplanted renal artery. Then after the angioplasty procedure was complete, the angiography was again performed to assess the degree of residual transplanted renal artery stenosis.

Fig. 2A Pelvic angiography of case #1 (S.RW.) showed status post-renal transplantation. The anastomosis was performed by end-to-end to left hypogastric artery. There was 49 % stenosis at the anastomotic site with kingking acute angle of the transplanted renal artery.

Fig. 2B Selective angiography post-angioplasty showed improvement of the transplanted renal artery stenosis without significant stenosis.

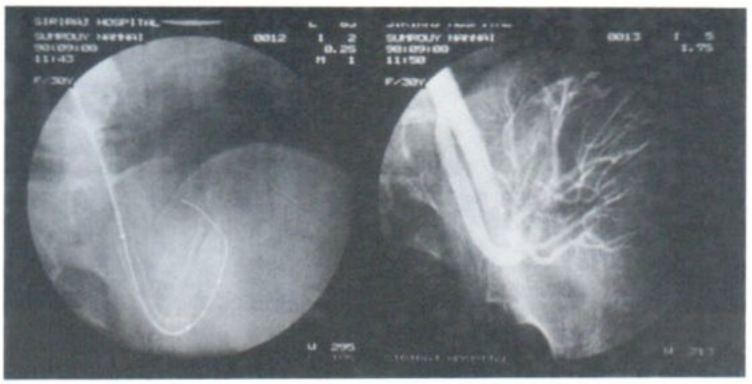

Fig 2C+D Post-Wall stent implantation at the anasto mosis, angiography showed reduction of acute vascular angle without significant stenosis.

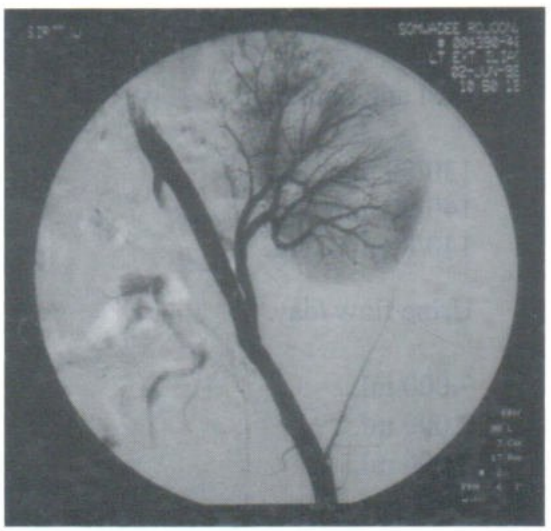

Fig. 3A Pelvic angiography of case # 3 (C.KT.) showed segmental intra-renal artery stenosis.

Fig. 3 B Post-angioplasty angiography showed no significant renal artery stenosis.

Appropriate antiplatelet therapy, Aspirin 325 mg. was administered orally, one day before and every day for at least one month period after the procedure.

RESULTS

The degree of transplanted renal artery stenosis before and after renal angioplasty was shown in the table # 1

Table No. 1. degree of renal artery stenosis

No. #	patient age	sex	Pre angioplasty	Post angioplasty.
1. S. RW.	31	F	49%	37% and 27 %*
2. S. NM.	43	F	53%	38% and 25%**
3. C. KT.	33	M	65%	38%

* degree of stenosis after Wall stent implantation.
** degree of stenosis at follow up study 6 months.

On follow up, blood pressure, serum creatinine level and medications are monitored while grafts are evaluated with color Doppler ultrasonography. The technical result of renal angioplasty are evaluated in terms of the extent of renal artery stenosis reduction. A residual post-angioplasty stenosis less than 30 % represents a satisfactory outcome. Immediate technical success was achieved in all patients.

The clinical findings were good and satifactory in all patients and was shown in table No.2

Table 2 The clinical outcomes after renal angioplasty.

No. # patient	Pre angioplasty Blood Pressure (mm. Hg.)		Post angioplasty.
#1. S.RW.	180/110		130/80 mm. Hg.
#2. S.NM.	180/100		140/90 mm. Hg.
#3. C.KT.	160/100		140/80 mm. Hg.
	serum creatinine (mg %)		Urine flow /day.
	Pre PTA	Post-PTA	
#1. S.RW.	1.7	2.3	7,000 ml.
#2. S.NM.	2.8	1.6	2,000 ml.
#3. C.KT.	3.2	2.5	3,000 ml.

In patient No.#1 S.RW., there was very good clinical response, after renal angioplasty, there was diuresis phase , with large amount of urine flow of 7,000 ml/day and the edema of her legs disappeared. So satisfactory renal function and good pharmacological control of the blood pressure have been achieved in all patients. However, there was minor complication in one patient (S.RW. No#1). There was a small false aneurysm 1.5 cm. diameter occurred at the contralateral femoral artery punctured site, but the false aneurysm can be treated successfully by ultrasonographic probe compression technique.

DISCUSSION

According to the literatures, the incidence of transplanted renal artery stenosis are 5.8% to 17.7 %, and the interval between transplantation and the diagnosis of transplanted renal artery stenosis ranges from 2 to 45 months. In our series the interval was 4 to 12 months. The cause of transplanted renal artery stenosis is likely to be multifactorial and its etiology may have an immunological component. Tiley et al reported poor resolution of hypertension and graft dysfunction following reparative surgery in patients with chronic rejection and transplanted renal artery stenosis.[5] Wong et al detected a significantly higher incidence of rejection in a transplanted renal artery stenosis group versus control group.[20]

Transplanted renal artery stenosis may occur at the anastomotic ostial site or distal to the anastomosis. There is no difference in stenosis incidence between end-to-side anastomosis to the external iliac artery and end-to-end anastomosis to the hypogastric artery. However, percutaneous transluminal angioplasty (PTA) of stenosis in the end-to-end anastomosis to the hypogastric artery is technically more difficult and results in a higher complication rate with higher allograft loss. Percutaneous transluminal angioplasty results vary according to the length of the follow up. An immediate success rate of 81%, decreasing to 75% at 1 month and to 57 % at 1 year has been reported.[13] A graft survival rate of 95% after one year and 82% after two years has been reported in a more recent study.[12]

The percutaneous transluminal angioplasty (PTA) has become the first choice in the transplanted renal artery stenosis treatment because of its technical effectiveness and tolerance by the patient. It does not preclude subsequent surgical correction and offers the possibility of implanting endovascular stent if stenosis reccurs.[14] One limitation of percutaneous transluminal angioplasty that may occur, is restenosis, which may appear 8-12 months after angioplasty,

usually as the result of reactive intimal hyperplasia. Percutaneously introduced vascular stents can improve the long-term results of renal angioplasty. Vascular endoluminal stents were introduced in 1987 for coronary and peripheral circulation.[16] They provide a mechanical scaffolding, prevent elastic recoil and repair arterial dissection if they do occur, while maintaining vessel patency. There are many reports about stent implantation safety and effectiveness. In 1995 Chan et al first reported the successful use of Palmaz stent for the treatment of transplanted renal artery stenosis in women to correct severe stenosis at the ostial site of the end-to-side anastomosis to the right external iliac artery.[7] They reported a 6-month follow up without any restenosis. The stent were clinically tested in native arteries after inadequate angioplasty or effective endarterectomy,[17] or for ostial lesions of native renal arteries.[18] Palmaz stent is consisted of a slotted stainless steel tube crimped onto the percutaneous transluminal coronary angioplasty balloon catheter after complete inflation of the carrier balloon, the metal stent mesh is incorporated into the arterial wall.Intimal cells and endothelium bridge over the support and completely cover the inner surface of the stent.

However, the Palmaz stent can kink in the acute angle (vessel's angle <90 degree) and it is unbendable. So that we used Wall stent that can be bendable in acute angle, in the patient (S. R.W., No.#1) with end-to-end anastomosis to the left hypogastric artery. And after Wall stent implantation the vascular anastomotic angle was straightened and there was minimal less residual stenosis.

One limitation of the using endovascular stent is that the cost of the stent is high, especially in this IMF period. However, as we compare with the cost of surgery, the stent treatment for renal artery stenosis is more cheaper with high success rate and low complication. And if the stent is more widely use, the cost of stent would be lower in the following day.

CONCLUSION

Percutaneous transluminal balloon angioplasty and stent implantation is the initial interventive treatment of choice of high grade transplanted renal artery stenosis. The clinical outcomes are better as for blood pressure, graft survival, serum creatinine. There is low minor complication in only one patient. The patient can tolerate the procedure well.

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