

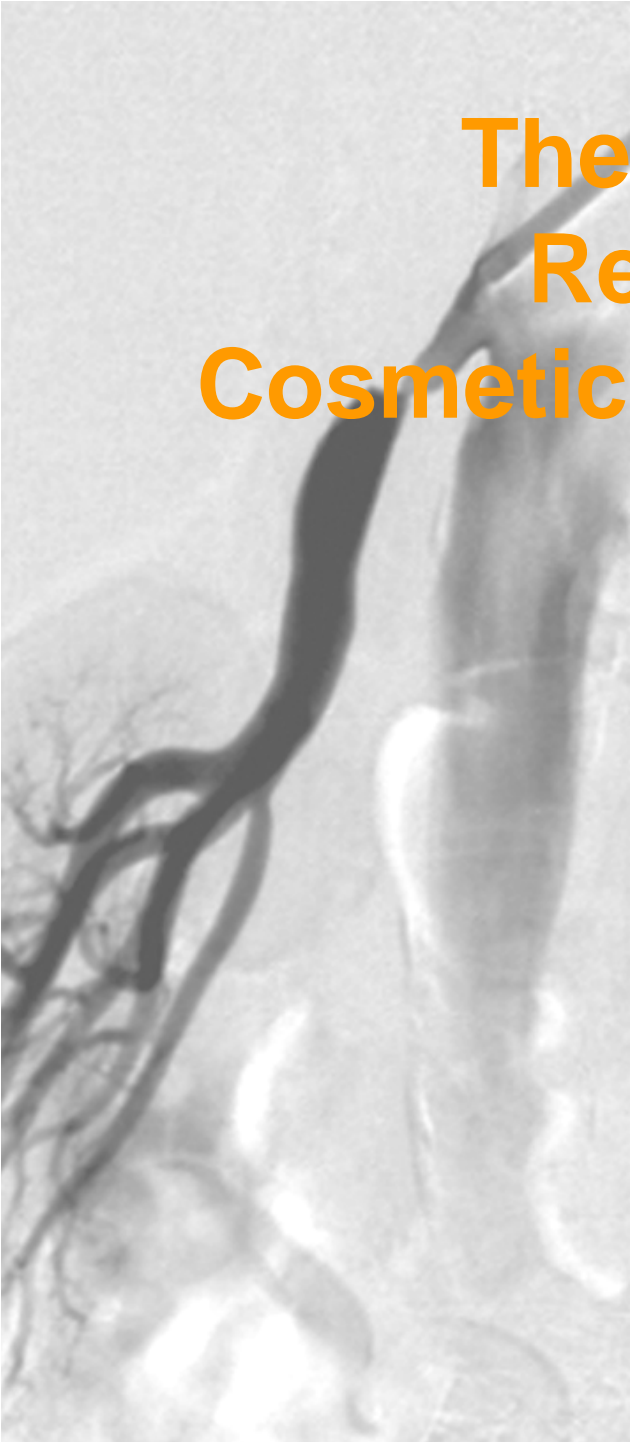
The Upsurge in Renal Revascularisation: Cosmetic or Clinically Relevant ?

G.Biamino



University Leipzig – Heart Center
Clinical and Interventional Angiology

Nothing to disclose



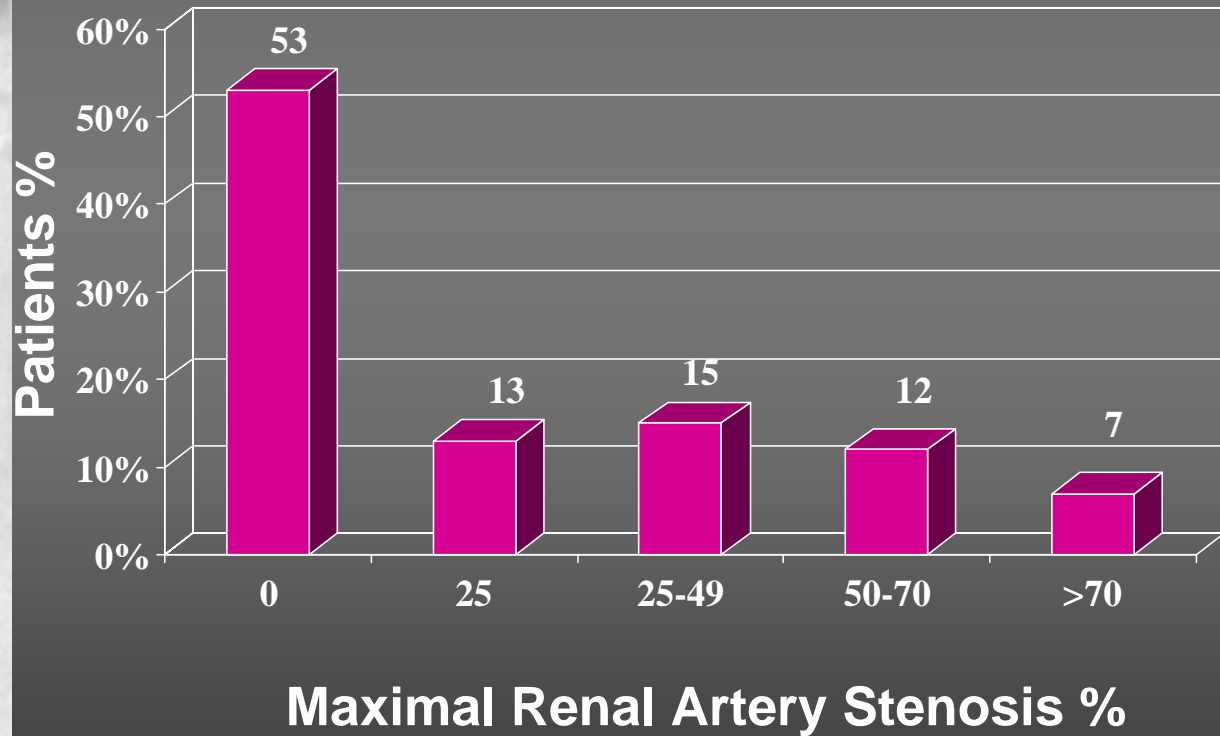
The Upsurge in Renal Revascularisation: Cosmetic or Clinically Relevant ?

- Nothing is clear about the **incidence** of renal artery stenoses

Renal Artery Stenosis at Time of Coronary Arteriography

- Prospective cohort of **297** hypertensive patients who underwent coronary angiography between (July 1998-March 1999)
 - All patients underwent screening abdominal aortography
- Mean Age 64.9 ± 10 years
- Mean Blood Pressure
 - $142.8 \pm 22.5/79.6 \pm 11.4$ mmHg

Renal Artery Stenosis At Time of Coronary Arteriography





Prevalence of Renal Stenosis in Patients with CHD

19 % of patients (101/534) referred for coronary angiography with refractory hypertension (> 140/90 on two drugs) had RAS >70%.

Prevalence of Renal Stenosis in Patients with CHD

- In a cohort of 500 consecutive patients showing a relevant coronary disease
 - 20 % had an undetected renal stenosis
 - in half of these cases the stenosis was considered critical

8%

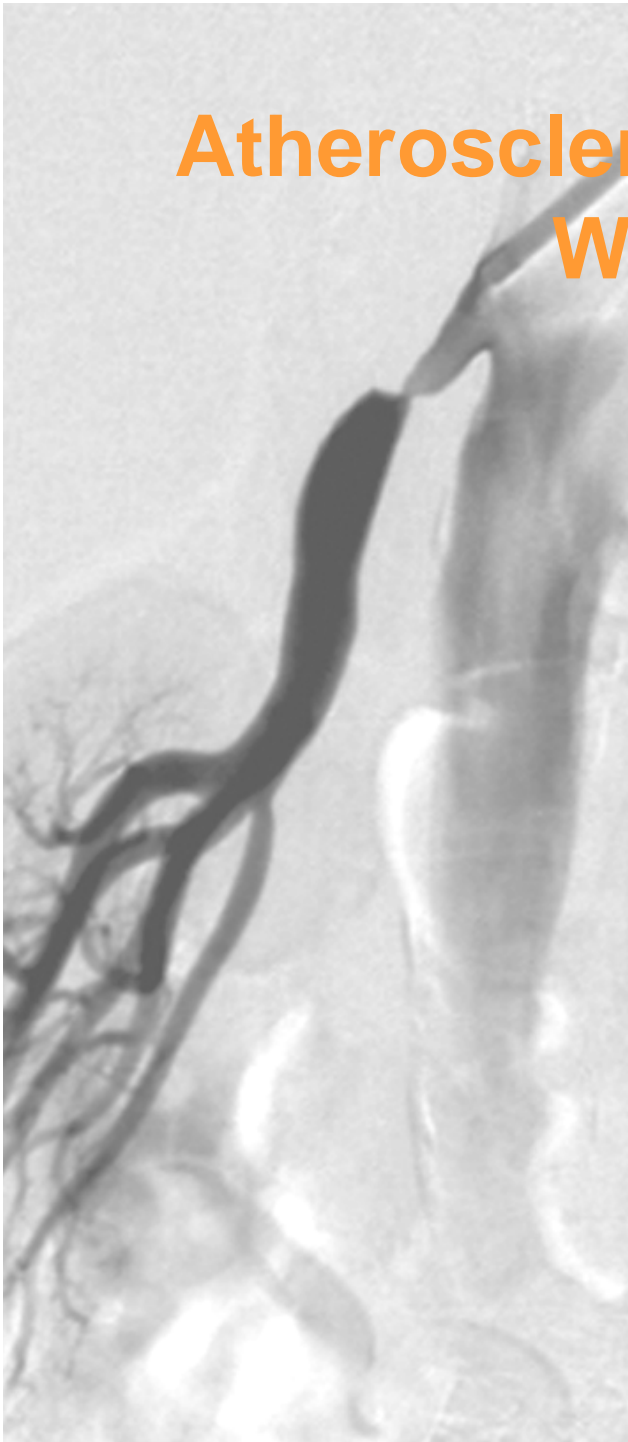
Renal Artery Stenosis and Fibromuscular Dysplasia - What are the Facts?




- Approx. < 10% of RAS
- Women 15-50 years
- Unknown etiology
- Distal location
- Typical anatomy
- Seldom ischemic nephropathy
- Rarely progression to occlusion
- Plain balloon angioplasty therapy of choice to cure hypertension

Atherosclerotic Renal Artery Stenosis- What are the Facts?

- Two facts have to be considered consolidate:
 - **Etiology**: as expression of a generalized atherosclerotic disease
 - **Location**:
 - > 90 % of the sclerotic lesions involve the origin of the renal artery



Atherosclerotic Renal Artery Stenosis-- What are the Facts?

- 
- More common than previously recognized
 - Progressive disorder
 - Associated with Coronary Artery Disease and/or PAOD
 - May cause “flash” pulmonary edema or unstable angina pectoris
 - Causes “difficult-to-control” hypertension
 - Leads to progressive renal insufficiency

Atherosclerotic Renal Artery Stenosis-- What are the Facts?

In case of stenoses

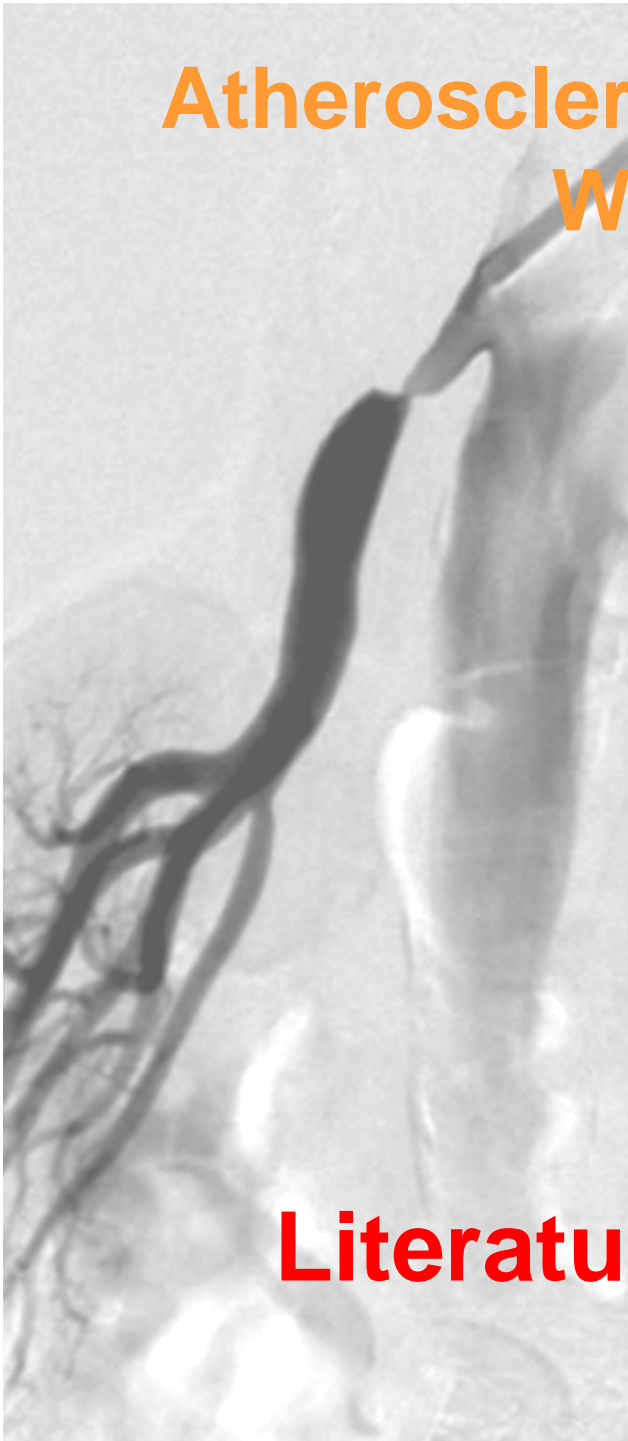
> 75% in 39%

a progression to occlusion

Has been observed within 2
years after the diagnosis

Greco and Breyer: Semin Nephrol 1996

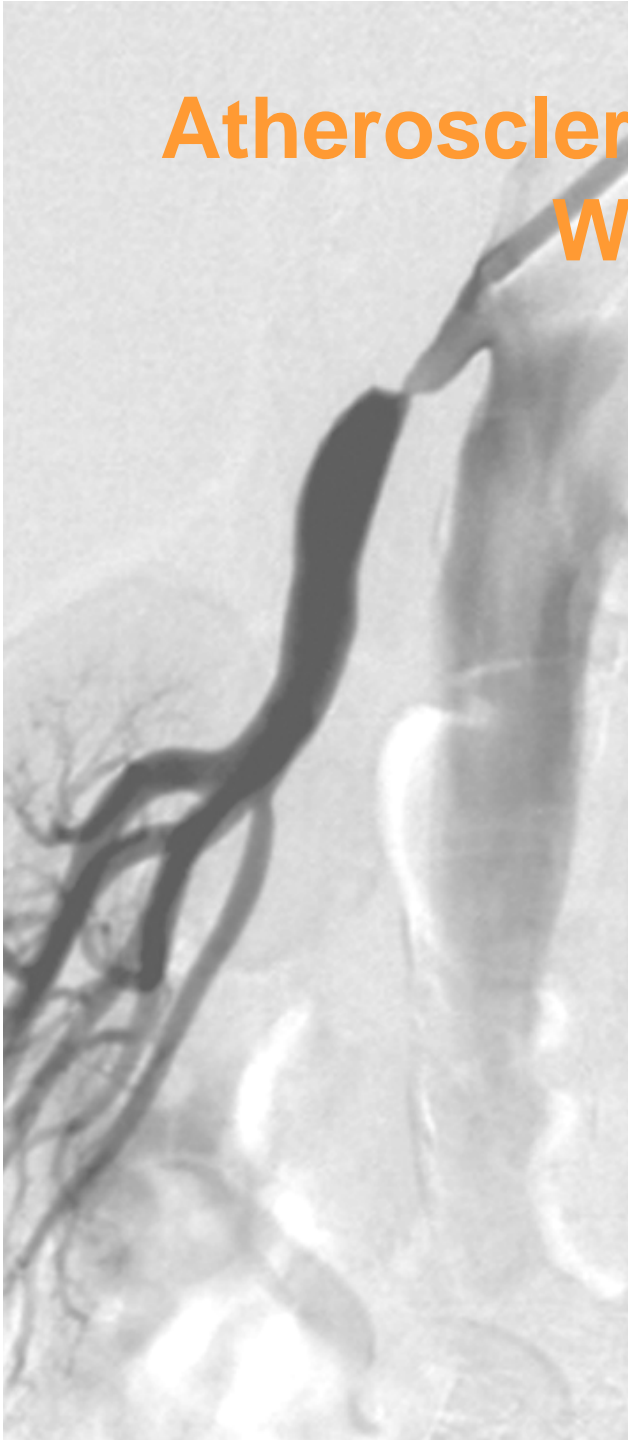
**Literature extremely inconsistent :
3 – 16 %**



Atherosclerotic Renal Artery Stenosis-- What are the Facts?

- **POOR DATA ON**

- **Incidence**
- **Prevalence**
- **Progression**



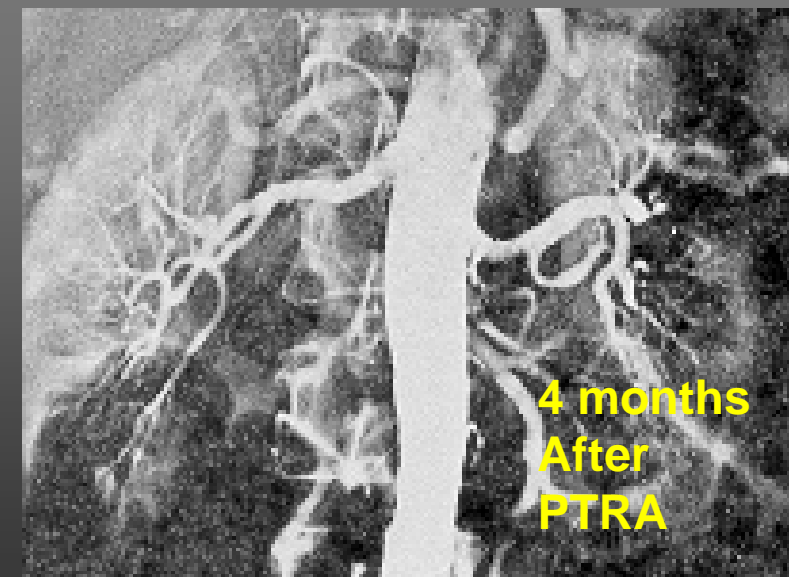
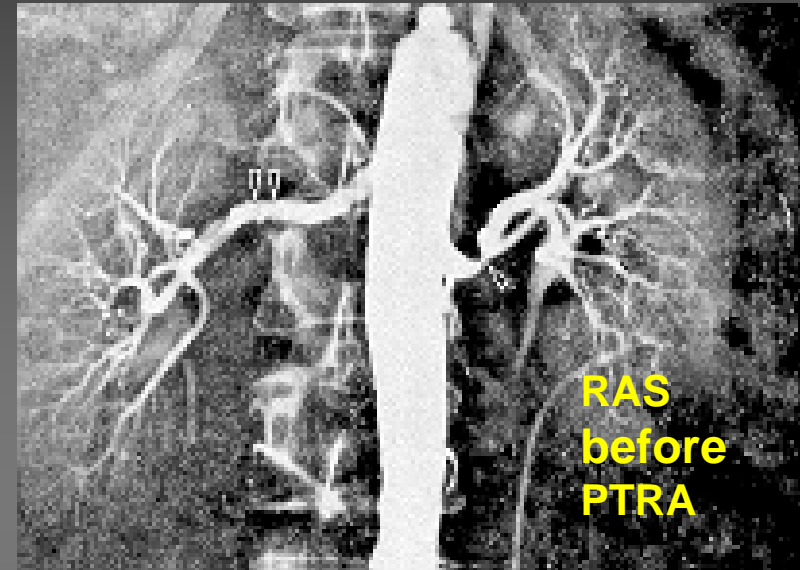
The first PTRA, 07.12.77

Treatment of Renovascular Hypertension by Transluminal Renal Artery Dilatation

FELIX MAHLER, M.D.; ALEX KRNETA, M.D.; and MICHAEL HAERTEL, M.D.

Inselspital; Bern, Switzerland

A 50-year-old woman was admitted to hospital in 1977 because of hypertension. In July her blood pressure was 240/120 mm Hg, and methyldopa therapy, 750 mg daily, was started. At examination her blood pressure was 140/100 mm Hg, and a high-pitched bruit was heard in the left upper abdominal quadrant. Arteriography revealed severe stenosis in the middle third of the left renal artery and a string-of-beads appearance of the distal right renal artery, suggesting intimal fibroplasia on the left and medial fibroplasia on the right side (4) (Figure 1a). Peripheral renin activity of 8.1 ng/ml · h was clearly higher than our normal standard (5), and the left-to-right ratio of the selective renal vein renin of 1.90 lateralized the excess renin to the left side. On 7 December transluminal dilatation of the left renal artery was done under general anesthesia at the patient's request (Figure 1b). After dilatation, anticoagulation therapy



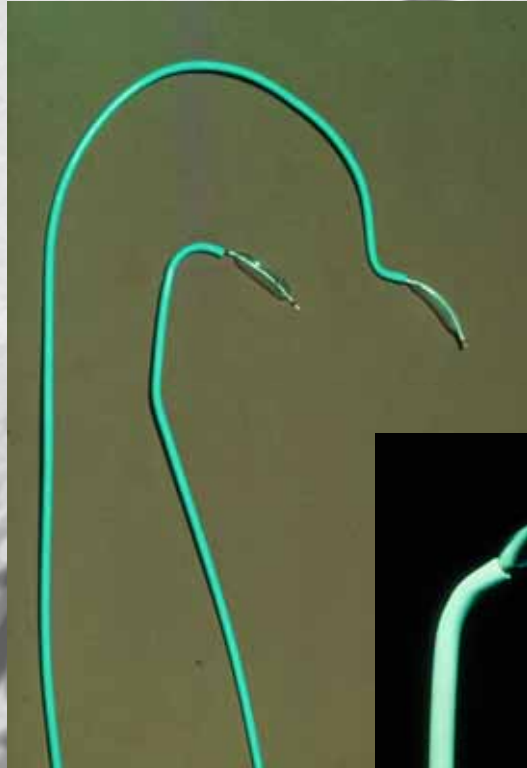
Reprinted from ANNALS OF INTERNAL MEDICINE Vol. 90, No. 1 January 1979
Printed in U.S.A.

Subtotal Stenosis of the left Renal Artery

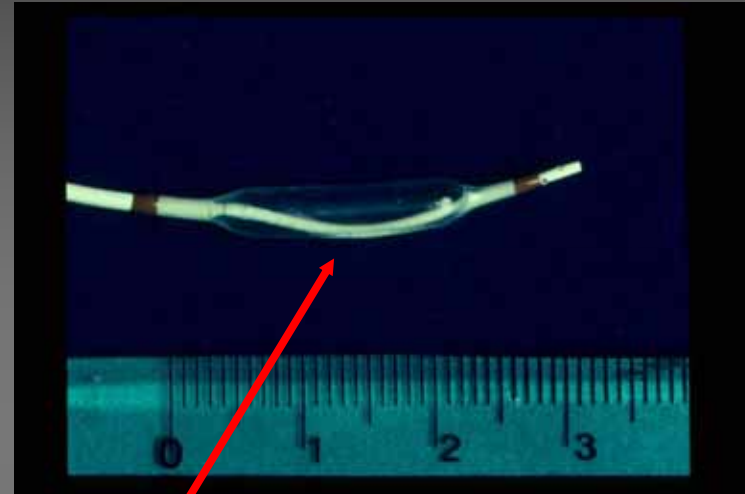
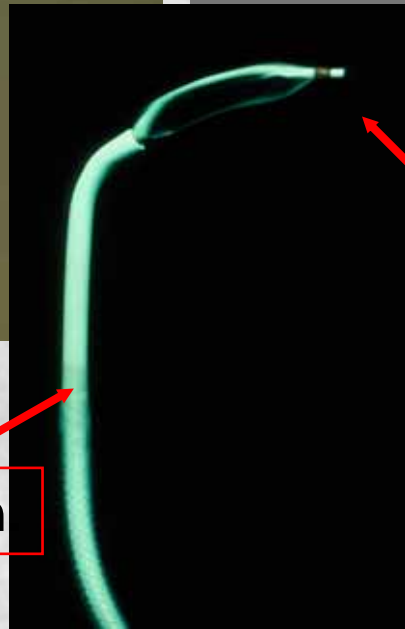


Andreas Grüntzig , Jan. 1978

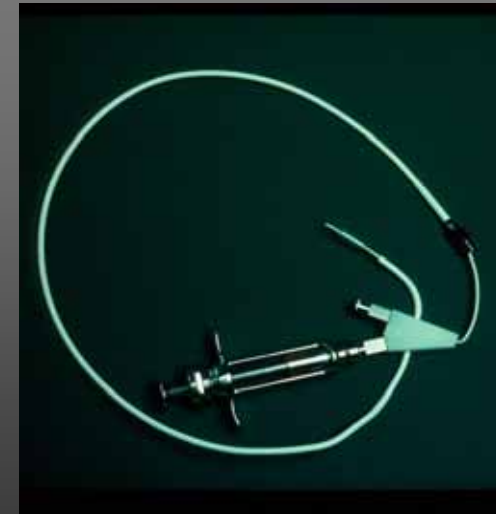
Instruments for the first PTRA, 1977



8 F guiding cath



4 F balloon cath. 5/20mm, no end-hole



With permission of Prof. Felix Mahler

Percutaneous Angioplasty of the Renal Artery

Results of a Randomised Study

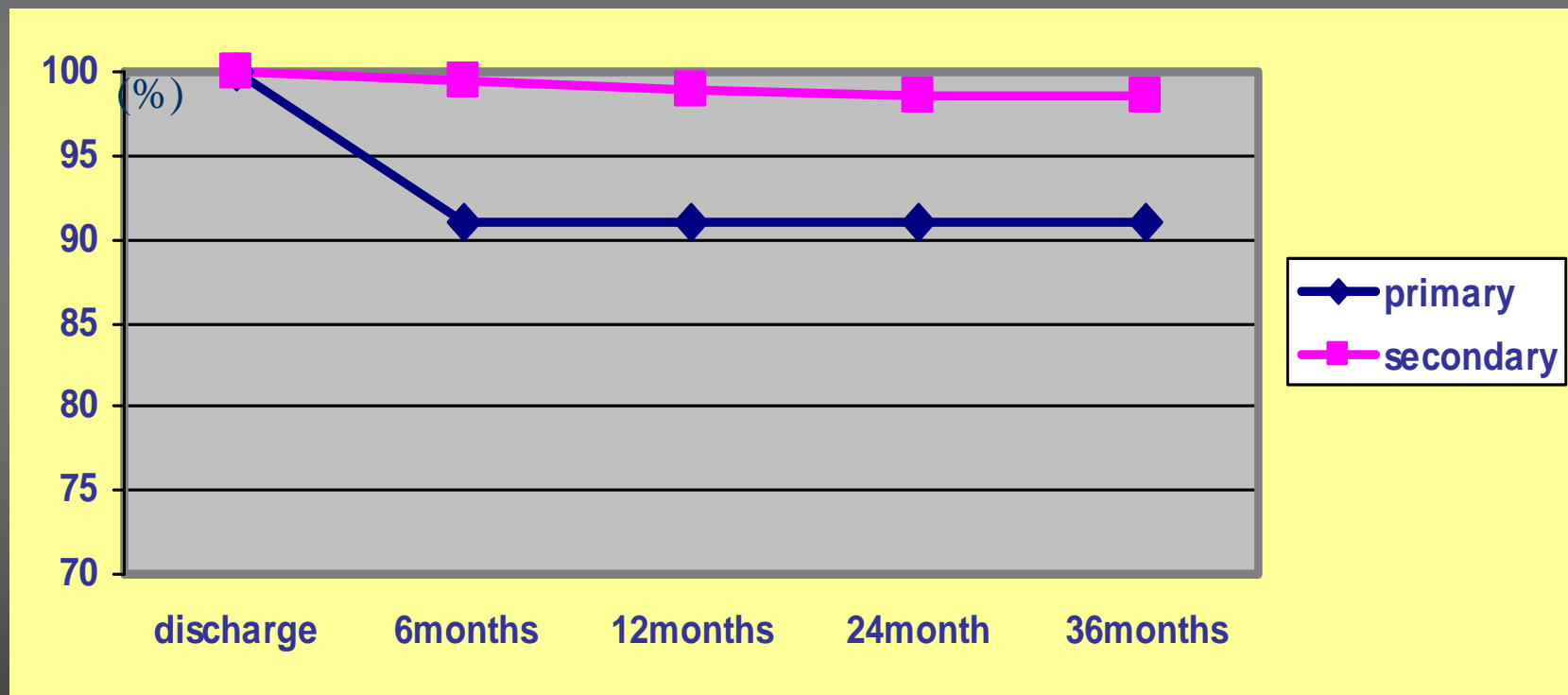
STENTING vs PTA

	PTRA	PTRA/Stent
Number of patients	42	43
Primary success rate	57%	88%
Primary patency rate	29%	75%
Restenosis rate	48%	14%

Van den Ven et al.: Lancet 1999; 282-286

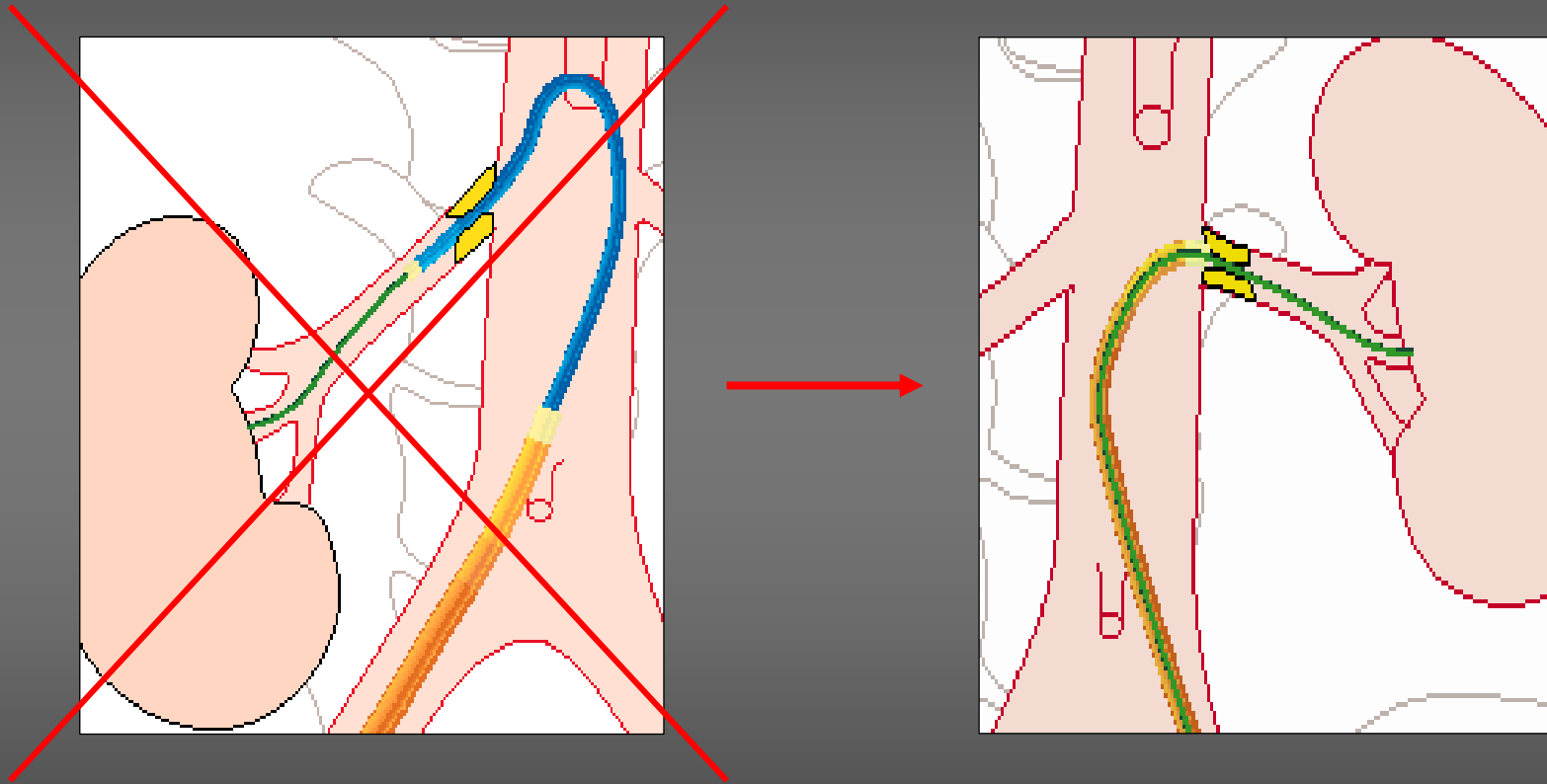
Stenting of the RAS

Kaplan-Meier-curve: n = 364



Th. Zeller, 2002

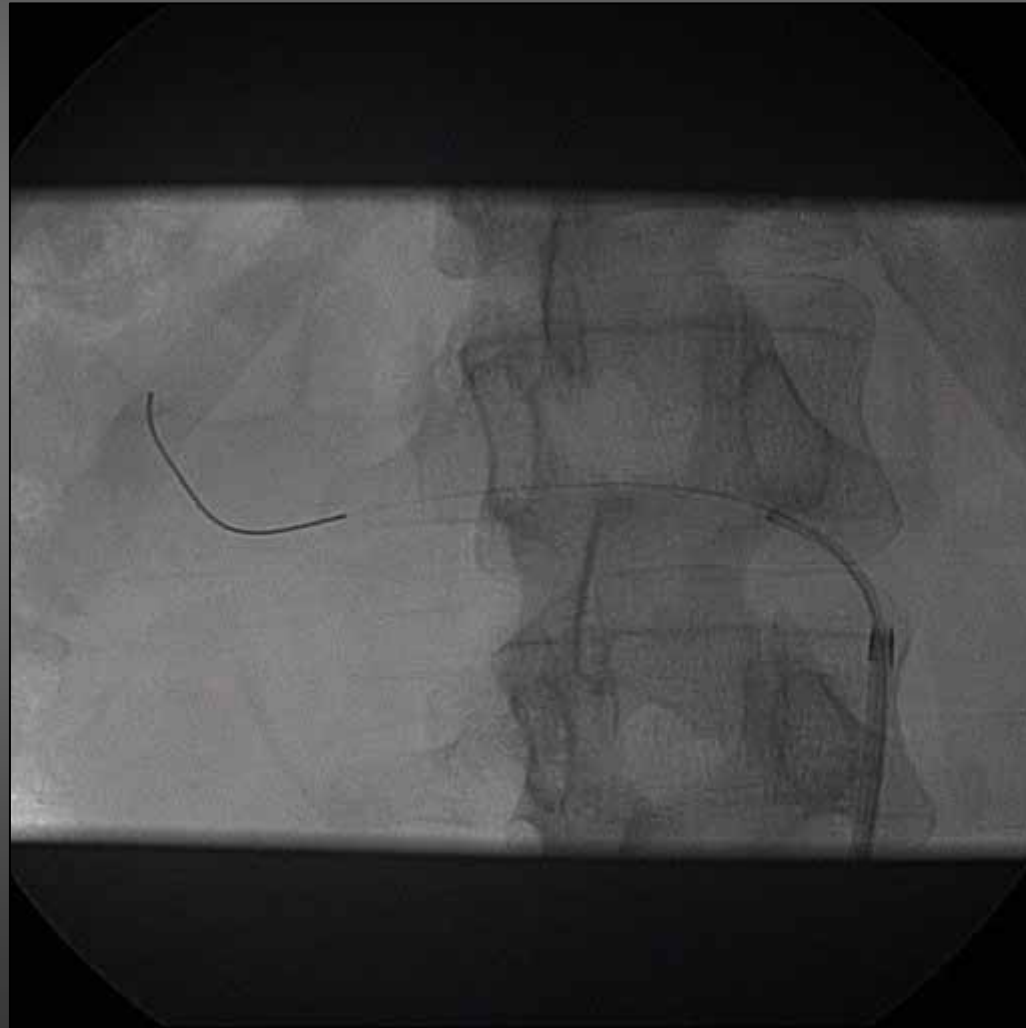
Technical Improvement : The Coronary Technique



Do we need PROTECTION DEVICES ???

Renal Artery Stenting

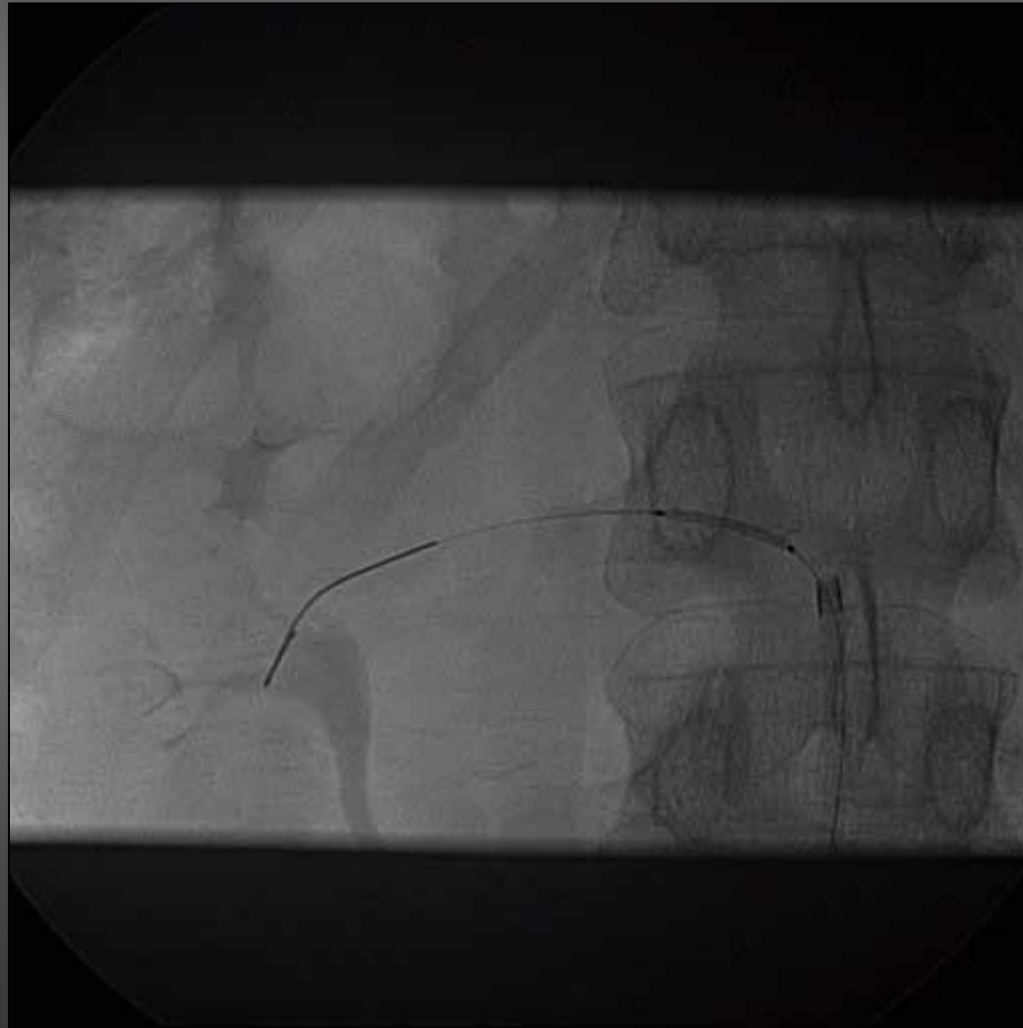
- Ostial stenosis of right renal artery



55726, P01-0446

Renal Artery Stenting

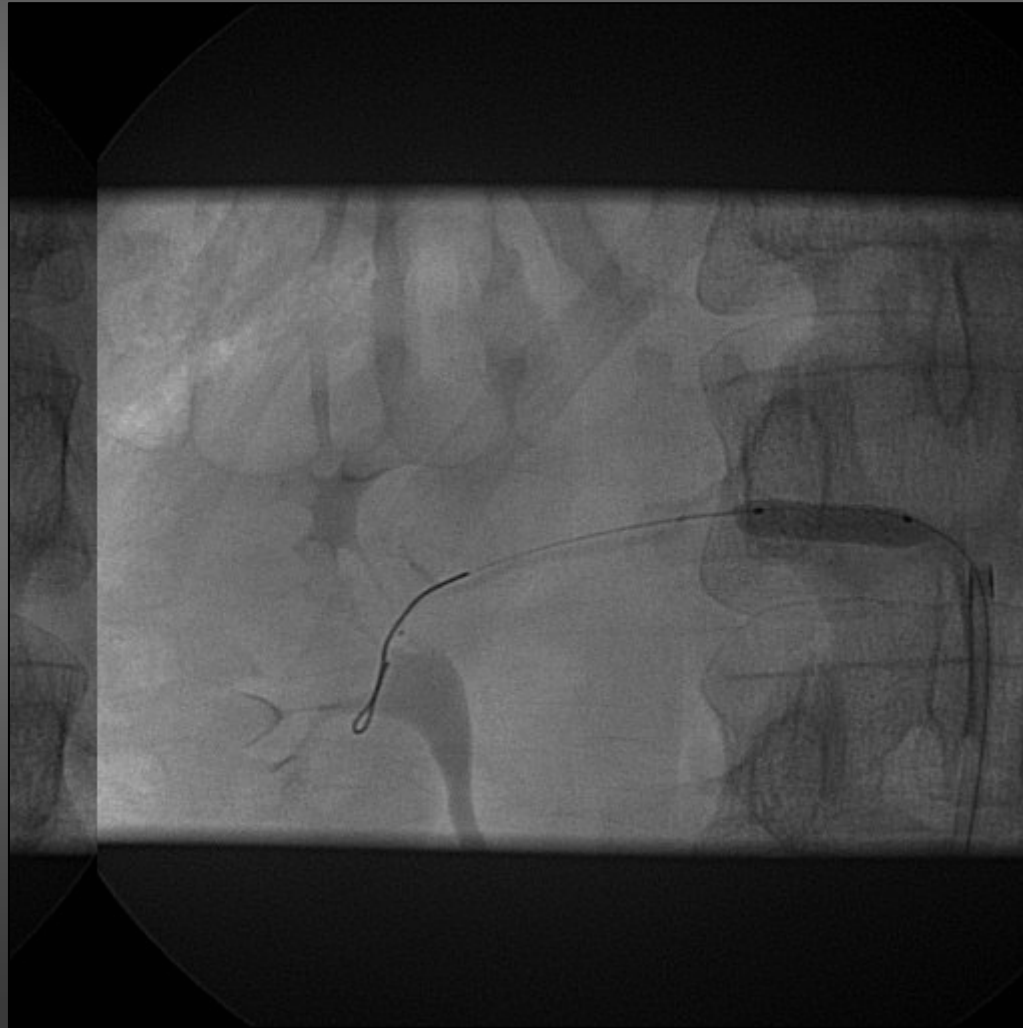
- Ostial stenosis of right renal artery



55726, P01-0446

Renal Artery Stenting

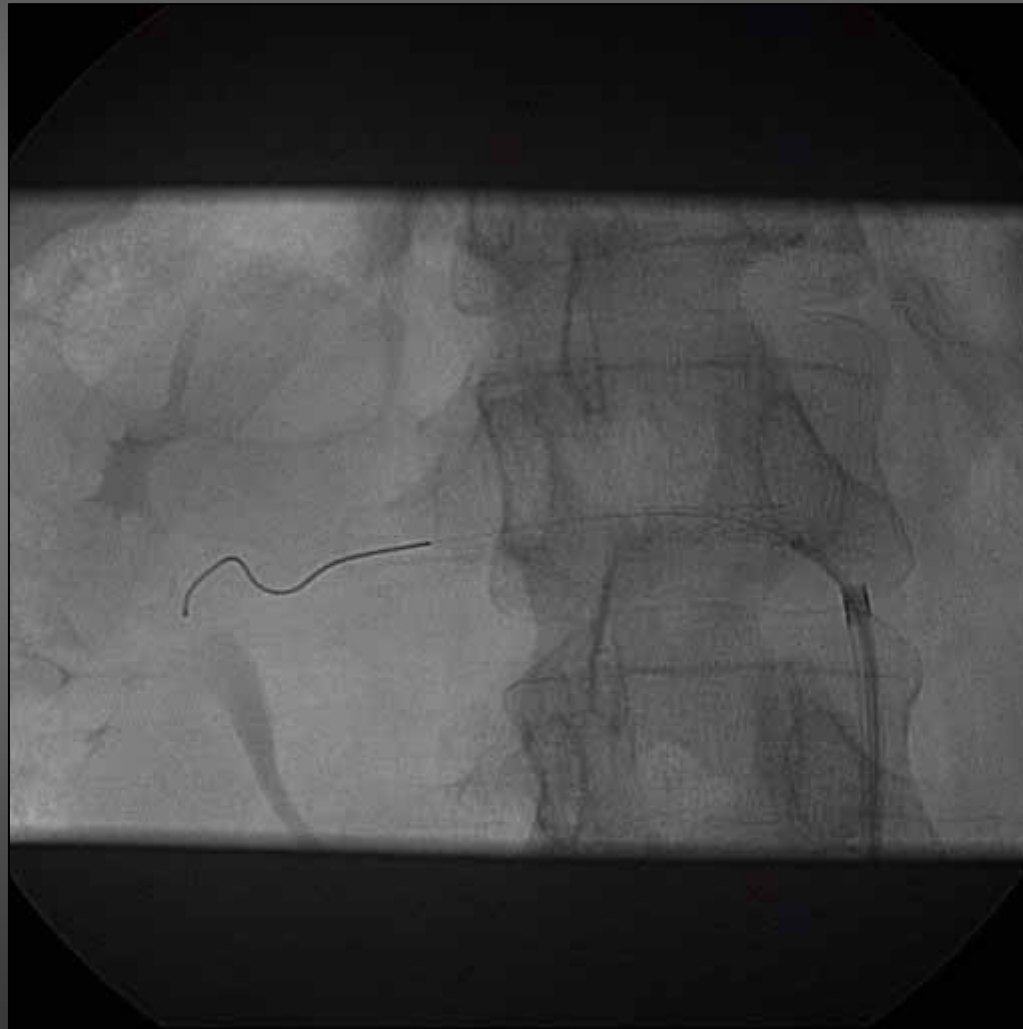
- Ostial stenosis of right renal artery



55726, P01-0446

Renal Artery Stenting

- Ostial stenosis of right renal artery



55726, P01-0446

What is the Problem Today ?



- Primary Success Rate
~100%
- Restenosis Rate < 10%
- Complications rare

LET`S DO IT !!!

INDICATION ???

Potential Indication for Renal Artery Revascularization

- Refractory/Resistant Hypertension
- Chronic Renal Insufficiency
- Recurrent „Flash“ Pulmonary Edema

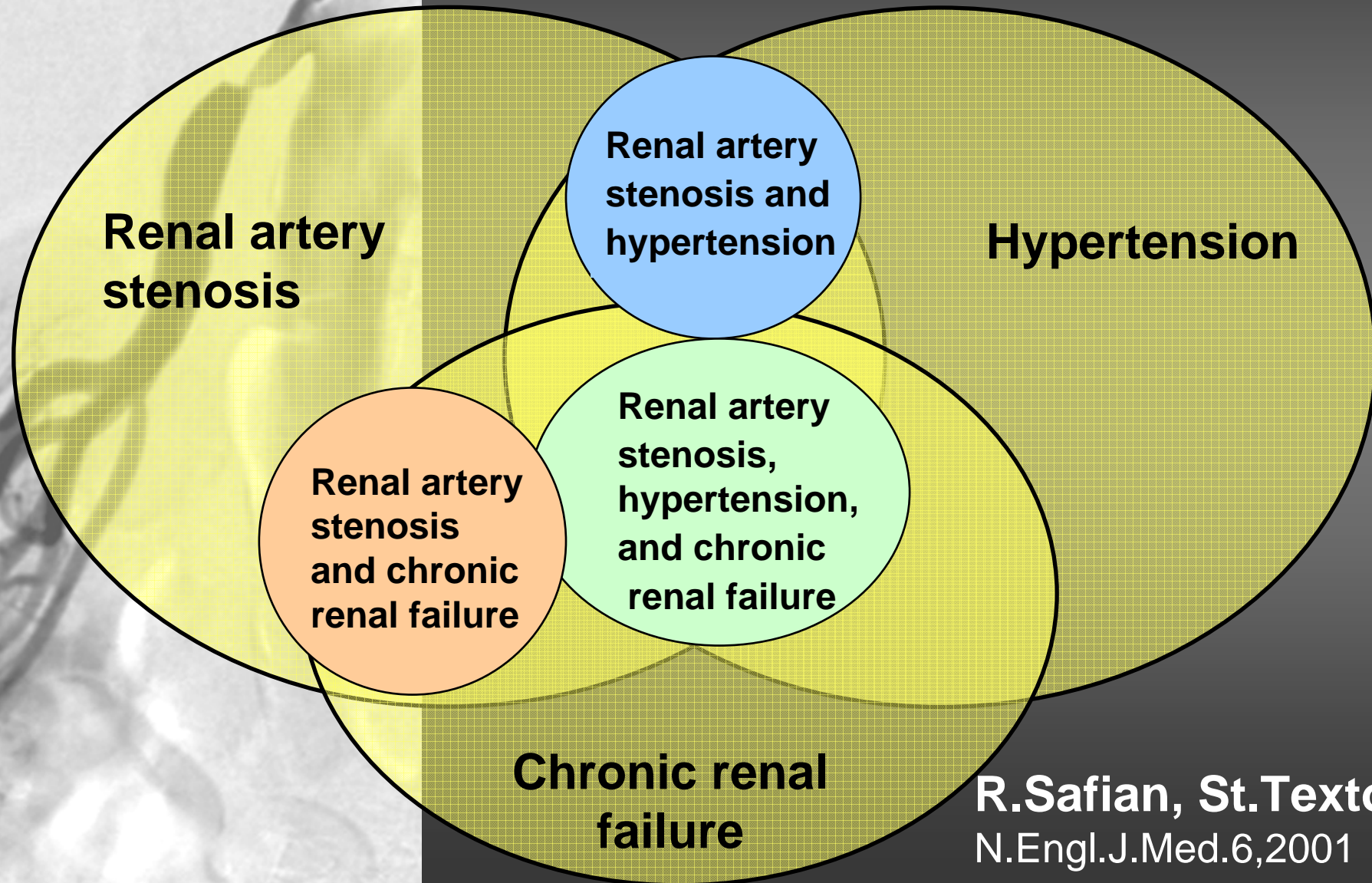
FEW DATA

- Need for Use of ACE Inhibitors
- Unilateral Renal Artery Stenosis

NO DATA



Renal Artery Stenosis Clinical Manifestation



R.Safian, St.Textor
N.Engl.J.Med.6,2001

Results of Renal Artery Angioplasty/ Stenting in Hypertensives

- Accumulate data from 8 authors
349 patients with mean follow up
11 months

Hypertension:

Unchanged

44%

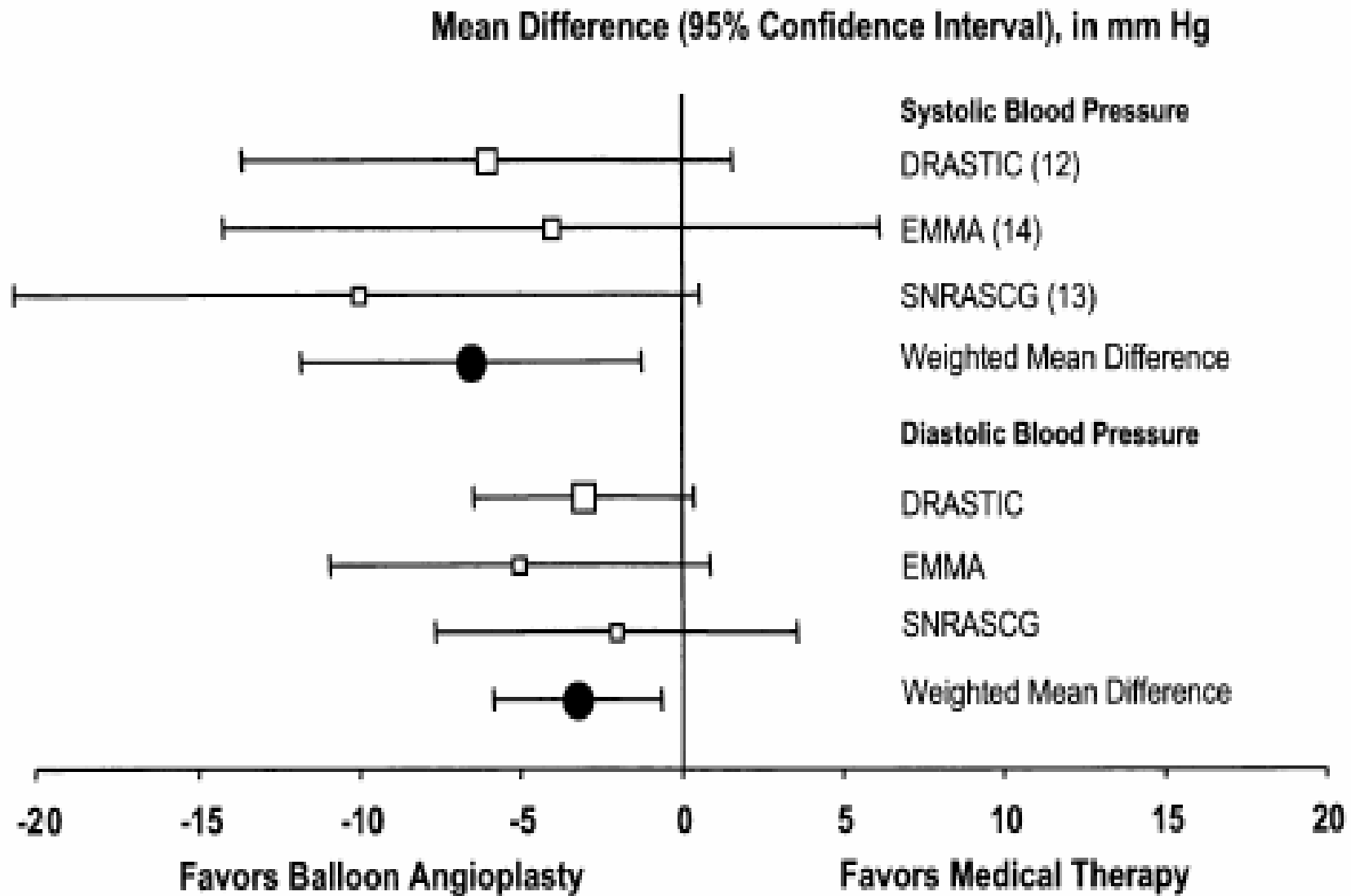
Improved

56%

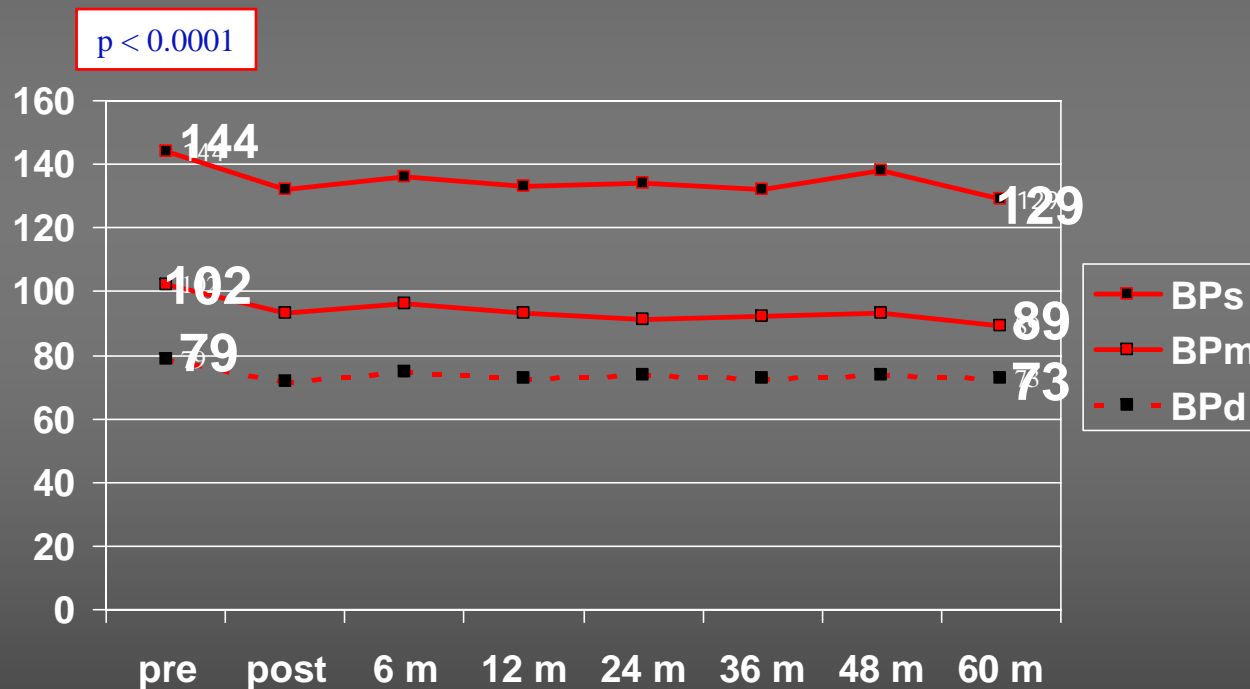
Cure

10%

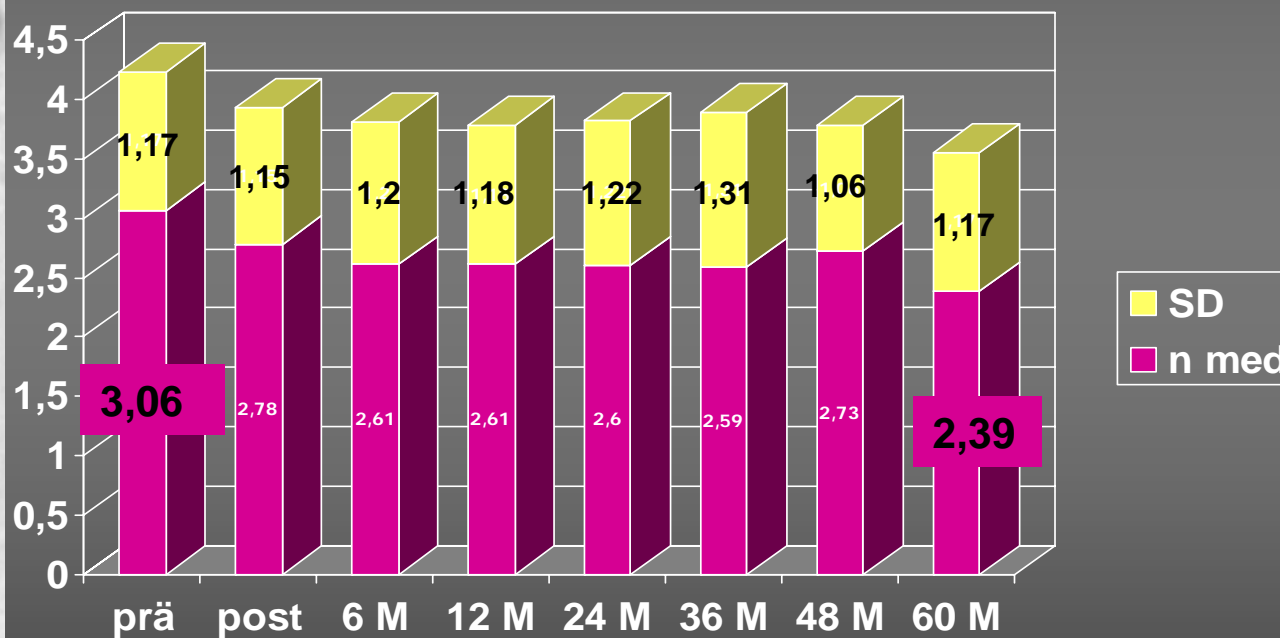
Meta-Analysis: PTRA vs Medicine in Hypertension and RAS



Renal Artery Stenting Blood Pressure - Bad Krozingen Data



Renal Artery Stenting Blood Pressure - Bad Krozingen Data



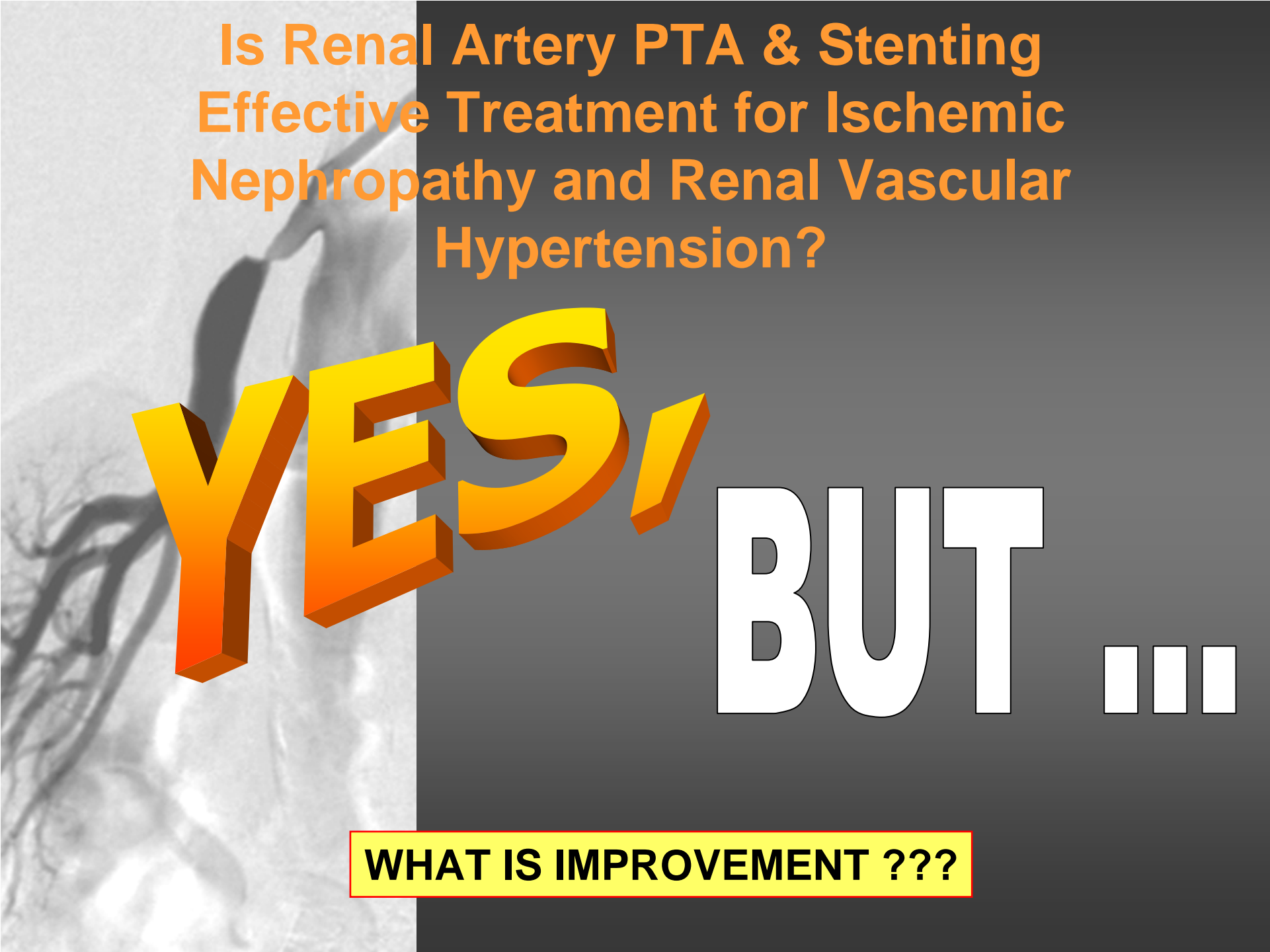
Zeller et al. Cath Cardiovasc Intervent 2003



**Interventional vs. Best Medical
Therapy
in Hypertension**

COST EFFECTIVE

STAR - study: answer in 5- 7- years !!



Is Renal Artery PTA & Stenting
Effective Treatment for Ischemic
Nephropathy and Renal Vascular
Hypertension?

YES!

BUT ...

WHAT IS IMPROVEMENT ???



Endovascular Treatment in Ischemic Nephropathy

- **Challenging for 2 main reasons:**

- Relatively poor reported results with stent revascularization

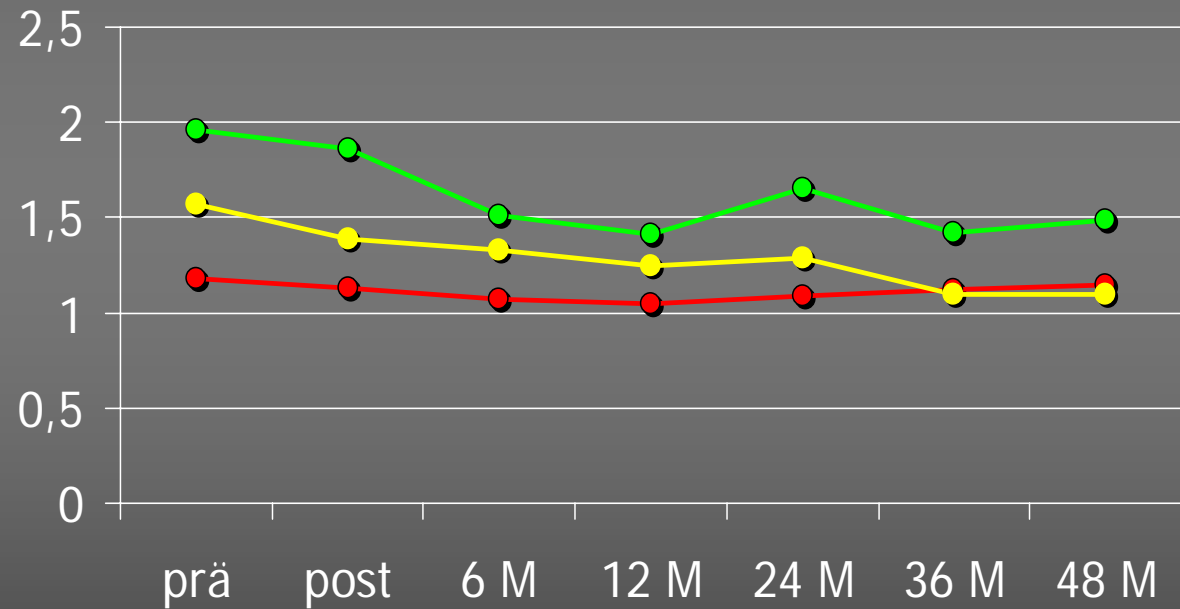
- No investigations available which reliably predict a therapeutic response to revascularization

(Doppler assessment of vascular may have a role)

Renal Artery Stenting

Renal Function- Bad Krozingen Data

Serum creatinine (mg%) and RI



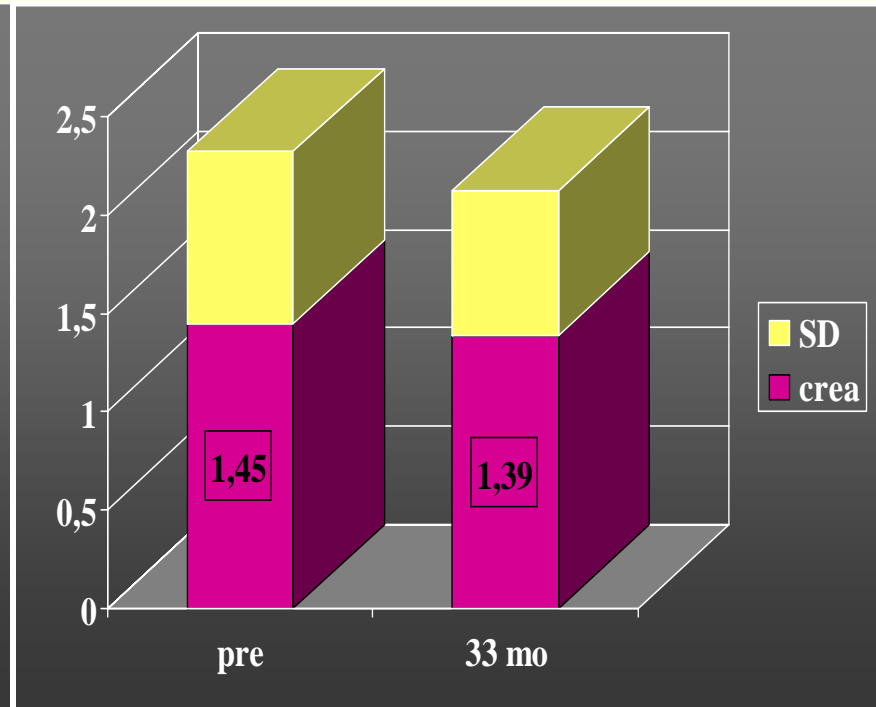
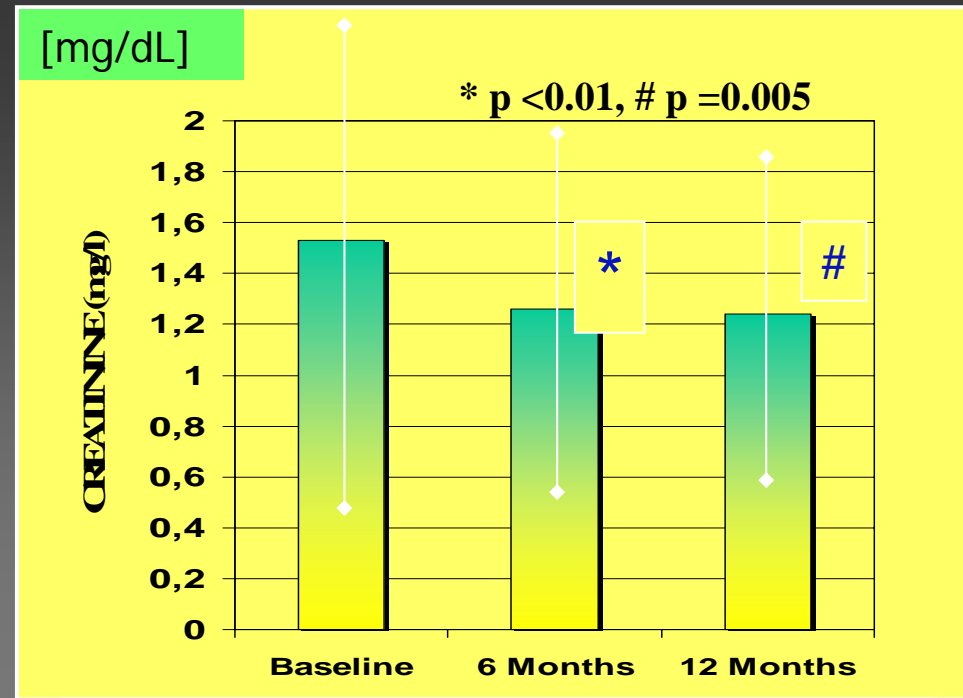
Zeller et al. Cath Cardiovasc Intervent 2003

- RI < 0.7
- 0.7-0.8
- RI > 0.8

Renal Artery Stenting Renal Dysfunction

Zeller et al., Circulation 2003;108:2244-2249

Zeller et al., J Endovasc Ther 2004, in press



Endovascular Treatment of RAS in Ischemic Nephropathy

~~CURED~~

IMPROVED

UNCHANGED

DETERIORATED ??



Renal Artery Stenting Renal Dysfunction

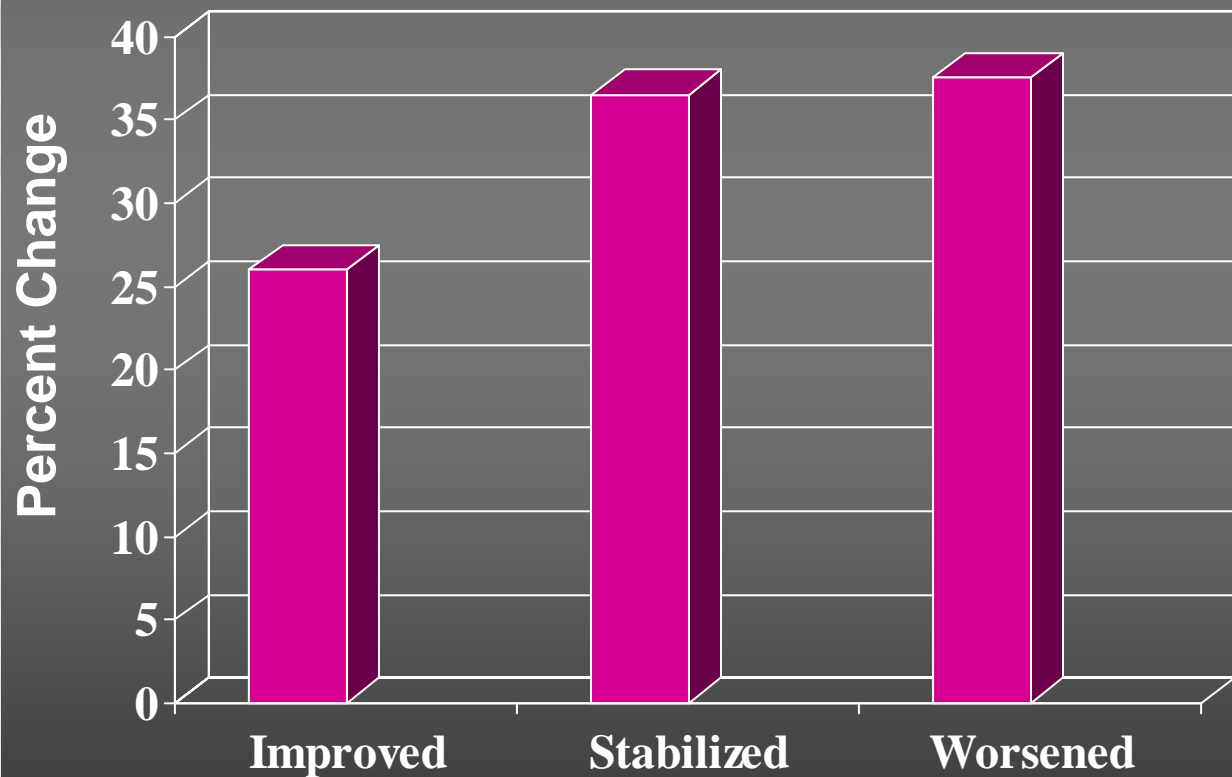
Serum Creatinine Concentration

- Decrease >10%: **34%**
- Unchanged (\pm 10%): 39%
- Increase > 10%: 27%

Mean follow-up 34 ± 20 months

Renal Artery Stenting in CRI

Impact on Renal Function



Matsumoto, A. Presented at ISET, Miami, Florida January 2003



Acute Deterioration in Renal Function after Angioplasty/ Stenting

- Incidence of **10-20%** in patients with ischemic nephropathy
- Possible etiologies:
 - iodinated contrast nephropathy
 - procedure related arterial trauma (e.g. dissection)
 - cholesterol atheroembolization

**99 000 procedures,
in 2003 (WW)**

- US : 60 000**
- EU : 30 000**
- ROW: 10 000**

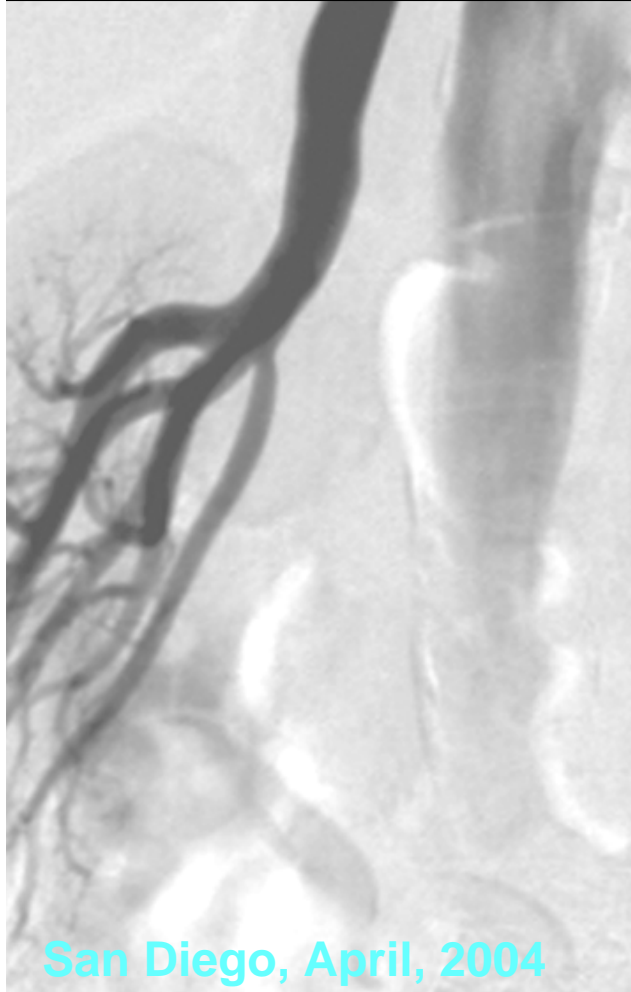
Renal Artery Angioplasty

- No reliable noninvasive tests to assess the functional severity of the renal stenosis**

- 1/3 improves, 1/3 unchanged, 1/3 further deterioration (BP + Renal function)**

- No reliable noninvasive testing to predict which patient might benefit from renal artery stenting**

- Very little is known on pathophysiology of renal artery stenosis revascularisation.**



San Diego, April, 2004

With permission of Bernard de Bruyne

Question of the day :

IS THIS LESION RELEVANT ?

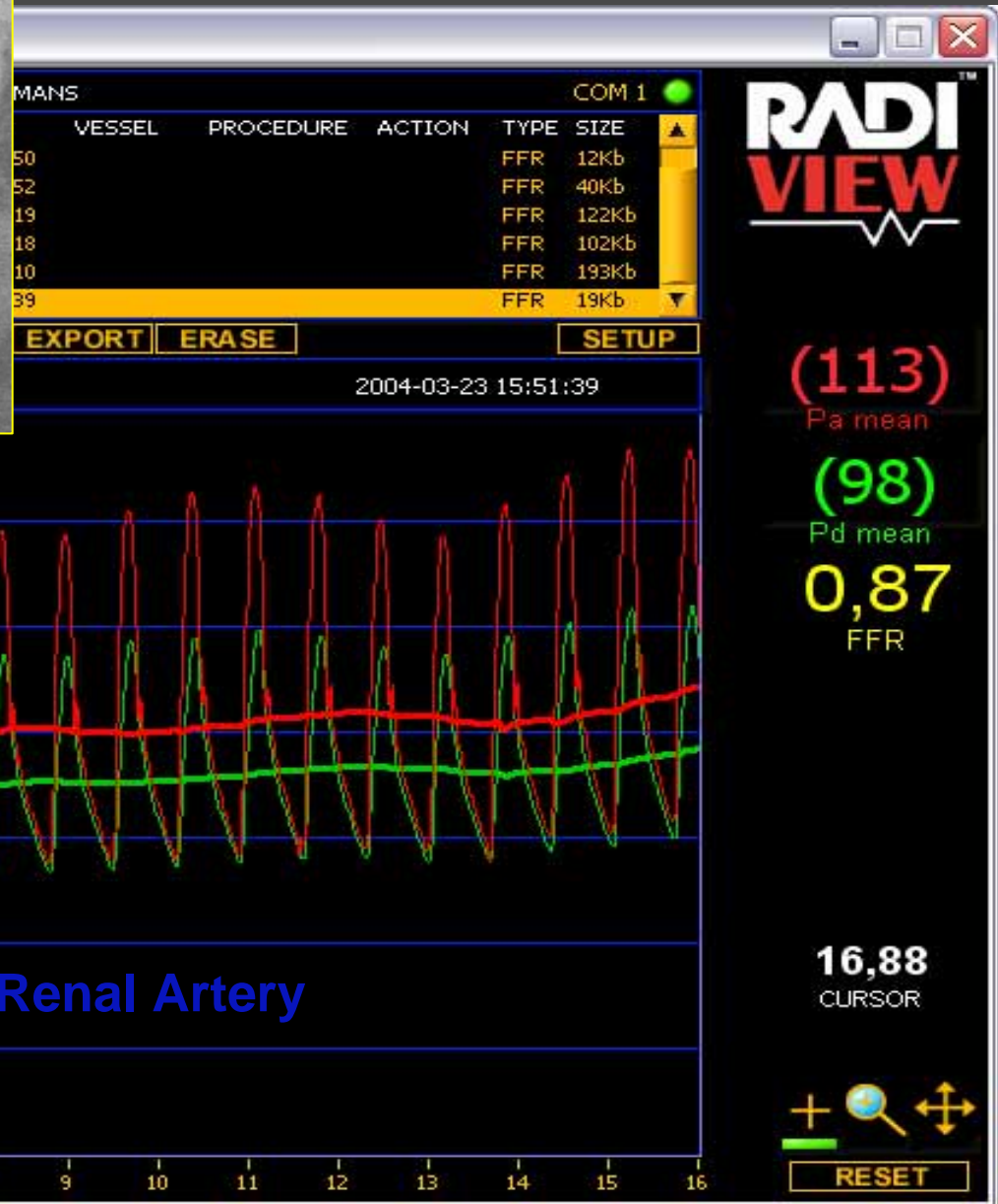


AT LEAST TRY TO MEASURE
THE PRESSURE GRADIENT
BEFORE YOU IMPLANT A
STENT !!!!!



*With permission of
Bernard de Bruyne*

74-year-old man with severe AHT
Diffuse coronary atherosclerosis

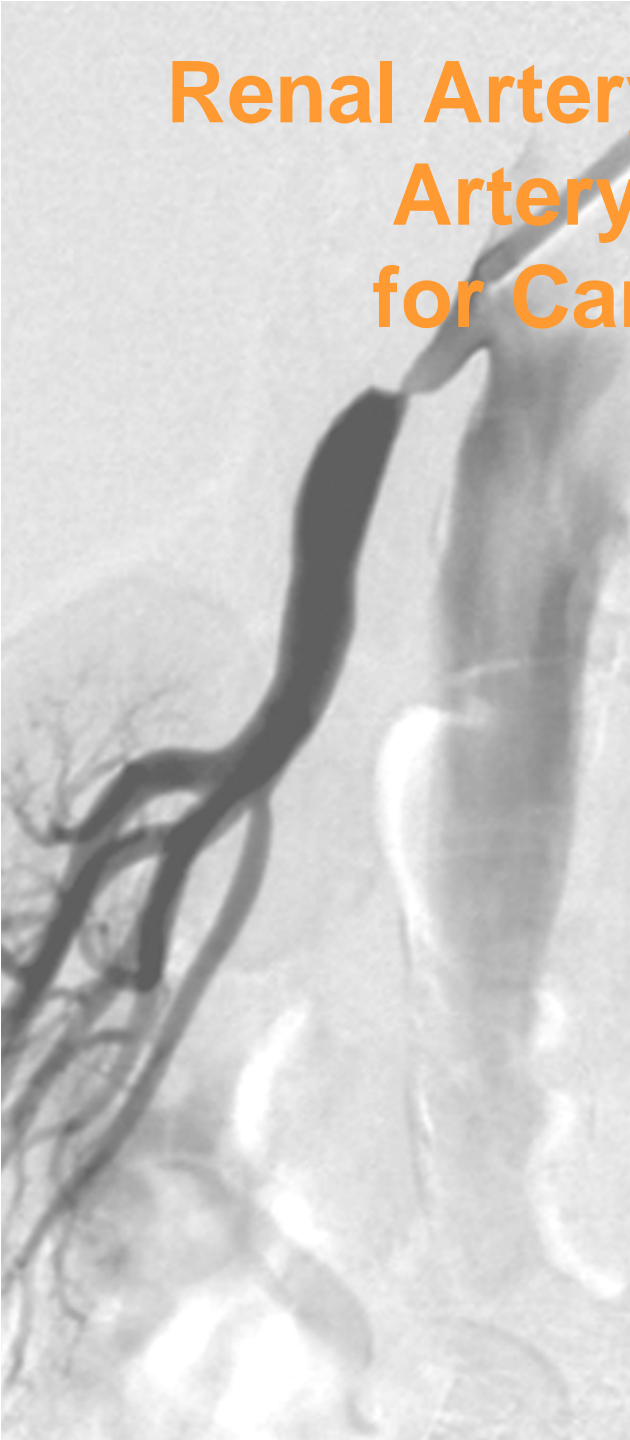




What is a “significant” gradient ?

- Which difference in pressure?
- Which pressure: mean, systolic, diastolic?
- Resting gradient or hyperemic gradient?
- Pressure gradient or resistance?

With permission of Bernard de Bruyne



Renal Artery Hemodynamics and Renal Artery Stenosis Angioplasty for Cardiac Interventionalists

Conclusions

1. We know very little about it
2. Let's apply sound physiology (and common sense) to
 - better understand what we are doing
 - select patients in whom renal stenting makes sense

With permission of Bernard de Bruyne



How can we prevent an excess
of

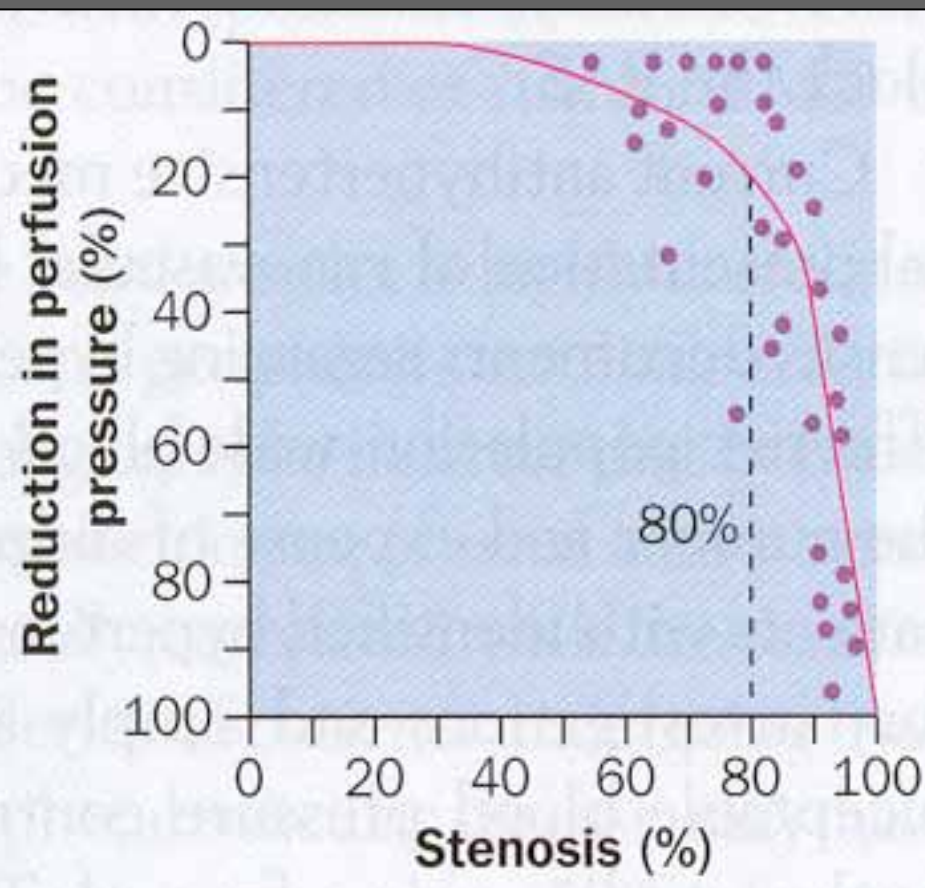
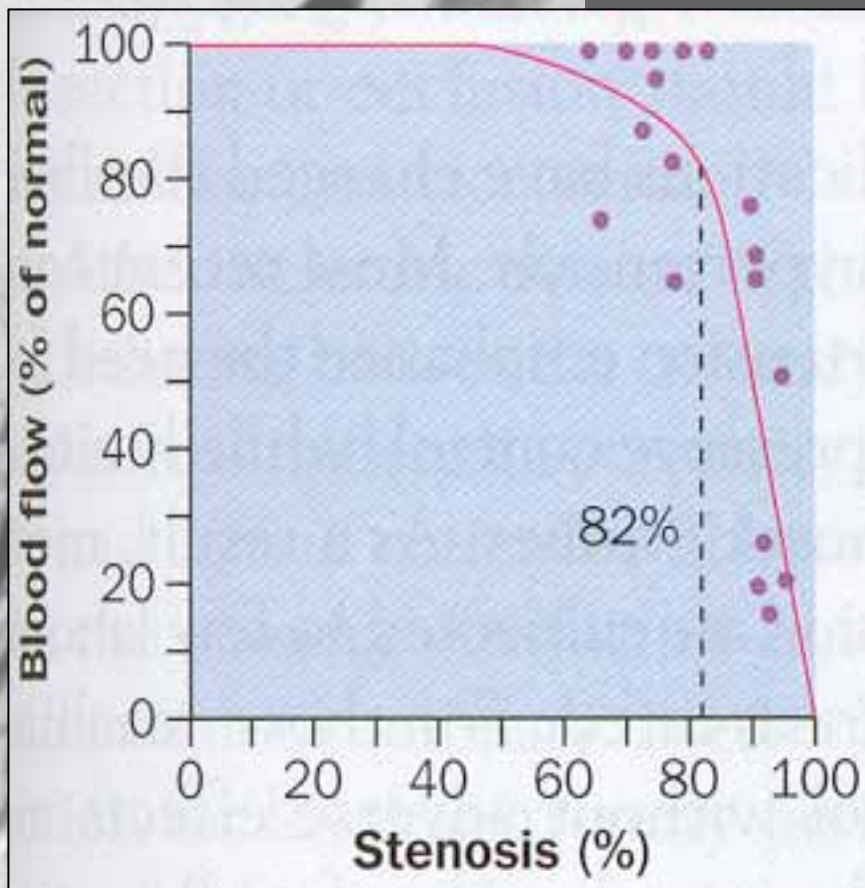
OCULO-STENOTIC REFLEXES IN RAS??

!!! WE NEED EVIDENCE BASED DATA !!!

Renal Stenosis Severity vs Renal Blood Flow and Renal Perfusion Pressure

FLOW

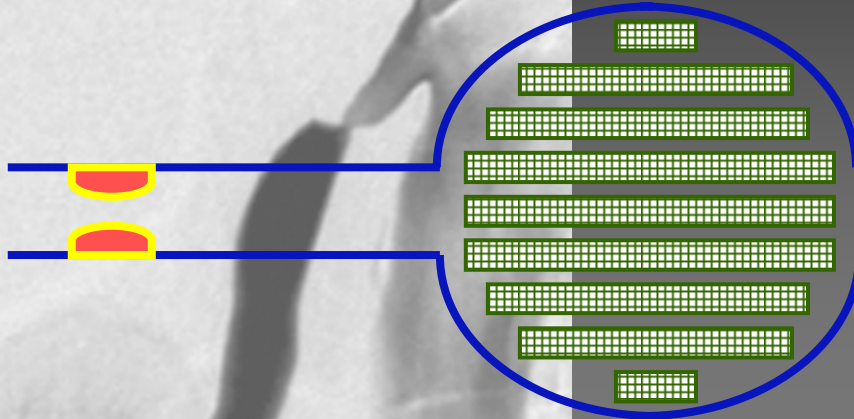
PRESSURE



May A. G. et al Surgery, 1963

Coronary and Renal Autoregulation

Coronary Circulation



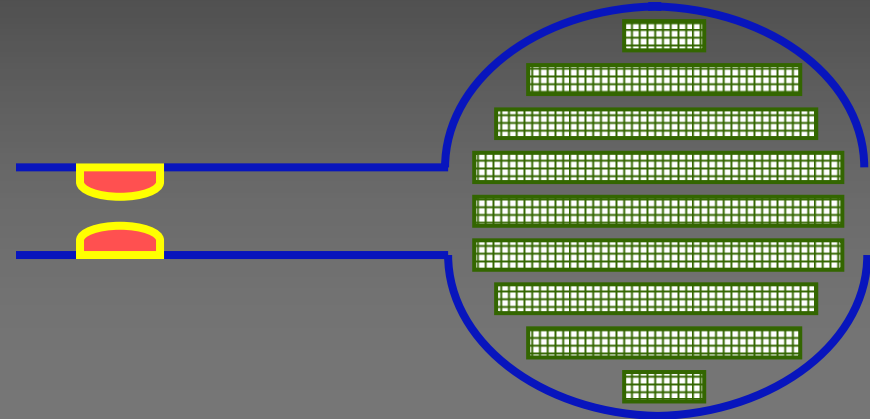
Local adaptation ONLY

In case of stenosis:

- P_{ao} remains normal
- P_d decreases
- Flow remains constant

**The heart keeps the flow constant
at the cost of the pressure**

Renal Circulation



Local AND systemic adaptation

In case of stenosis:

- P_{ao} increases
- P_d remains normal
- Flow tends to decrease

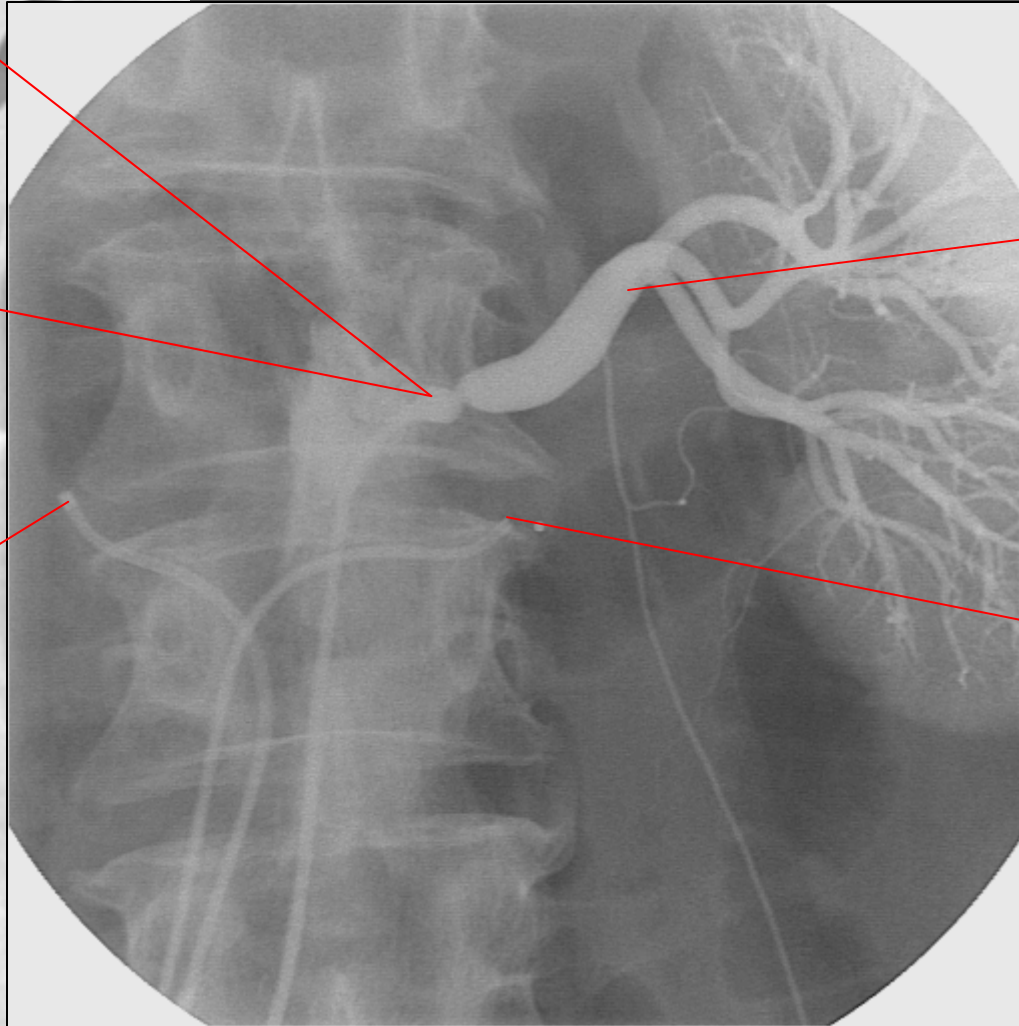
**Kidneys keep the pressure constant
at the cost of the flow**

Catheter Positions

Proximal Renal Pressure (P_a)

Renin Sampling In the Left Renal Artery

Renin Sampling In the Right Renal Vein



Distal Renal Pressure (Radi PressureWire, P_d)

Renin Sampling In the Left Renal Vein