
PERCUTANEOUS TRANSLUMINAL ANGIOPLASTY FOR RENOVASCULAR HYPERTENSION IN ARTERITIS ; EXPERIENCE IN THAILAND

PRABHASAVAT Krisdee M.D., VANAPRUKS Saroj M.D.,
KRUATRACHUE Chutakieat M.D., CHAITEERASUWET Somyot M.D.,
SUCHATO Nasuda M.D.

ABSTRACT

PURPOSE To evaluate the result of the treatment of the percutaneous transluminal angioplasty (PTA*) for renovascular hypertension in arteritis.

MATERIAL and METHODS There were 14 patients, 8 males, 6 females, age 18-53 years, mean 31 years. Five patients had bilateral renal artery stenosis. But PTA was performed in both renal arteries in only 1 case. The transfemoral route was used to treat 14 stenoses, except one patient who had complete aortic occlusion, transaxillary route was used. The PTA was performed, by exchange balloon catheter technique. Follow-up examination included blood pressure, renogram, and medication evaluation.

RESULTS Technical success rate was obtained in 14 lesions (93%) in 13 patients (93%). Only one failure occurred in the very tight proximal stenosis of the renal artery. Clinical success rate was 88 % (improvement of hypertension, or discontinue medication). No complication was occurred except there was temporary spasm/thrombosis of renal artery in one case (7%).

CONCLUSION The renal angioplasty in non-specific arteritis (Takayasu's arteritis) is effective and safe procedure. The results are good, and there is low acceptable complication. There is no long -term follow up examination.

PTA* = Percutaneous Transluminal Angioplasty

INTRODUCTION

In Thailand the non specific aortoarteritis or Takayasu's disease was not uncommon, especially in the young adult females, who were hypertensive. We diagnosed Takayasu's arteritis by clinical signs, and symptoms, such as headache, fever, hypertension, unequal, or absent peripheral pulse, abdominal bruit or abdominal pulsation, increasing erythrocyte sedimentation rate etc..

Then we performed an angioaortography to evaluate the entire aorta and its branches. It resulted in irregularity of the intima of endothelium, stenosis of artery, occlusion of aorta, or origin of its branches, and dilatation of the arterial lumen. Of all these, stenosis and occlusion were the most common ones, that involved abdominal aorta and renal arteries. When there was renal artery steno-

sis, the patients eventually were hypertensive.

PATIENTS AND METHOD

Between January 1985 and January 1987, there were 14 patients, 8 males, 6 females, age range between 18-53 years, mean age was 31 years.

All of them had the clinical diagnosis of renovascular hypertension caused by Takayasu's disease. Their aortography showed evidence of aortitis and/or arteritis especially in main arterial branches. The abdominal aorta were involved by irregularity, stenosis, and dilatation in 11 cases out of 14 cases, or 78.57% (Fig.1).

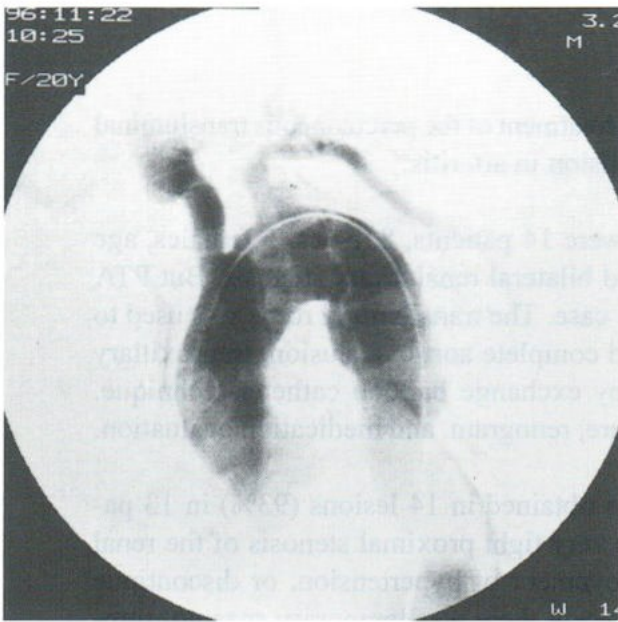


Fig. 1A

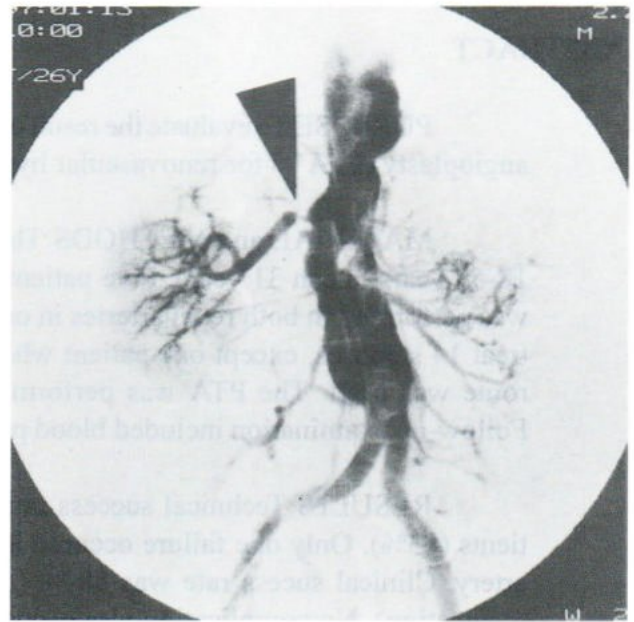


Fig. 1B



Fig. 1C

The patient was female , 20 years old.

Fig. 1A , B and C : Thoracic and abdominal aortography and ultrasonography showed that there were irregularities and aneurysmal dilatation of the entire aorta. There were also segmental narrowing of aorta .

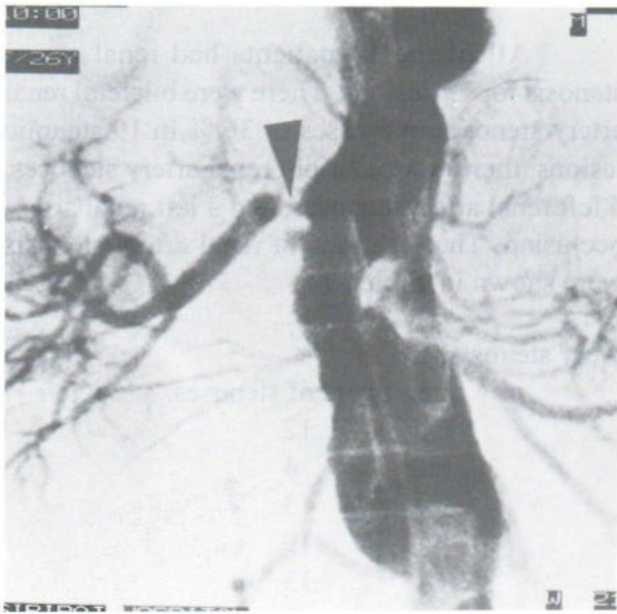


Fig. 1D

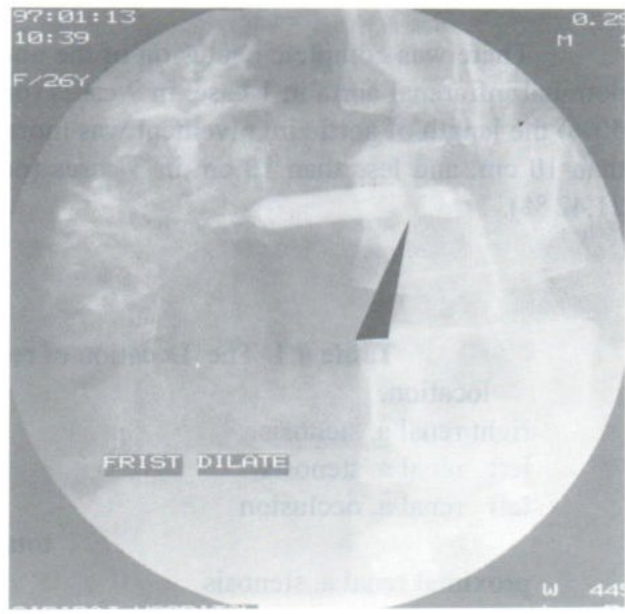


Fig. 1E



Fig. 1F

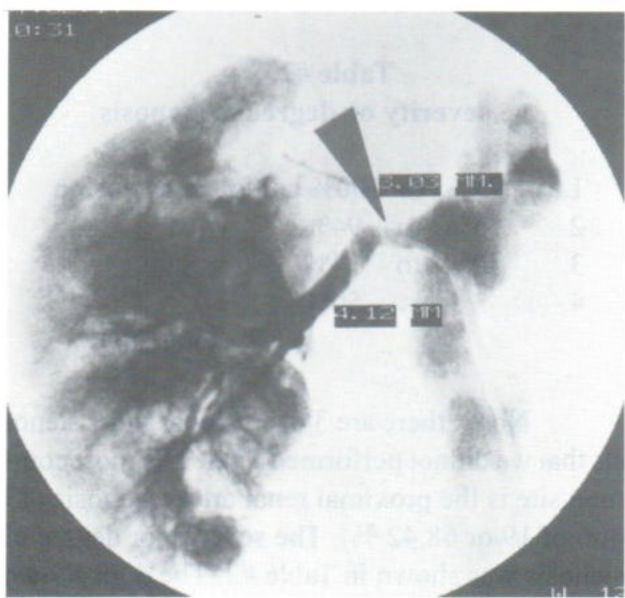


Fig. 1G

Fig.1 D There were 80% right renal artery stenosis, and complete occlusion of the left renal artery. And after PTA, fig.1 E,F showed there was reopening of the right renal artery, with minimal residual stenosis 25% ,fig 1G.

There was complete occlusion of the abdominal infrarenal aorta in 1 case. In 7 cases (or 50%) the length of aortic involvement was more than 10 cm. and less than 10 cm in 3 cases (or 21.42 %).

All of the 14 patients had renal artery stenosis for 19 lesions. There were bilateral renal artery stenoses in 5 cases or 36 %. In 19 stenotic lesions, there were 12 right renal artery stenoses, 4 left renal artery stenoses, and 3 left renal artery occlusion. The locations of renal artery stenosis were shown in Table #1.

Table # 1 The Location of renal artery stenosis.

location.	numbers of stenoses.
right renal a. stenosis	12
left renal a. stenosis	4
left renal a. occlusion	3
total	19
proximal renal a. stenosis	13
proximal and mid renal a. stenosis	3
mid renal a. stenosis	2
total	19

Table #2.

severity or degree of stenosis	No.# of stenoses	
	before PTA	after PTA
1. > 95% to 100% complete occlusion	1	0
2. 75% to 94%	8	1
3. 50% to 74%	2	3
4. < 50%	4	11
total NO#	15	15

Note : there are 3 occlusions, and 1 stenosis that we didnot performed PTA. The most common site is the proximal renal artery stenosis (13 out of 19 or 68.42 %). The severity or degree of stenosis was shown in Table #2. The digit shown in percentage was the stenotic part of arterial lumen from the original normal lumen diameter. There were 12 renal artery stenoses (from total 19) and the degree of stenosis was more than 75%.

renal angioplasty was performed at the side where there was the most stenotic renal artery. In 3 patients who had complete left renal artery occlusion, the angiopasty was performed, at contralateral (right) stenotic renal artery.

Fifteen renal angioplasty were performed in 14 patients. In 5 patients who had bilateral renal artery stenoses, the angioplasty was performed at both renal arteries in 1 case, and in 2 patients

Aspirin (300 mg) was administered orally on a daily basis beginning 2-3 days before, and at least 7 days after the PTA procedure. The transfemoral route was used to treat 14 renal artery stenoses. In 1 patient who had complete abdominal aortic occlusion just below the renal artery, transaxillary route was used, Fig.2.

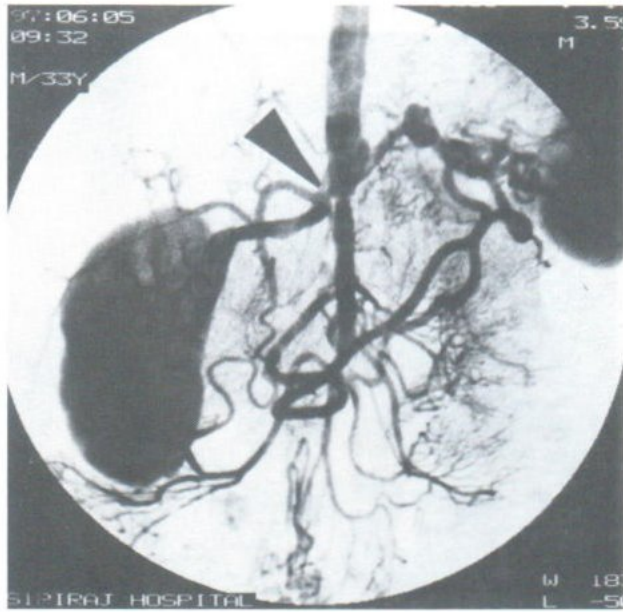


Fig. 2A

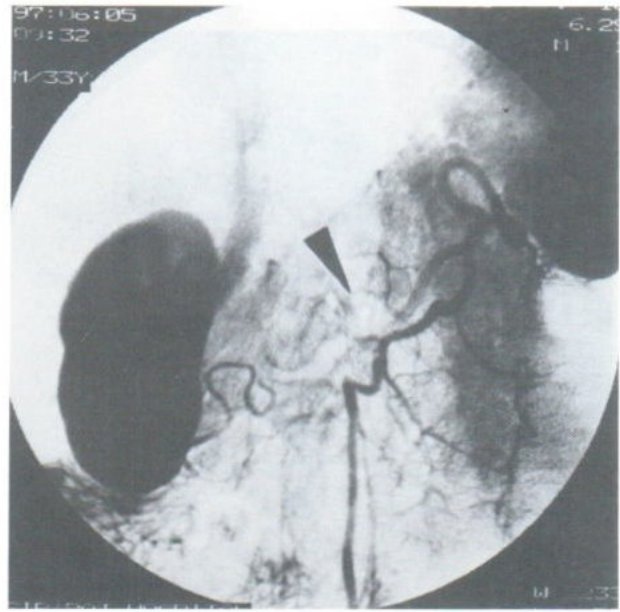


Fig. 2B

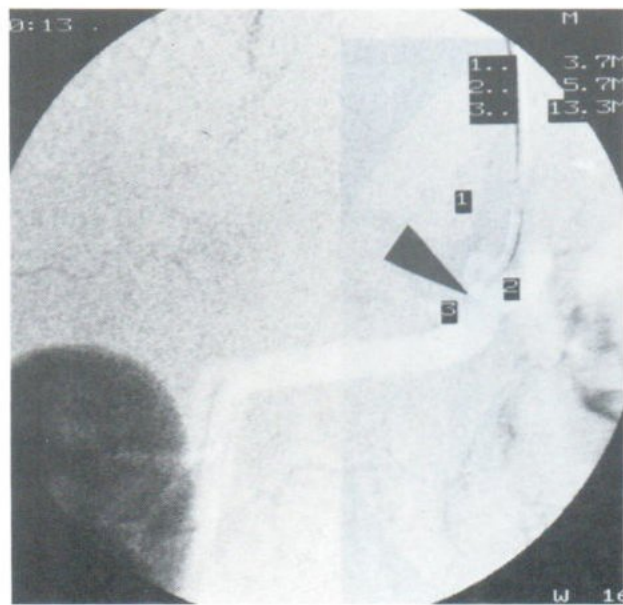


Fig. 2C

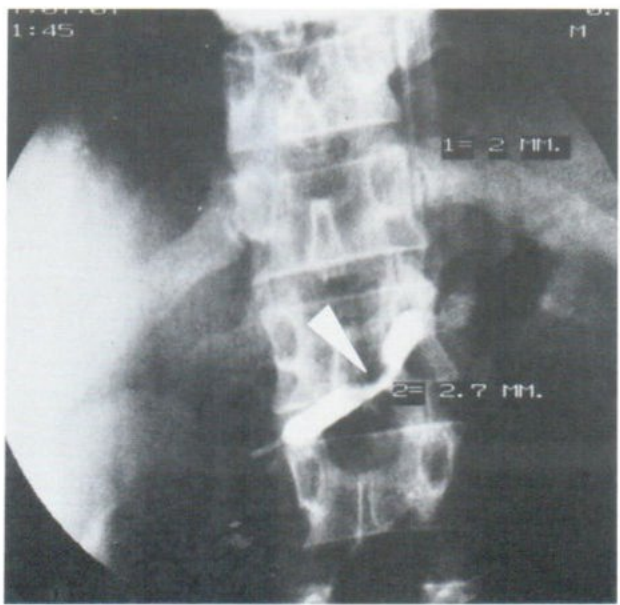


Fig. 2D

The patient was male, 33 years old.

Fig.2 A-B The abdominal aortography (from left axillary puncture) showed complete aortic occlusion at the infra renal level. There was right renal artery stenosis 60% (fig.2 C). During PTA, there was “waist” of the balloon at the stenosis (fig.2D).

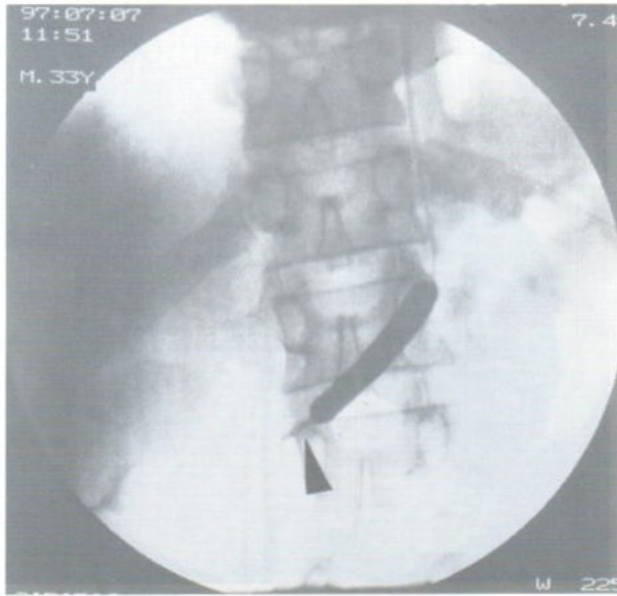


Fig. 2E

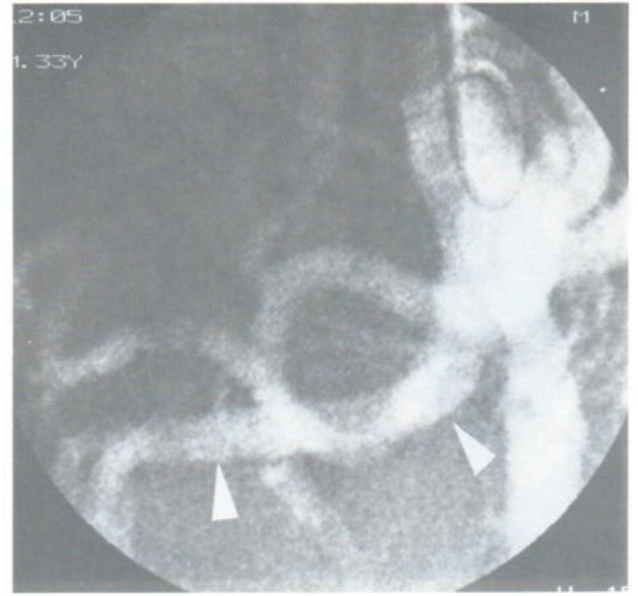


Fig. 2F

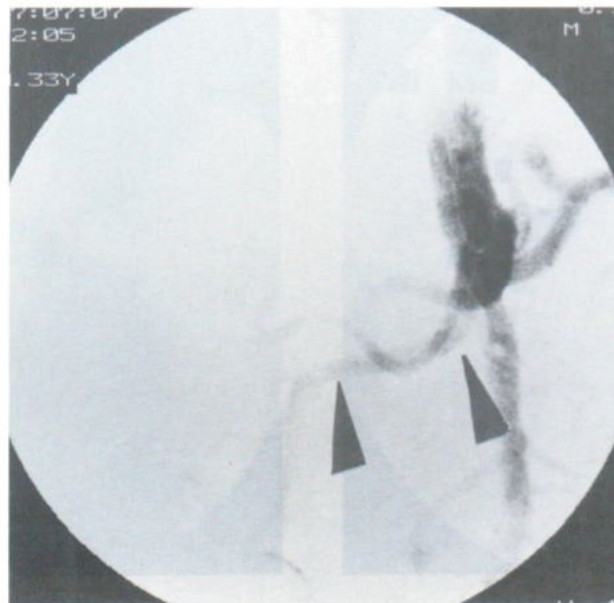


Fig. 2G

Fig. 2E

After applying a high pressure by manual injection of contrast media 3-5 times, the stenosis disappeared substantially (fig 2 E). The right renal artery was normal in size without residual stenosis (fig.2F-G). The blood pressure of the patient before PTA was 180/110 and BP after PTA was 140/90 mm.Hg.

All of the 14 patients had aortography and captopril renogram studies on the day before the PTA was performed.

The balloon catheters were 5 french size, and the diameter of the balloons were 4 or 6 mm. depending on the actual size or corrected size of the patient's renal artery. The selective renal angiography was performed, by cobra-head catheter. Then the J-shape guide wire was placed in the stenotic renal artery and the PTA was performed by appropriate size balloon catheter by using standard exchange technique. When the balloon was in the appropriate position. The balloon was inflated by manual injection of contrast medium with 5 ml syringe, 3-5 times, for 60 sec. each until the balloon "waist" disappeared substantially. The pressure in the balloon by this manual injection was raised to 12-15 atmospheric pressure. During 60 sec. of inflation of the balloon, we infused normal saline with 3,000 units of heparin into the renal artery through the lumen in the balloon catheter, for prevention of renal artery thrombosis. We did not use over-sized balloon catheters to avoid arterial rupture. In some cases, pethidine was injected intramuscularly to the patient who had "back pain" during PTA procedure. Immediately after the procedure, the angiography was obtained to access the adequacy of angioplasty. ECG and systemic blood pressure were monitored continuously throughout the procedure.

Angioplasty was considered as followings
 1. technically successful, if there is residual steno-

- sis of renal artery lumen less than 30%, after PTA.
- 2. technically good improvement, if there is residual renal artery stenosis between 30-60%
- 3. technically mild improvement, if there is residual renal stenosis more than 60% or the postangioplasty renal arterial lumen is larger less than 15% from previous stenotic lumen.
- 4. technically a failure, if there is no significant change in stenosis.

The clinical results of angioplasty was judged as the followings.

- 1. cure, when the patient had normal blood pressure in 1 month after PTA.
- 2. improved, when there is at least 15% reduction in diastolic blood pressure or diastolic blood pressure is between 90-110 mm.Hg. and the patient takes less antihypertensive medications.
- 3. failed, when there is no significant change in blood pressure after the procedure.

All patients who had been cured or improved were considered to have benefit from angioplasty. The follow up examination includes blood pressure, renogram, and medication evaluation.

RESULTS

Initial total technical success was achieved in 14 lesions out of total 15 lesions (93%) in 13 patients out of 14 patients (93%) shown in Table # 3.

Table No.3 Technical results.

	% Residual stenosis after PTA	No.# of renal a.
A. Good success	< 30%	6
B. Good improvement	30-60%	5
C. Mild improvement	> 60%	3
D. Fail	No significant change	1

Blood Pressure and,clinical results are shown in table # 4.

Diastolic pressure(mm.of Hg.)	No.# of patients.(total=14)	
	before PTA	after PTA
> 110	5	2
90-110	9	5
80-90	0	7
Mean diastolic pressure	103	83 mm.Hg.
clinical results	patients	
cure	6	
clinical improvement	7	
fail	1	

The total clinical benefit from PTA is 13 cases out of 14 cases or 93 %. The mean blood pressure of these patients before PTA was 167/103 mm.Hg. and after PTA, mean BP was reduced to 130/83 mm.Hg. The number of antihypertensive drugs necessary to relieve hypertension before PTA was 3.1 types of medications (range 2-4), and after PTA the number of drugs was reduced to 1.8 (range 1-4).

There was no mortality but there was one technical failure (7%) because there was very tight stenosis at the origin of renal artery.

There was one complication in one case, who was 44 years old, female patient. There was renal artery spasm. The patient had severe aortitis and bilateral renal artery stenosis of more than 78%.

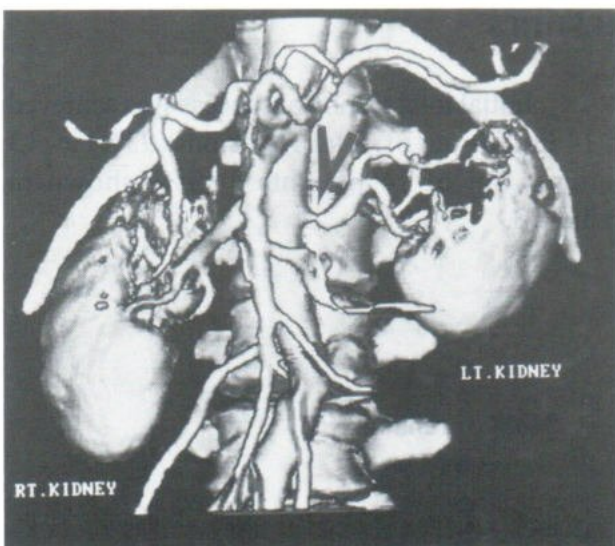


Fig. 3A

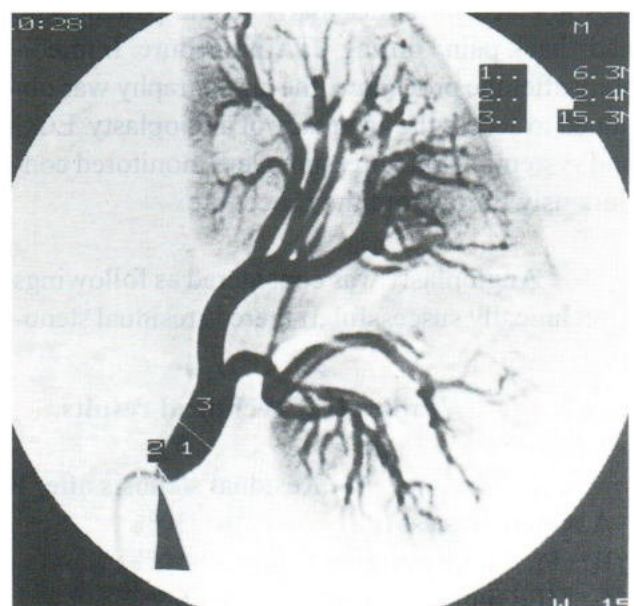


Fig. 3B

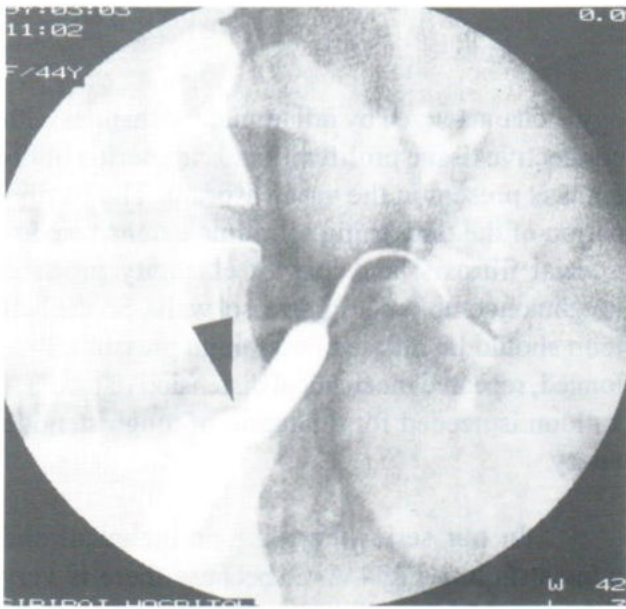


Fig. 3C

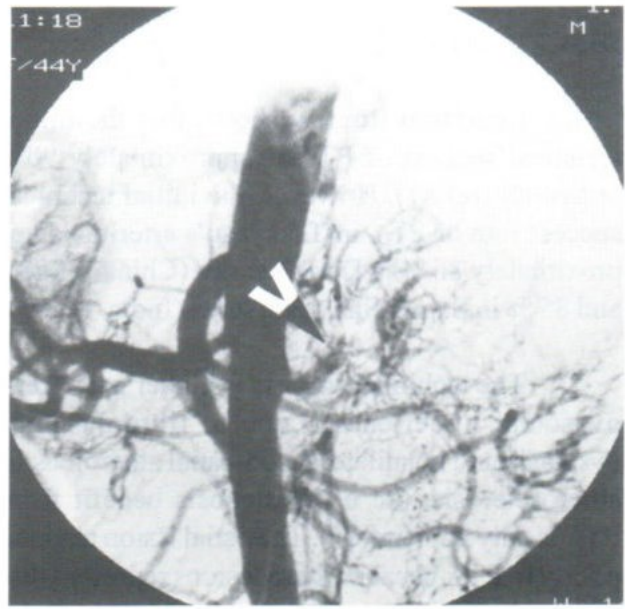


Fig. 3D

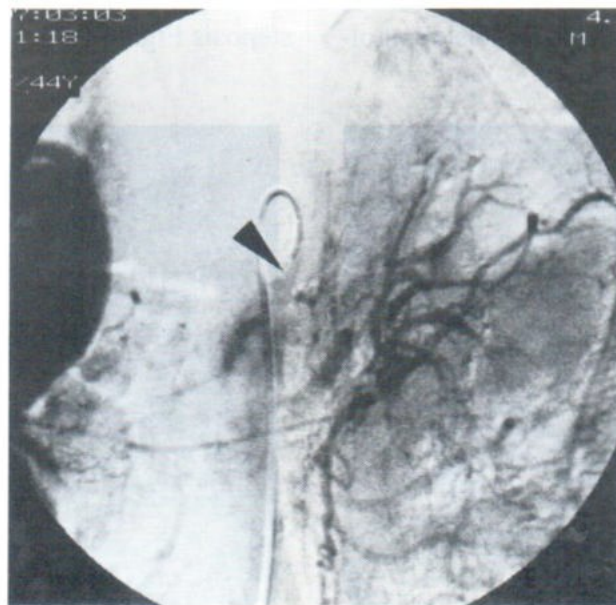


Fig. 3E

Fig. 3 A was a reconstruction of the computed tomoangiogram (CTA) of this patient and Fig.3 B was a selective left renal angiogram showed proximal renal artery stenosis. Immediately after PTA (fig.3 C), there was spasm of the left renal artery. Fig.3 D and E were early and late arterial phase and there was transient left renal ischemia. The conservative medical treatment without surgery obtained a good result.

One month follow up angiography study in 2 cases showed there is no evidence of recurrent renal artery stenosis.

DISCUSSION

Literature Review shows that the initial technical success of PTA is approximately 90% in overall (ref.#1). However, the initial technical success rate of PTA in Takayasu's arteritis is approximately 86 % in Dong's series (China-ref.#8), and 85 % in Sanjiv Sharma's series(India- ref#3).

The technical success is higher in the renovascular hypertension due to fibromuscular dysplasia, and in unilateral non-ostial atheromas. In atherosclerosis, the ostial stenosis benefit from PTA is only 25%(ref.#1). The ostial lesion respond poorly to PTA because these lesions represent disease in the aorta, and not in the renal artery. To be effective, angioplasty must be performed, with the balloon parallel to the direction of the involved vessel. In Takayasu's arteritis, there are panarteritis involving all layers of the vessels. Histopathol-

ogy is characterized by inflammatory changes with connective tissue proliferation. Endarteritis obliterans is present in the vasa vasorum. The combination of the thickening of intima, extensive periarterial fibrosis, and loss of elasticity produce tough, noncompliant, rigid vessel walls. So the balloon should be inflated under high pressure. Prolonged, repeated mechanical distension of the PTA balloon is needed for dilatation of tough stenotic artery.

In our series, there is one technical and clinical failure Fig.4 A-C. because there is very tight stenosis at the origin of renal artery and there is involvement of abdominal aorta. The .032 guide wire can pass through the stenosis but the 5F balloon catheter cannot pass through the very tight stenosis Fig.#4 C.



Fig. 4A

A 33 year -old -man.

Fig.4A The selective left renal angiogram showed the tight proximal stenosis (98%) of left renal artery.



Fig. 4B

Fig. 4B The MRA showed normal right renal artery but there was no signal from the stenotic part of the left renal artery because there was tight stenosis.

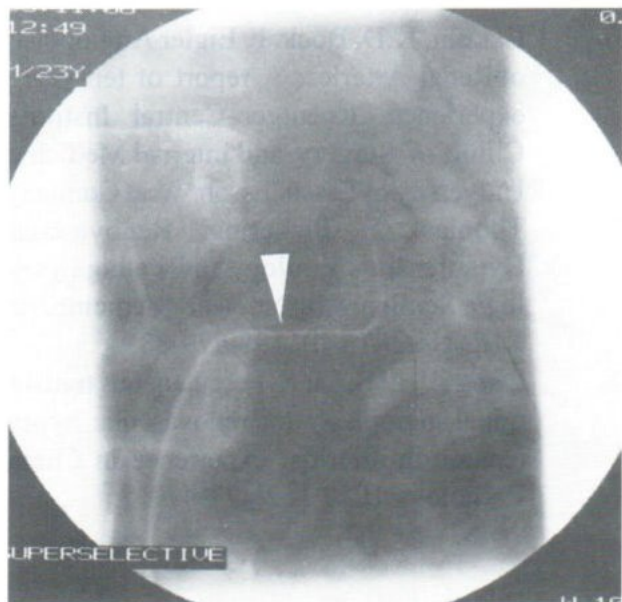


Fig. 4C

Fig. 4C showed the guide wire can be passed through the stenosis but the 5F.catheter cannot be passed through the stenosis.

However, there was another case who had severe proximal right renal artery stenosis more than 95% but we can pass 028 guide wire through the stenosis and we used thin wall 4F catheter for exchange to 035 guidewire. After that 5F balloon catheter can pass through the stenosis and PTA was successful with very good result. The residual stenosis was reduced from 95% to 15% or about of normal size renal artery.

The value of PTA in the management of renovascular hypertension caused by Takayasu's arteritis has been described infrequently in the literature. In China, Dong (ref.#8) reported the experience with PTA in 30 patients, of these 22 patients were Takayasu's disease. The PTA was successful in treating hypertension in 86% and there were 7 complications (excessive bleeding in 3 patients, pseudoaneurysm in 1, occlusion of renal artery in 2 and dissection of renal artery in 1). In India, Sanjiv Sharma (ref.#3) reported that

the PTA in Takayasu's arteritis technically successful in treating 28 lesions (85%) in 17 patients(85%). Clinical cure, or improvement was achieved in 14 (82%) of these 17 patients. There was only one major complication that necessitated emergency surgery due to rupture of renal vein in one patient. They described technical failure related to the unfavorable angiography. The diseased renal artery arose from a stenoses or tortuous segment of aorta, and showed tight proximal stenosis.

CONCLUSION

In our experiences, the renal angioplasty in renovascular hypertensive patient, caused by Takayasu's arteritis, is an effective and safe procedure. The technical, and clinical results are very good (93%). There is low and acceptable minor complication (7%) from renal arterial spasm. The PTA of renal artery stenosis is the best method of treating renovascular hypertension.

REFERENCES

1. Carl Tack, Thomas A. Sos Radiologic Diagnosis of Renovascular Hypertension and Percutaneous Transluminal Renal Angioplasty. *Seminars in Nuclear Medicine*, vol XIX, No.2 (April), 1989:89-100.
2. Jan klinge, Willem P.T.M.Mali, Carl B.A.J.Puijlaert. Percutaneous Transluminal Renal Angioplasty: initial and long-term results. *Radiology* 1989;171:501-506.
3. Sanjiv Sharma, Anita Saxena, Kewal K. Talwar et al Renal Artery Stenosis Caused by Nonspecific arteritis (Takayasu's disease): Results of treatment with Percutaneous Transluminal Angioplasty. *AJR* 158;417-422, February, 1992

4. Guy E. Wilms, Albert L. Baert, Antoon K. Amery. Short-term Morphologic Results of Percutaneous Transluminal Renal Angioplasty as determined with Angiography. *Radiology* 1989;1019-1021.
5. Philippe Cluzel, Alain Raynaud, Bernard Beyssen. Stenoses Of Renal Branch Arteries in Fibromuscular Dysplasia: Results of Percutaneous Transluminal Angioplasty. *Radiology* 1994;193:227-232
6. E. Lohr, K.D. Bock, F. Eigler. Angioplasty of Renal Arteries: A report of ten year's experience. Roentgen-Central Institute. Clinic of Surgery and Internal Medicine. University of Essen, Essen. West Germany.
7. Thomas G. Pickering. Renovascular Hypertension: Etiology and Pathophysiology. *Seminars in Nuclear Medicine*, vol XIX, No.2(April), 1989:79-88.
8. Dong ZJ, Li S, Lu X. Percutaneous transluminal angioplasty for renovascular hypertension in arteritis: experience in China. *Radiology* 1987;162:477-479.