

PCI for Renal Artery stenosis

Why should we treat Renal Artery Stenosis?

Natural History of RAS

RAS is progressive disease

Study	Follow-up (months)	Pts	Progression N (%)	Total occlusion
Wollenweber	12 ~ 88	30	21 (70 %)	
Meaney	6 ~ 120	39	14 (36)	3 (8%)
Dean	6 ~ 102	35	10 (29)	4 (11)
Schreiber	12 ~ 60	85	37 (44)	14 (16)
Tollefson	15 ~ 180	48	34 (71)	7 (15)
TOTAL	6 ~ 180	237	116 (49)	28 (14)

Rimmer et al. Ann Intern Med 1993;118:712-9

Renal Artery Stenosis

Clinical Consequences

Cardiovascular

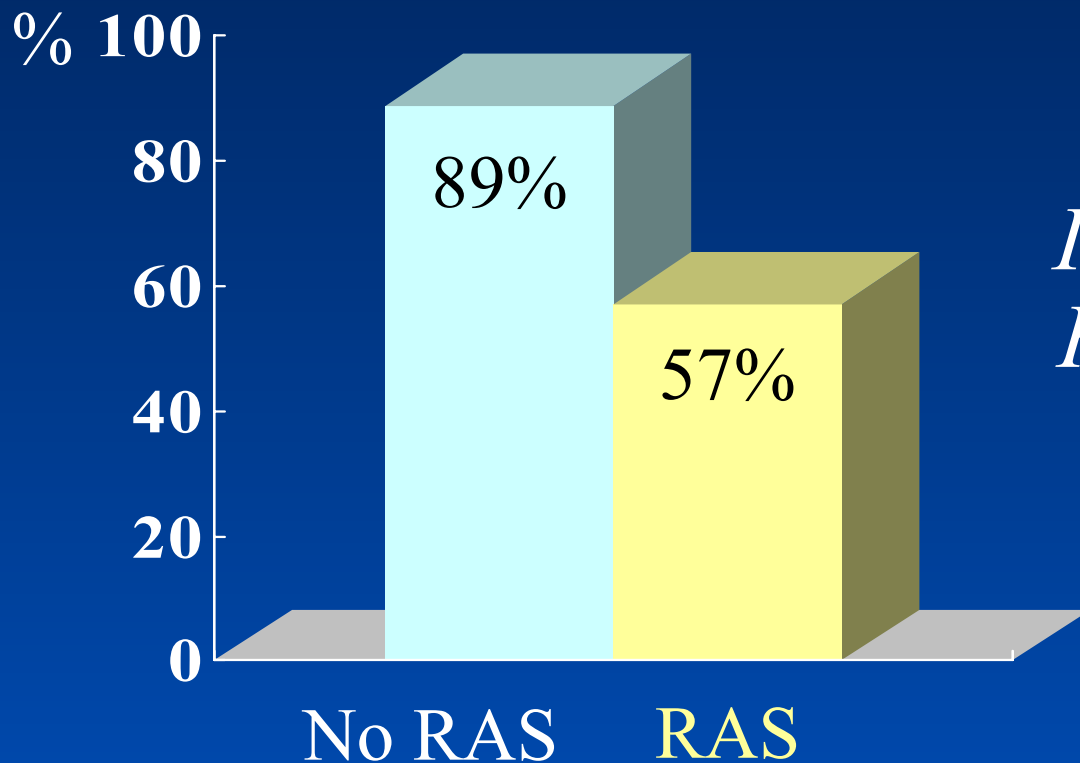
- Angina pectoris
- “Flash” pulmonary edema
- Myocardial infarction
- Left ventricular hypertrophy
- Stroke
- Aortic dissection

Renal

- Chronic renal insufficiency
- End-stage renal disease

Renal Artery Stenosis

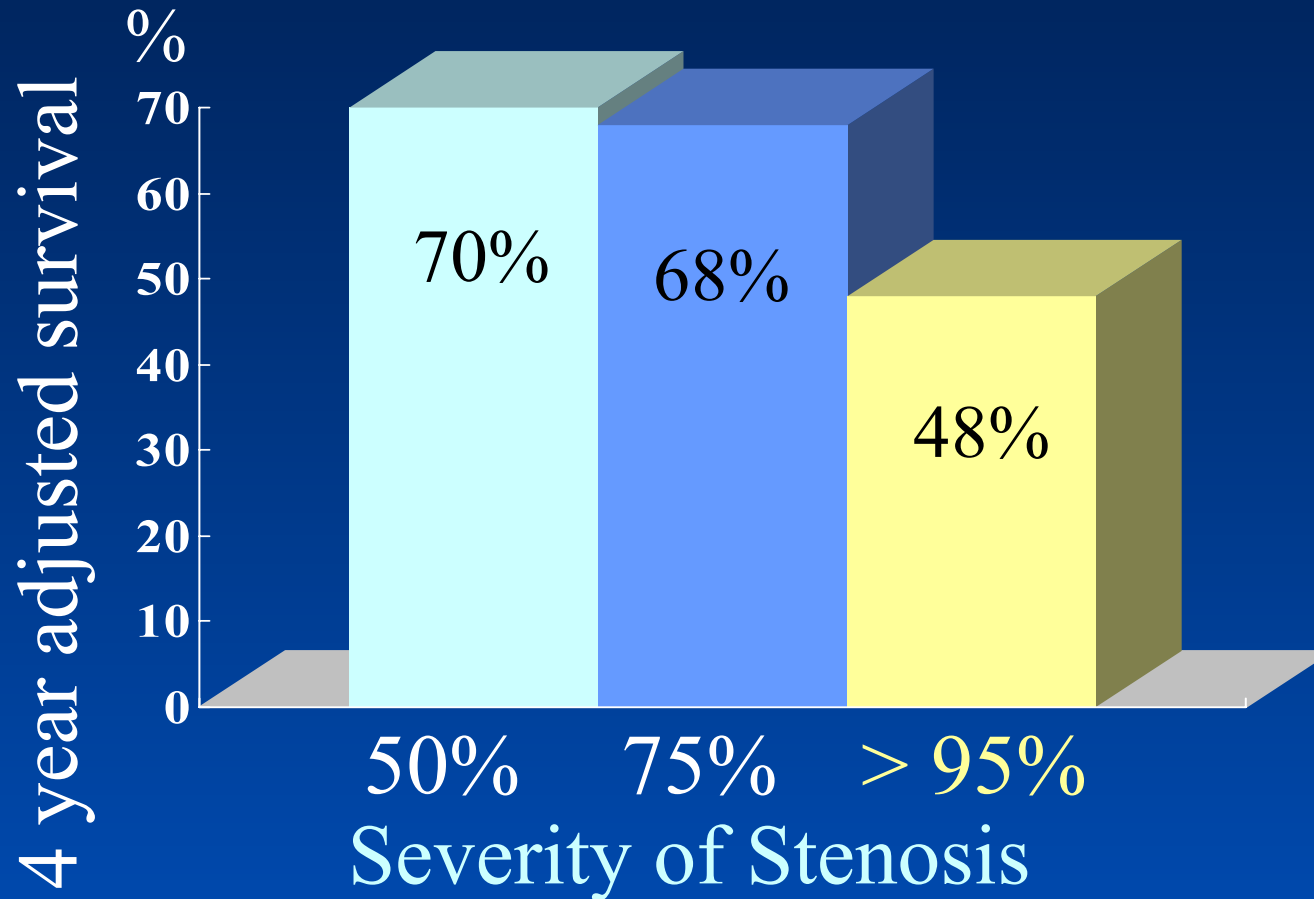
4 year adjusted survival



*Independent
Predictor of
Mortality*

Conlon et al. Kidney Int 2001;60(4):1490-7

Severity of RAS vs Survival



Conlon et al. Kidney Int 2001;60(4):1490-7

Why should we treat Renal Artery Stenosis ?

Improve Morbidity / Mortality



Salvage
Renal Function



Adequate
BP Control

Medical Treatment

Aggressive pharmacologic therapy is sufficient for adequate BP control and maintenance of renal function ?

Outcome of RAS

Medical treatment

69 pts with RAS > 70%, Follow-up 36 Mo

- Mean Cr : 1.4 → 2.0 mg/dl (p<0.05)
- SBP : 157 mmHg → 155 mmHg (p=NS)
- 10 % progressed to ESRD
- 10 % progressed to renal intervention
- 29 % mortality

Chabova V et al. Mayo Clin Proc 2000;75:437-44

Outcome of RAS

Managed without Revascularization

Renal Insufficiency can be
progressive
despite aggressive BP control

Renal Artery Stenosis

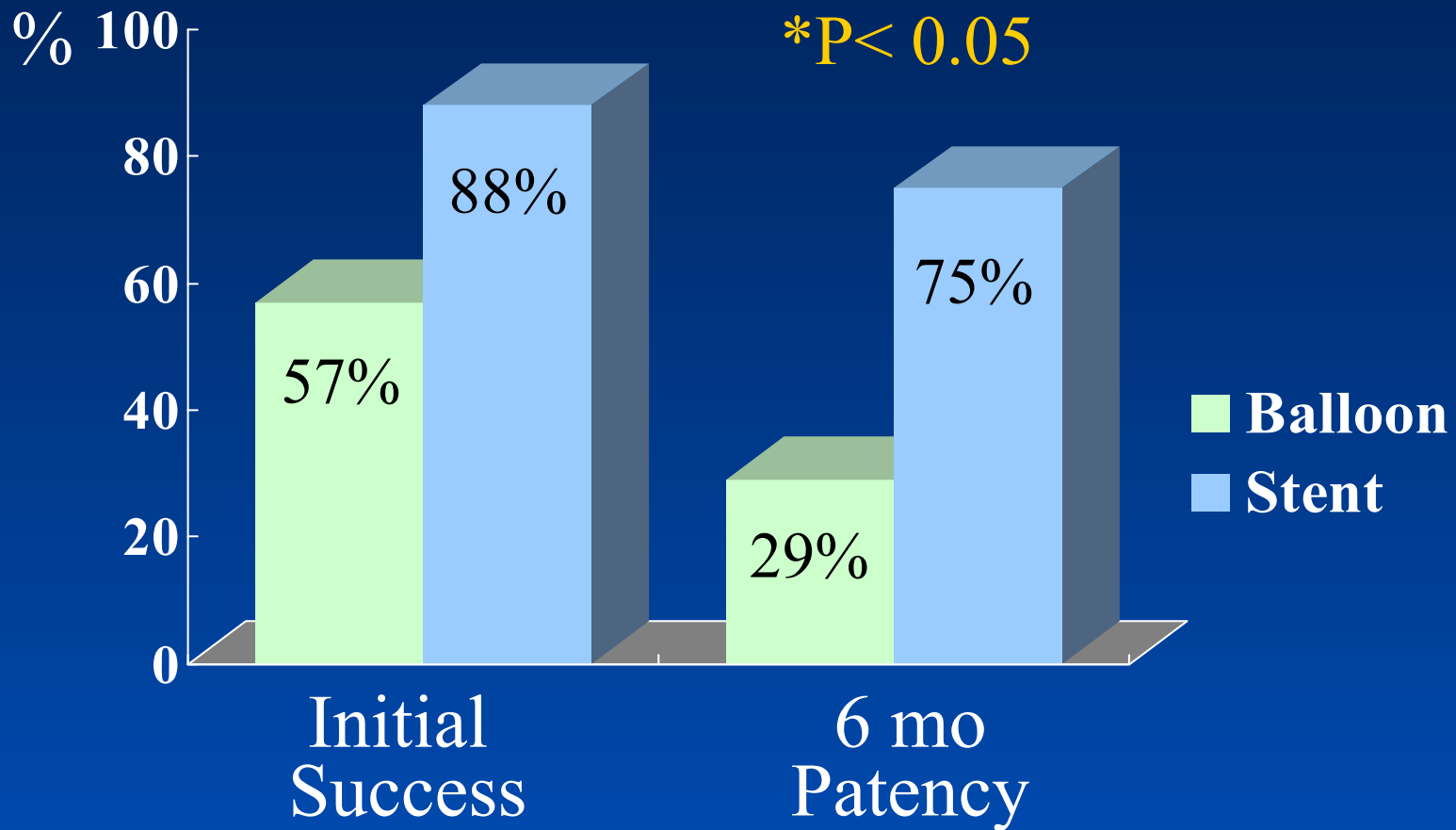
Rationale for Invasive Treatment

- Progressive disease
- Cause of hypertension and decline in renal function
- Associated with increased mortality
- Limited benefit of aggressive medical therapy

Renal Artery stenosis

Should we stent it ?

POBA vs Stent



Van de Ven et al. Lancet 1999;353:282-86

Renal Artery Stenting

Technical Success

Study series	No. of Arteries	Ostial Lesion(%)	Success (%)
Rodriguez-Lopez	125	66	98
Henry	104	77	99
Rocha-Singh	180	43	98
Tuttle	148	100	98
Dorros	202		99

~ 98%

Lim and Rosenfield, Curr Int Cardiol 2000;2:130-9

Renal Artery Stenting

Restenosis

Study	RA evaluated (% original total a.)	F/U (mo)	Restenosis (%)
van de Ven	52 (95%)	6	21
Rocha-Singh	158 (88%)	13	12
Rundback	28 (52%)	12	26
Tuttle	49 (33%)	8	14
White	80 (60%)	9	19

~ 20%

Lim and Rosenfield, Curr Int Cardiol 2000;2:130-9

Renal Artery Stenting

- Technically Feasible
- Safe & Durable
- Superior to Balloon

Renal Artery Stenting

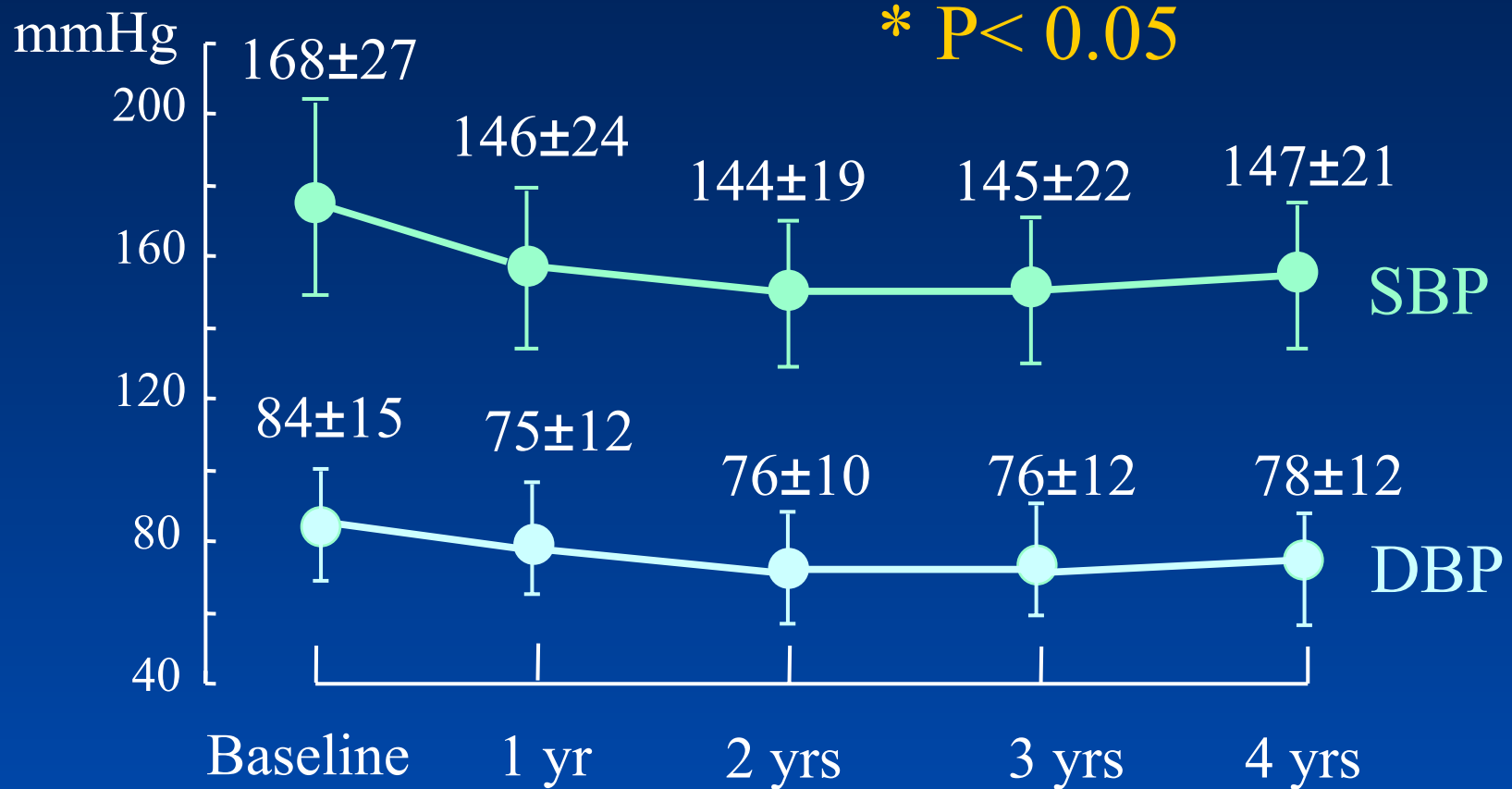
However,

*Is it effective in improving
Hypertension & slowing
progressive decline in renal
function ?*

Renal artery stenting ?

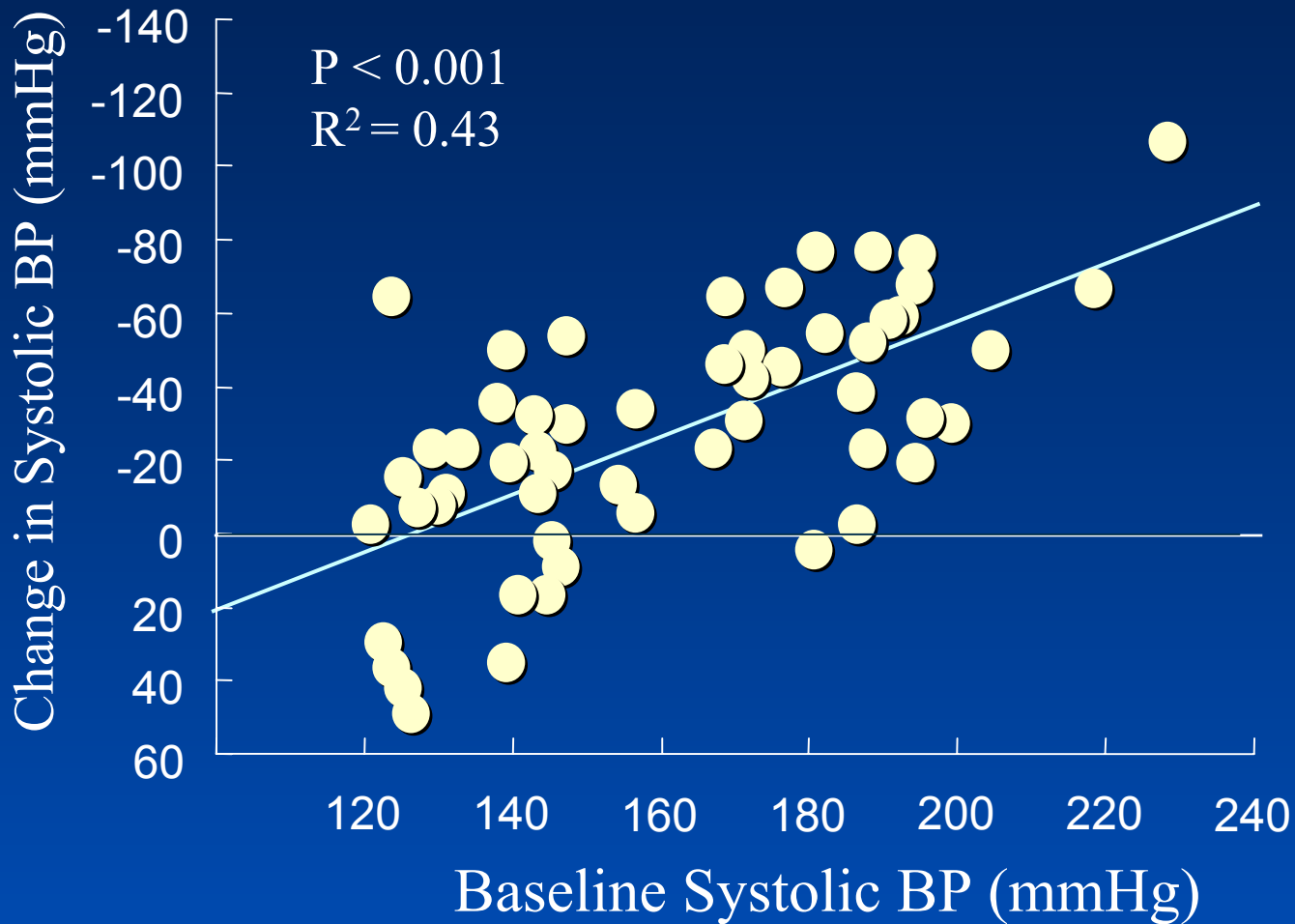
Effect on hypertension

BP Change after Stenting



Doroso G, et al. Cathet Cardiovasc Intervent 2002;55:182-188

BP Change by Baseline BP



Burket MW, et al. *Am Heart J* 2000;139:64-71

Renal Artery Stenting

Effect on Hypertension

Study series	No.	Cure (%)	Improved (%)	Benefits (%)
Tegtmeyer	65	23	71	94
Klinge	134	10	68	78
Martin	94	22	46	68
Lossino	153	12	51	63
Rodriguez-Perez	37	0	81	81
Blum	74	16	62	78
Pooled Result	586	14	63	~ 77%

Effect on hypertension

Cure 12 ~ 23 %

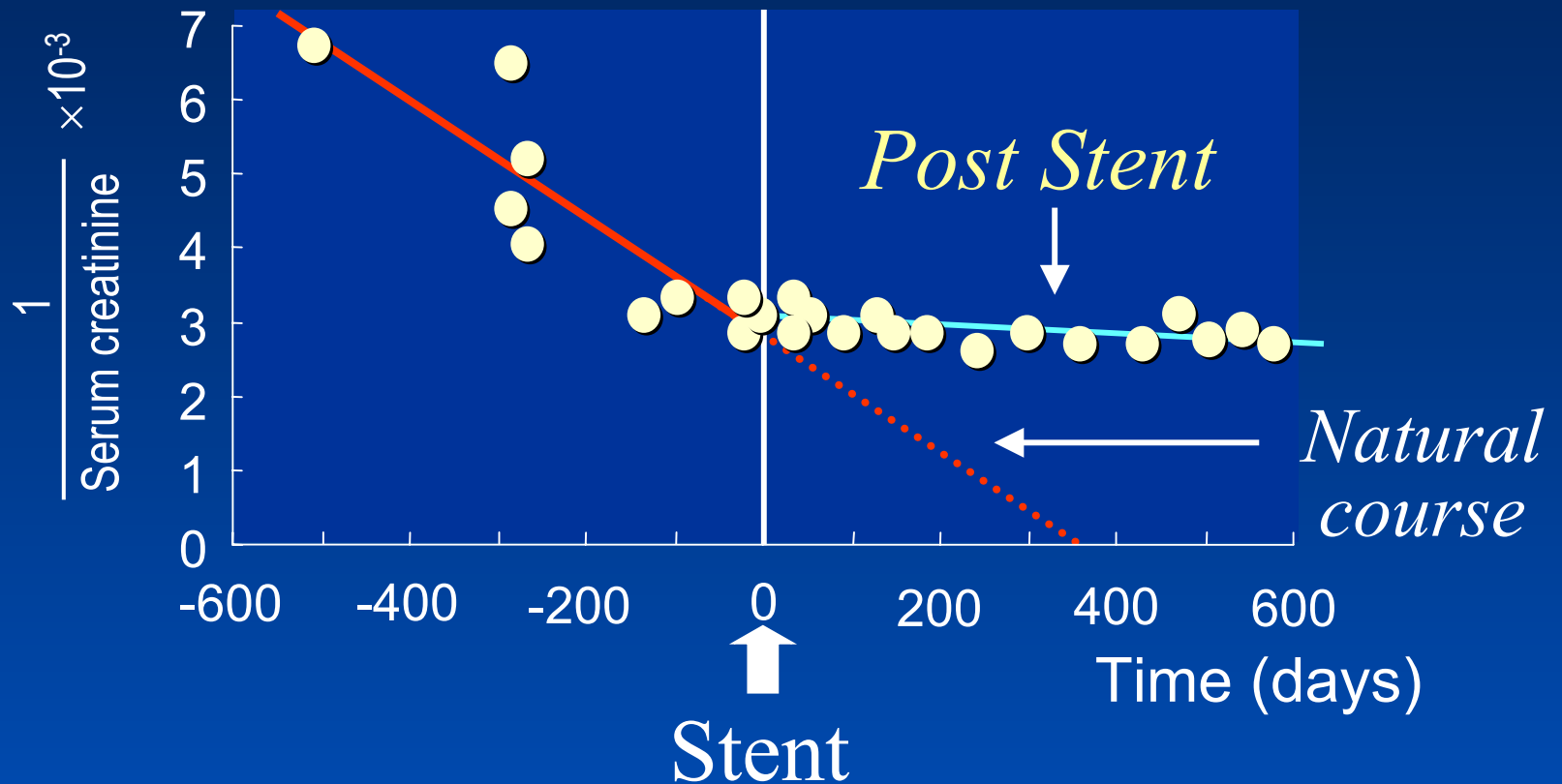
Improved 46 ~ 81 %

Renal artery stenting

Can We Salvage Renal Function ?

Stabilization of Renal Function

Reciprocal serum creatinine plot



Harden, et al. Lancet 1997;349:1133-6

Renal Artery Stenting

Effect on Renal Function

Study	No	Improved (%)	Stable (%)	Deteriorated (%)
Van de Ven	42	12	62	26
Rocha-Singh	150	22	70	8
Tuttle	129	15	81	4
Dorros	163	18	48	34
Rundback	45	20	47	33
Harden	32	34	38	28
TOTAL	561	19%	62%	19 %

Lim and Rosenfield, Curr Int Cardiol 2000;2:130-9

Renal Artery Stenting

Effect on Renal Function

- Improved 23 ~ 41%
- Stabilized 29 ~ 100 %
- Deteriorated 5 ~ 38 %

Renal Artery Stenting

- Technically Feasible
- Safe & Durable
- Superior to Balloon
- Effective in improving HTN
- Beneficial to preserve renal function

Renal Artery Stenting

Superior to Surgery ?



No Randomized Trials of
Renal Artery Stenting vs
Surgery

Surgical Revascularization

Aorto-renal bypass
Renal endarterectomy

Death	2 ~ 6 %
MI	2 ~ 9 %
Stroke	0 ~ 3 %
Bleeding	2 ~ 3 %
Cholesterol Emboli	1 ~ 4 %

Libertino JA, et al. J Urol 1992;147:1485-7
Cambria RP, et al. J Vasc Surg 1994;20:76-87
Clair DG, et al. J Vasc Surg 1995;21:926-34

Late Results of Surgery

5 year results

- Graft failure 6 ~ 18 %
- Reoperation 5 ~ 15 %

Libertino JA, et al. J Urol 1992;147:1485-7
Cambria RP, et al. J Vasc Surg 1994;20:76-87
Clair DG, et al. J Vasc Surg 1995;21:926-34

Renal artery stenting

- Acute success rate $> 98 \%$
- Restenosis $< 15 \%$

Renal Artery Stenting

- Technically Feasible
- Safe & Durable
- Superior to Balloon
- Effective in improving HTN
- Beneficial to preserve renal function
- Safer than surgery
- FDA approved (July 10, 2002)

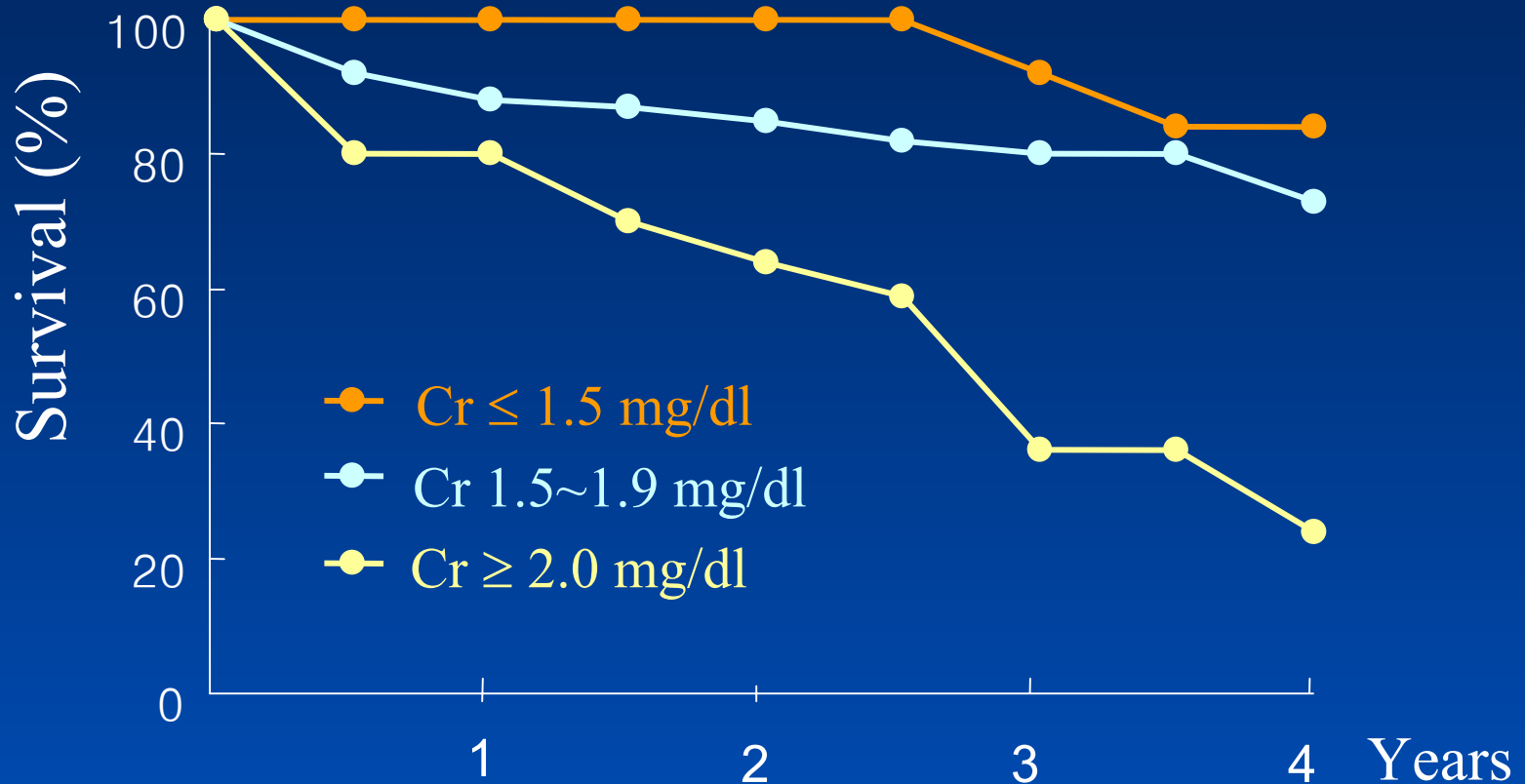
Renal artery stenting

Long-Term Survival

Do All Benefit ?

Survival after Stenting

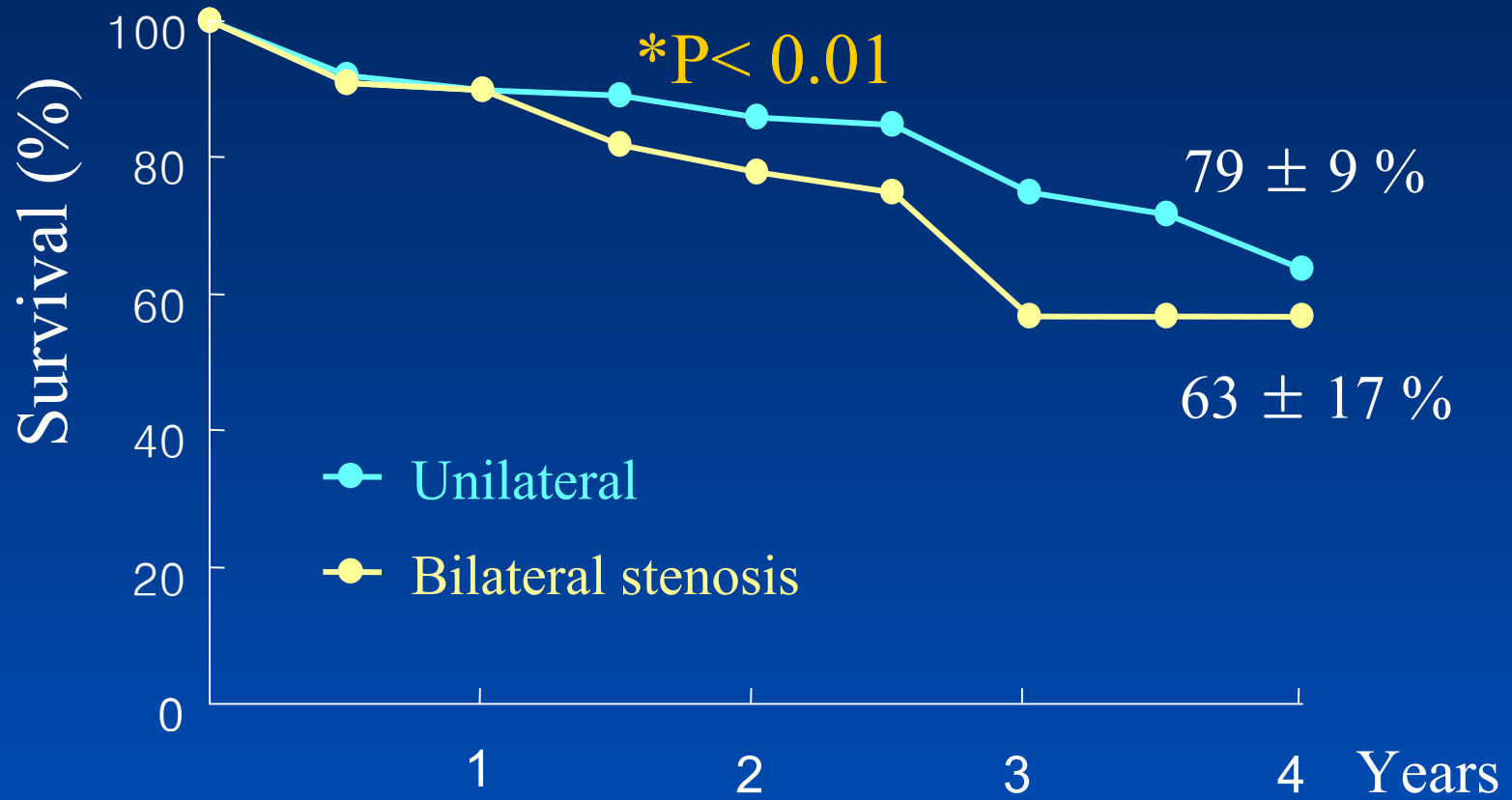
Categorized by baseline Creatinine



Dorros, et al. Circulation 1998;98:642-647

Survival after Stenting

Unilateral vs Bilateral Stenosis



Dorros, et al. Circulation 1998;98:642-647

Survival after Stenting

4 year survival (N=1058)

Baseline creatinine

- Cr \leq 1.4 mg/dL 85 \pm 3% (622)
- Cr 1.5 - 1.9 mg/dL 78 \pm 5% (168) *
- Cr \geq 2.0 mg/dL 49 \pm 5% (268) *

*P < 0.05

Doroso G, et al. Cathet Cardiovasc Intervent 2002;55:182-188

Survival after Stenting

4 year survival (N=1058)

Renal artery stenosis

Baseline creatinine

- Cr \leq 1.4 mg/dL
- 1.5 - 1.9 mg/dL
- Cr \geq 2.0 mg/dL

Unilateral

86 \pm 3% (397)
78 \pm 7% (103)
49 \pm 5% (173)

Bilateral

85 \pm 7% (225)
78 \pm 5% (65)
49 \pm 5% (95)

Doroso G, et al. Cathet Cardiovasc Intervent 2002;55:182-188

Renal Artery Stenting

Beneficial impact on survival

Renal artery stenting before the
onset of renal dysfunction !

“Dark side” of Renal Artery Stenting

Atheroembolism...

Incidence of Atheroembolism

During Renal Artery Stenting

Study	No	Embolism
Van de Ven	42	7 %
Rocha-Singh	42	5.9 %
White	150	2 %

Promoting Factors of Atheroembolism

Procedural

- Length of the procedure
- Difficulties of the procedure
- Size of the devices
- Primary stenting
- High pr. dilatation
- Guiding catheter intubation

Clinical

- Elderly (> 60 years)
- Male
- Renal insufficiency
- Multisegment dis
- Associated aorta / peripheral lesions
- Anticoagulants – Fibrinolytic drugs

Distal Protection During Renal Artery Stenting

*Will it make a difference ?
Should we use it ?*

Distal Protection

60 pts, 69 renal arteries

Distal protection : occlusion balloon (n=38)
filter (n=31)

- Success 100%, mean particle No.= 98 ± 60
- Follow - Up @ 6-mo

Renal function deterioration	0 pts
improvement	8 pts

Distal Protection may prevent renal insufficiency after procedure.

Henry, et al. TCT 2003

In Conclusion

Renal Artery Stenting

- Effective and Safe
- Sustained Benefit
- Choice for Complex

Renal Artery Stenosis

Renal Artery Stenting

In the near future

Outcomes will be advanced by

- Improved stents/delivery systems
- Distal protection device
- Drug – eluting stent