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Percutaneous transluminal angioplasty in the treatment of renovascular hypertension: sequential prospective study

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Objective: to evaluate the use of percutaneous transluminal renal angioplasty (PTRA) in the treatment of renal vascular hypertension. **Design:** sequential prospective PTRA treatment of severe arterial hypertension, screening by the captopril test, confirmed by renal arteriography, and the result evaluated by post-PTRA arteriography, blood pressure measurement and renal function. **Site:** Vascular Surgery, angioradiology sector, and Nephrology outpatients department of the Federal University of São Paulo - Paulista School of Medicine, São Paulo, Brazil, a tertiary health-care institution. **Participants:** PTRA was employed on 32 patients screened by clinical examination, captopril test and renal arteriography. **Evaluation:** PTRA results were evaluated by the criteria of the Cooperative Study of Renovascular Hypertension. **Results:** after PTRA the completion arteriography showed no renal stenosis in 24 patients (75%), residual stenosis (20-50%) in 3 (9.4%) and no change in 5 (15.6%). The blood pressure results were: 3 patients (9.4%) were cured, 24 (75%) improved and 5 (15.6%) were unchanged. We observed normal renal function before and after PTRA in 25 patients (78%); altered pre- and improved post-PTRA in 2 (6.3%); post-PTRA remained unaltered in 2 (6.3%); and altered pre- and worsened post-PTRA in 3 (9.4%). Recurrence of stenosis occurred in one patient after 8 months. **Conclusions:** PTRA is a convenient procedure, relatively safe and an effective complementary method of medical therapy for controlling renovascular hypertension.

UNITERMS: Renovascular hypertension. Transluminal angioplasty. Renal artery stenosis. Atherosclerosis. Fibromuscular dysplasia.

INTRODUCTION

The use of percutaneous transluminal angioplasty for the treatment of renal artery stenosis (PTRA) was first reported by Gruntzig et al ⁽¹⁾ in 1978, and since then the results of PTRA have been reported by several centers ⁽²⁻¹⁰⁾.

Acquired experience has reduced the complications rate and primary success has reached nearly 90%⁽²⁻¹³⁾ with good results above 70% in longer follow-ups ⁽¹⁴⁻²⁰⁾. The treatment decision is taken by a multidisciplinary team, PTRA being the first choice except in cases of anticipated technical difficulties, treating one renal lesion at time in cases of bilateral lesion. PTRA has a low incidence of technical failure and renal loss, being the preferred route for inguinal catheterism. Balloon-catheter insufflation at the stenosis site breaks the intimal layer, the atherosclerotic plaque and the medial layer, dilating the renal artery ^(21,22). Complications have been reduced and primary successes increased with greater experience and technological advance, using digital subtraction angiography, reduced quantities of injected contrast, adequate hydration and

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better materials⁽²³⁾. Good results have been observed in children⁽¹⁹⁾, transplanted kidneys⁽²⁴⁾, segmental renal branches⁽²⁵⁾, ostial lesions^(26,27) and even in short segmental obstructions⁽²⁸⁾. PTRA is considered a long-term effective treatment for preventing renal function impairment and controlling blood pressure^(19,24,25).

The good results observed in the medical literature have led us to use this procedure and the aim of this article is to summarize our experience with PTRA in the treatment of renovascular hypertension.

PATIENTS AND METHODS

Out of a total of 2,554 angiograms performed during a five year period, 137 patients (5.6%) with arterial hypertension underwent screening renal arteriography. Percutaneous transluminal renal angioplasty (PTRA) was performed on 32 patients with renovascular hypertension

Table 1

Patient distribution according to age group

Age (years)	Patients
01 - 10	1
11 - 20	0
21 - 30	8
31 - 40	7
41 - 50	8
51 - 60	6
61 - 70	2
Total	32

Table 2

Etiology of renal artery stenosis

Etiology	Patients
Fibromuscular Dysplasia	16
Atherosclerosis	12
Takayasu Disease	2
Renal Transplant	2
Total	32

diagnosed by the clinical examination, renal function tests, captopril test and renal angiography.

The mean age was 36 years (range 1 to 70) (table 1), and the cause of renal arterial stenosis is summarized in table 2.

The technique used for renal angioplasty did not differ from the classic techniques reported in the literature⁽²⁹⁻³²⁾. Acetylsalicylic acid 500 mg/day was prescribed for six months after the procedure.

The results were evaluated in accordance with the criteria of the Cooperative Study of Renovascular Hypertension⁽³³⁾:

- 1 - The technical results before and after PTRA were quantified as: without stenosis, having residual stenosis (20-50%), and unchanged.
- 2 - The blood pressure results were classified as cured (without antihypertensive drugs), improved (controlled with decreased doses of antihypertensive drugs), and unchanged.
- 3 - the renal function results before and after PTRA were classified by the creatinine dosage needed.
- 4 - the complications of the procedure and recurrence of the hypertension.

RESULTS

- 1 - The technical results of PTRA were shown by the completion arteriography: renal artery without stenosis in 24 patients (75%), residual stenosis in 3 (9.4%), and unchanged in 5 (15.6%).
- 2 - The blood pressure results ranged from one month to five years (mean period of 16 months), showing: three patients (9.4%) had diastolic blood pressure under 90 mmHg without medication; in 24 (75%) diastolic pressure under 109 mmHg was achieved with decreased doses of antihypertensive drugs taken; and in 5 (15.6%) the pressure was unchanged.
- 3 - Renal function results: we observed normal renal function before and after PTRA in 25 patients (78%); impaired before and improved after PTRA in 2 (6.3%); remaining impaired in post-PTRA in 2 (6.3%); and impaired before and worsened after PTRA in 3 (9.4%).
- 4 - Complications occurred in 10 patients and are listed in table 3. In 5 (15.6%), PTRA failed to achieve dilation of the stenotic lesion: two underwent surgical renal revascularization and one was submitted to a new PTRA successfully. The others were treated medically.

Table 3
Complications in 10 out of 32 patients treated with percutaneous transluminal angioplasty

Complications	Patients
Nausea	2
Local Hematoma	2
Renal Artery Dissection	2
Renal Art. Perforation + Nausea	2
Renal Art. Perforation	1
Hematoma + Arterial Hypertension	1
Total	10

Recurrence of stenosis occurred in one patient after 8 months, which was treated with another successful PTRAs after the termination of this work.

DISCUSSION

Renal function impairment and the progression of renovascular disease has been associated with the clinical treatment of renovascular hypertension. PTRAs and surgical treatment result in better control of arterial hypertension with lesser occurrence of cardiovascular events and mortality, preserving renal function^(18,33,34).

The use of PTRAs in the treatment of renovascular hypertension has lower operative risk and the results are comparable to surgical treatment^(8,18).

To evaluate the results of PTRAs the criteria of the Cooperative Study of Renovascular Hypertension were

used⁽³³⁾. The technical results of PTRAs depend upon the stenosis characteristics⁽²⁹⁾, chiefly the etiology, our best results being the treatment of fibromuscular hyperplasia which was similar to other authors^(14,15,19,25,31,35-38). These good results, ranging from 89 to 100%, may be attributed to younger age groups and lesser effects of hypertension on contralateral kidney and systemic vessels⁽²¹⁾. Recently, with a minor procedural risk, a cure rate of less than 30% has been obtained in the atherosclerotic group, which should be compared with rates greater than 50% in the fibromuscular dysplasia group⁽¹⁸⁾. No significant difference has been found between ostial and non-ostial PTRAs treatment results of renal lesions^(20,26,27). These findings are different from some works relating ostial dilating difficulties compared with non-ostial lesions^(15,29,39), because ostial plaque is generally an extension of aortic plaque.

The PTRAs cure rate is low, ranging from 6%⁽⁴⁰⁾ to 25%^(4,15), and the best results have been obtained in fibromuscular dysplasia⁽²⁵⁾. In our experience the cure rate was 9.4%. The hypertension control with decreased doses of medication was a real benefit, as obtained in 75% of our patients treated with PTRAs and in accordance with other authors⁽²¹⁾ (table 4).

The PTRAs complication rate ranged from 7.2%⁽³⁴⁾ to 46.2%⁽¹⁶⁾, with local complications being the most frequent. We observed PTRAs complications in 10 patients (table 3). However, the lack of comparability between patients in different series and the problem of definition of a "complication" leaves the discussion of this issue outside of the scope of this paper.

In 5 cases (15.6%) it was not possible to dilate the renal stenosis, which is comparable to other authors' reports relating technically unsuccessful dilation ranging from zero to 15%^(11-13,18-21,23-27). In these cases surgical treatment or a new PTRAs should be performed. In one of our patients, changing the femoral catheterization method

Table 4
Percutaneous transluminal angioplasty results in patients with atheromatous or fibromuscular dysplasia lesions collected from several authors

Lesion Type	Cured (%)	Improved (%)	Unchanged (%)	Total (N)
Atheromatous	19	51	30	360
Fibromuscular Dysplasia	46	45	9	163

Modified from Libertino & Beckmann, 1994.⁽²¹⁾

to the axillar route made the catheterization and dilation of the renal artery successful.

In the literature, a recurrence rate of 5 to 8% has been reported^(9,15,20,41). Generally, most recurrences take place within the first year⁽¹⁷⁾. Our patient with recurrence of renal stenosis 8 months after PTRA was successfully submitted to redilation after the end of this study. The use

of PTRA and "stents" has been recommended for diminishing the recurrence of renal stenosis^(42,43), although these devices are at present expensive and are not available in the public hospital where we work.

In conclusion, PTRA is a relatively safe and convenient procedure and an effective complementary method of medical therapy for controlling hypertension.

RESUMO

Objetivo: avaliar os resultados da angioplastia transluminal percutânea (ATPR) utilizada para tratamento da hipertensão renovascular. **Desenho:** Trabalho observacional prospectivo em que a ATPR foi empregada seqüencialmente em pacientes com diagnóstico clínico de hipertensão arterial de difícil tratamento, triados pelo teste de captopril e confirmados pela arteriografia renal, sendo o seu resultado avaliado pela imagem arteriográfica pós-ATPR, medida da pressão arterial e função renal. **Local:** setor de Angio-radiologia da Disciplina de Cirurgia Vascular e ambulatório de Hipertensão da Disciplina de Nefrologia da Universidade Federal de São Paulo- Escola Paulista de Medicina, com atendimento de nível 3 de atenção à saúde. **Participantes:** foram incluídos no estudo 32 pacientes selecionados pelo quadro clínico, teste de captopril positivo e com estenose na arteriografia renal. **Mensuração:** para a avaliação do resultado da ATPR foram empregados os critérios do Estudo Cooperativo em Hipertensão Renovascular⁽³³⁾. **Resultados:** Após a ATPR, a arteriografia de controle mostrou ausência de estenose renal em 24 (75%), estenose residual (20-50%) em três (9,4%) e inalterada em 5 (15,6%). Os resultados sobre a pressão arterial foram: três (9,4%) pacientes curados, 24 (75%) melhoraram e 5 (15,6%) ficaram inalterados. Foi observada função renal normal antes e após ATPR em 25 (78%) pacientes; alterada pré e melhorada após ATPR em dois (6,3%); permaneceu inalterada pós-ATPR em dois (6,3%) e estava alterada e piorou pós-ATPR em três (9,4%). A recorrência da estenose ocorreu em um paciente após 8 meses. **Conclusões:** a ATPR mostrou-se um método conveniente, relativamente seguro e efetivo para controle da hipertensão renovascular neste grupo de pacientes.

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