Renal artery stenting
clinical indications and benefits

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The prevalence of renal artery stenosis
“Open renal arteries are better than closed arteries”

White CJ. Cather Cardiovasc Diagn 1998;45:9-10
Renal artery interventions in US


- Atherosclerotic renal artery stenosis: overtreated but underrated?

- Textor SC.
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[Bar chart showing data: 7660 in 1996, 18520 in 2000, 35000 in 2005]
• Few clinical questions provoke more controversy and debate among cardiologists, internists and nephrologists than decisions about the optimal management of patients with renal artery stenosis. Even well-informed clinicians from different subspecialties hold widely divergent opinions about the role of renal revascularization particularly for atherosclerotic disease.”

Garovic VD, Textor S. Circulation. 2005;112:1362-74
Main questions
indications for endovascular treatment

1. Incidental stenosis (kidney preservation)
2. Hypertension
3. Function decline
Recommendations for renal artery revascularisation—from Hirsch et al (2006)\(^7\)

**Asymptomatic stenosis**

- The usefulness of percutaneous revascularisation of an asymptomatic unilateral haemodynamically significant RAS in a viable kidney is not well established and is presently clinically unproved (class IIb: LOE C)
- Percutaneous revascularisation may be considered for treatment of an asymptomatic bilateral or solitary viable kidney with a haemodynamically significant RAS (class IIb: LOE C)
Incidental renal artery stenosis in peripheral vascular disease: A case for treatment?

• In a retrospective study, a cohort of consecutive patients was followed who had undergone angiography 8 to 10 years previously for peripheral artery disease.

• RAS was present in 126 of 386 evaluable patients (33%). The serum creatinine levels remained stable during follow-up in both patients with RAS and controls. None of these patients required renal replacement therapy during the 10-year follow-up
The natural history of **incidental** renal artery stenosis in patients with aortoiliac vascular disease


• *there was no statistically significant difference* \((P = 0.88)\) *in the mean change in serum creatinine concentration per year in the 78 patients with renal artery stenosis* \((0.06+/-0.33 \text{ mg/dL per year})\) *as compared with the 96 patients without renal artery stenosis* \((0.06+/-0.22 \text{ mg/dL per year})\).
Asymptomatic stenosis

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Incidental stenosis
Coaxial technique

Renal ostium
Is hypertension an indication for PTRA/stenting?

- There is no published evidence directly comparing angioplasty with stent placement and “aggressive” medical treatment with currently available drugs for RAS.
- Few randomized controlled trials directly compared angioplasty without stent placement to medical treatment, with outcomes primarily reported at 6 and 12 months.
The DRASTIC study

- Randomized: 56 PTA and 50 medical therapy
- Stenosis > 50%
- Creatinine level < 2.3 mg/dL
- Diastolic pressure > 95 mmHg with 2 drugs or
- Cr Increase > 0.2 mg/dL with ACE inhibitors

At 3 and 12 months:
- BP, number of drugs and RF

At 12 months:
- Angiographic patency
The DRASTIC study
BP at 3-month

<table>
<thead>
<tr>
<th></th>
<th>PTRA</th>
<th>Medical</th>
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<tbody>
<tr>
<td>Systolic</td>
<td>169</td>
<td>176</td>
</tr>
<tr>
<td>Diastolic</td>
<td>99</td>
<td>101</td>
</tr>
</tbody>
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P: 0.25

P: 0.36
Antihypertensive Meds

PTRA vs MEDICAL

BASELINE: P = NS
3 MONTHS: P = .002
12 MONTHS: P = .002
The DRASTIC study
RF at 3 and 12 months

• While renal function was improved at 3 months in those undergoing angioplasty, the function at 12 months was similar.
The DRASTIC study conclusions

- In the treatment of patients with renal artery stenosis and hypertension, angioplasty has little advantage over antihypertensive-drug therapy.
- Restricting angioplasty to those with atherosclerotic renovascular hypertension persisting despite use of 3 or more antihypertensive medications was prudent.

but
The DRASTIC study

1. The patients in this trial did not undergo angioplasty with stent placement.

2. 9% of patients in the drug therapy group experienced total occlusion of the affected renal artery on 12-month follow-up angiography.

3. In the drug therapy group 22/50 patients underwent balloon angioplasty after 3 months because a persistent hypertension despite 3 or more drugs or because a deterioration in the renal function.
Ongoing randomized trials

- ASTRAL
- NITER
- STAR
- CORAL
- RAVE
CORAL: “Cardiovascular Outcomes in Renal Atherosclerotic Lesions” (U.S., Canada, Australia and New Zealand)

- Primary endpoint: Event-free survival from CV and renal adverse events, defined as composite of CV or renal death, stroke, MI, hospitalization for CHF, progressive renal insufficiency, or need for permanent renal replacement therapy during a 5-year follow up

- “Study start: April 2004; Expected completion: March 2010”; recently expanded to Australia and New Zealand
The ASTRAL study

- 806 patients (54 centers in UK, Australia, New Zealand)
- Hypertension
- Creatinine: >2.0 mg/dL
- Mean degree of stenosis: 76%
- Randomisation: stent + BMT vs BMT
SCAI-ACC scientific meeting
Chicago April 1, 2008
ASTRAL study 1-year follow up

- No difference in SCL (> 0.2 mg/dL in both groups)
- No difference in BP
- No difference in the rate of renal events
- No difference in the rate of heart attacks and stroke
- No difference in risk-adjusted mortality
- Even in the highest-risk patients (highest CRL, rapid decrease of RF): no benefit of stenting
SCAI-ACC scientific meeting  
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1. “In this study we were looking at the majority of patients with renal artery stenosis—those in whom there is substantial uncertainty about whether to revascularize.

2. “The message is: you don’t put a stent in these patients without more careful evaluation. More often than not, it will make no difference whatsoever in clinical outcomes.

3. However, some patients with renal artery stenosis have more definite indications for revascularization, such as acute renal failure or severe acute heart failure, and they should continue to receive this therapy.”

Kalra PA, for the ASTRAL study
PTRA versus medical therapy

• “Available data are insufficient to conclude that PTA is superior to medical therapy in lowering blood pressure in patients with RAS in whom blood pressure can be controlled by medicaments”

• “In patients with hypertension refractory to medical therapy, there is some weak evidence that PTA lowers bp more effectively than medical therapy”

Cochrane database syst review 2003
An indication to PTRA: FMD

- Renovascular hypertension
- High rate of benefit
- High complexity of procedure
- Difficulty in estimating the technical result
Is renal insufficiency an indication for endovascular intervention?

- In several studies renal function has been shown to improve or stabilize after angioplasty
- To date, level one evidence supporting endovascular treatment for renal function improvement based on randomized prospective controlled trials is lacking
ASTRAL study 1-year follow up preliminary report

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The characteristics of dissemination of embolic materials during renal artery stenting.

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BACKGROUND: Though one of the major complications of renal artery stenting is dissemination of embolic materials which may cause deterioration of renal function, the characteristics of this phenomenon are unclear. We investigated the characteristics of embolization in renal artery stenting by intrarenal duplex ultrasound monitoring. METHOD: A total of 17 patients with 21 lesions that underwent primary renal artery stenting were prospectively included. Intrarenal artery blood flow velocity spectra exhibiting microembolic signals (MES) were examined during renal artery intervention. RESULT: Renal artery stenting was successful in all cases. Predilatation was needed in eight cases, and direct stenting without predilatation was performed in 13 cases. Postdilatation or flare formation was performed in 13 cases. Multiple stenting was not performed in any patients, though stenting of both renal arteries was performed in four cases. Major embolization and no reflow/slow flow were not determined by angiography. Except for one case of technical kidney failure, real-time intrarenal duplex ultrasound monitoring was possible and the study protocol was completed. MES were detected during all procedural phases. The number of cardiac beats with MES was significantly higher in stenting (11.1 +/- 2.8) following postdilatation flare formation (8.3 +/- 4.1) than in predilatation (3.3 +/- 2.1) (predilatation vs. stenting: P < 0.001, predilatation vs. postdilatation/flare: P = 0.009, stenting vs. postdilatation/flare: P = 0.03). The mean creatinine value was 1.31 +/- 0.68 mg/dl at baseline and 1.54 +/- 1.08 at 1 month. Deterioration of renal function was observed in 43% (3/7) of patients with renal impairment, whereas 10% (1/10) of patients without renal impairment experienced deterioration of renal function (P = 0.250). CONCLUSION: Dissemination of embolic materials was detected in all procedures. Higher MES were detected in stenting following postdilatation/flare formation. Pre-existing renal impairment yielded a trend toward the deterioration of renal function after renal artery stenting during the short-term follow-up. Protected renal artery stenting might be considered advisable, at least in atherosclerotic renal artery stenosis patients with renal impairment though a larger number and long-term study will be required.
Does distal embolization affect renal intervention? Are filters effective?

Literature data report that up to 20% of patients have potential deterioration in their renal function for atheroembolization.

Excellent results for renal preservation at 6-month using distal embolic protection device (60% of the filter baskets contained embolic material).

Holden A et al. Kidney Int. 2006

“...although we frequently use distal protection device during RAS a consensus or general recommendation for using them during RAS cannot be made at this time”...

Dave R. Endovascular Today 2007
Systematic Review: Comparative Effectiveness of Management Strategies for Renal Artery Stenosis Balk E. et al.

- Available evidence does not clearly support one treatment approach over another for atherosclerotic renal artery stenosis.

Unselected patients
The treatment
Two opposite view

- Think before acting
  - Atherosclerotic renal artery stenosis – When is intervention by PTRA or surgery justified?
    Zuccalà and Zucchelli
    Nephrol Dial Transplant 1995; 10:585-8

- Find it and fix it
  - Open renal arteries are better than closed arteries”
    White CJ. Cather Cardiovasc Diagn 1998;45:9-10
Waiting for the ongoing trials

• Diagnosis is important

• Technical aspects must be considered

• Patients should be selected

All these are called “stenosis”, but....
Since many years...

Patients at risk for ARAS

Non-invasive renal artery imaging

ARAS ≥ 50%

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Resistant HTN
Pulmonary edema
Progressive azotemia
Drop in Ccr during ACEI

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Age <60 or high grade/bilateral stenosis and patient preference

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Noninvasive treatment

6-monthly follow-up

Drop in Ccr or kidney length

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Catheter angiography, PTRA ± stenting

Plouin P-F et al., JASN 2001;12:2190-6
.....to the present

- Revascularization is usually indicated in patients with hemodynamically significant lesion who have resistent hypertension, malignant hypertension, hypertension with an otherwise unexplained unilateral small kidney, an inability to tolerate anti-hypertensive medications, and recurrent episodes of flash pulmonary edema or perhaps unstable angina, especially if the patient is below the age of 50 to 60.

- Revascularization may also be indicated in patients who develop progressive and otherwise unexplained renal failure.