2022 MID-ATLANTIC CONFERENCE

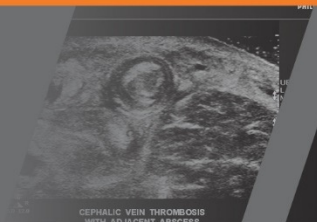
10th ANNUAL CURRENT CONCEPTS IN

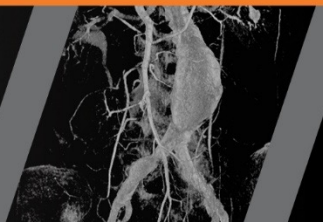
VASCULAR THERAPIES

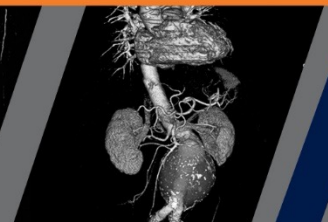
2022

Hilton Virginia Beach Oceanfront
Virginia Beach, Virginia

APRIL 28-30







Sentara Vascular Specialists

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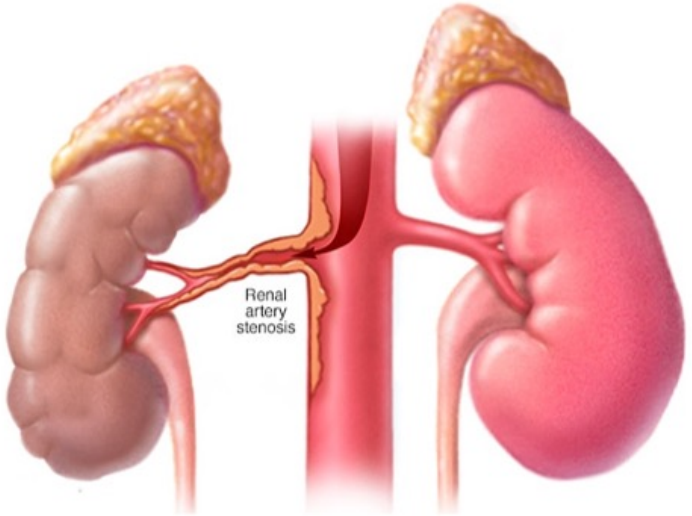
Renovascular hypertension



Jurabek Babadjanov MD
Riverside Vascular Specialists
Newport News VA

- No disclosures

Background

- High blood pressure affects 75 million adults in the US and accounts for 8.6% of all primary care visits.

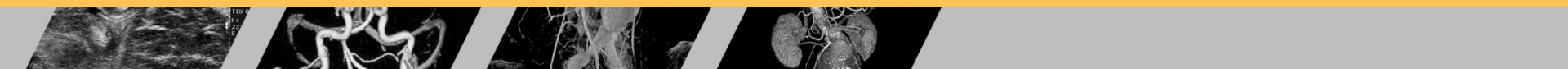
- Providing care for uncontrolled hypertension costs $48.6 billion each year.

Hypertension

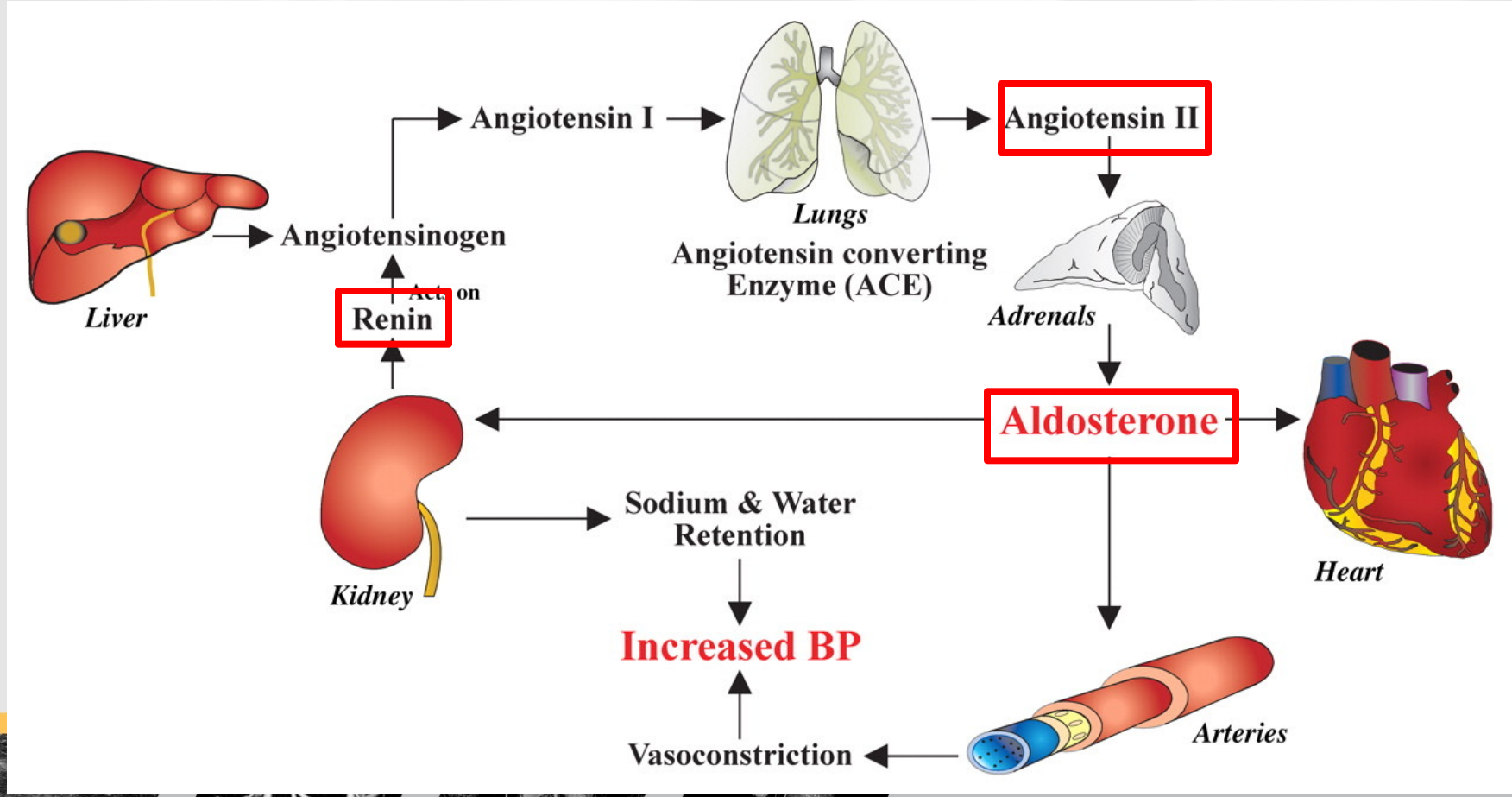
- Essential hypertension (90%)
- Secondary hypertension (10%)
  - Renovascular hypertension (75%)

Most common causes of renovascular hypertension

- Renal artery stenosis (RAS), secondary to atherosclerosis
- Fibromuscular dysplasia (FMD)
- Autoimmune disease (Takayasu's)
- Renal artery dissection or infarction
- Radiation fibrosis
- Obstruction from aortic endovascular grafts
- Extrinsic compression of a renal artery
- Mid aortic syndrome (younger patient)

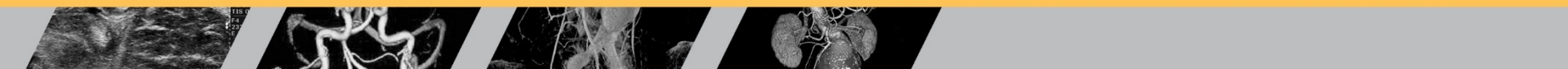


Renin angiotensin aldosterone system



History and Physical

- Uncontrolled BP necessitating the use of 2-3 antihypertensive agents of different classes.
- History of multiple hospital admissions for hypertensive crisis
- Elevation in creatinine >30% after starting an angiotensin-converting enzyme inhibitor (ACE-I).
- Smoking, presence of other atherosclerotic diseases (carotid artery stenosis, PVD, CAD).
- Recurrent episodes of flash pulmonary edema and/or unexplained CHF.
- Children and young females with malignant hypertension.

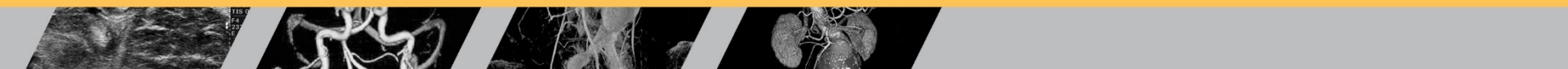


Diagnosis

- Many individuals incidentally found to have RAS on ultrasound or angiogram are asymptomatic.
  - Robust intrinsic adaptive responses
  - Kidney may be so damaged that it is incapable of significant renin release.

Hansen KJ, Edwards MS, Craven TE, et al. Prevalence of renovascular disease in the elderly: a population-based study. *J Vasc Surg*. 2002;36:443–451.

Edwards MS, et al. Relationships between renovascular disease, BP, and renal function in the elderly: a population-based study. *Am J Kidney Dis*. 2003;41:990–996.



Renal duplex diagnostic criteria

Condition	Systolic velocity	Renal-aorta index
Normal	< 180 cm/s	< 3.5
Stenosis < 60%	> 180 cm/s	< 3.5
Stenosis > 60%	> 180 cm/s	> 3.5
Obstruction	Absente	-

Transplant renal artery stenosis:

PSV> 200

RA:iliac artery ratio > 1.8

Intrarenal parvus tardus waveform

Renal duplex diagnostic criteria

- Resistive index (RI)
  - Normal < 0.7
  - A value > 0.7 indicates the presence of pathological resistance to flow.
  - A value >0.8 predicts poor response to revascularization.

Management of RAS

- When to intervene?
- How to manage?

When to intervene?

- Treatment of hemodynamically significant RAS in a patient with:
  - Severe multidrug resistant hypertension (on 3-4 medications).
  - Rapidly progressive decline in renal function.
  - Salvageable renal mass.

How to manage?

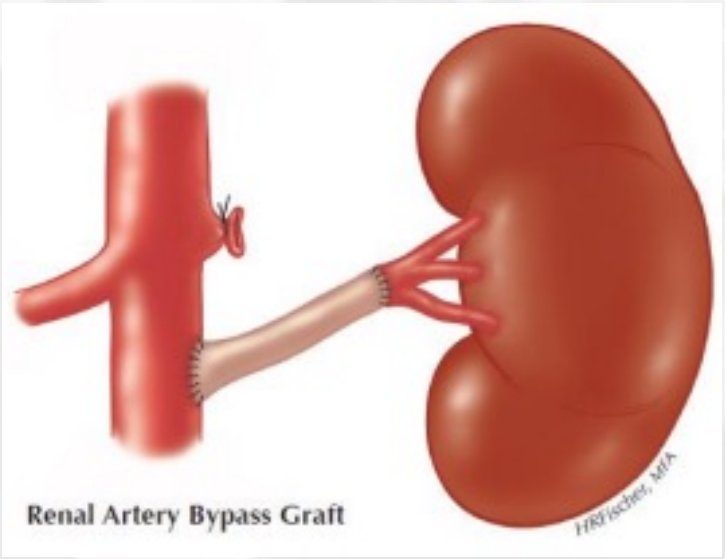
- Optimal medical therapy
- Surgical revascularization:
  - Renal/aortic endarterectomy
  - Renal artery bypass
- Percutaneous intervention:
  - Angioplasty with selective/routine stenting

Optimal medical therapy

- Tight BP control to <130/80.
- Tight glycemic control (HbA1c < 7%).
- Control of hyperlipidemia (LDL cholesterol < 70).
- Antiplatelet agents.
- Lifestyle modifications:
  - Avoidance of tobacco
  - Normalization of body weight

Open interventions

Aortorenal endarterectomy



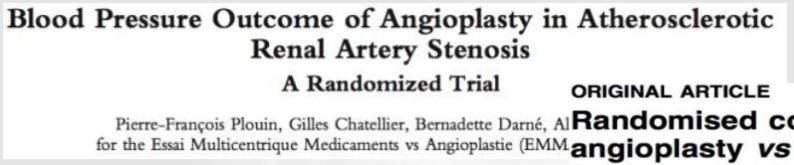
Renal artery bypass

Open interventions

- Open revascularization proved effective at improving HTN, **but not every patient benefited**.
- Surgery improved BP in up to 85% of patients but in 15% BP was no better or worse. Greater experience with open revascularization demonstrated that the major benefit in terms of **improving survival related to the impact of surgery on renal function rather than HTN**.
- If estimated glomerular filtration rate (eGFR) stabilized or improved after surgery, then patients demonstrated improved dialysis-free survival, **independent of the impact on HTN**.

Cherr GS, Hansen KJ, Craven TE, et al. Surgical management of atherosclerotic renovascular disease. *J Vasc Surg*. 2002;35:236–245.
Hansen KJ, et al. Dialysis-free survival after surgical repair of ischemic nephropathy. *Cardiovasc Surg*. 2002;10:400–404.

Does the stenting help in treating HTN and renal failure?



Blood Pressure Outcome of Angioplasty in Atherosclerotic Renal Artery Stenosis

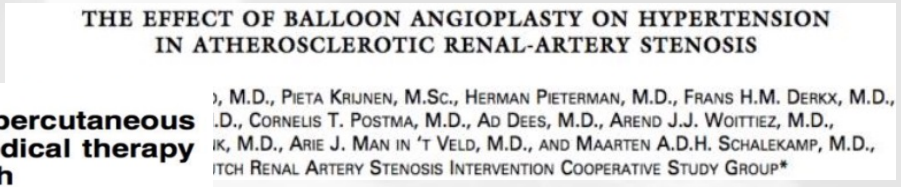
A Randomized Trial

Pierre-François Plouin, Gilles Chatellier, Bernadette Darné, Al
for the Essai Multicentrique Medicaments vs Angioplastie (EMM

ORIGINAL ARTICLE

Randomised comparison of percutaneous angioplasty *vs* continued medical therapy for hypertensive patients with atheromatous renal artery stenosis

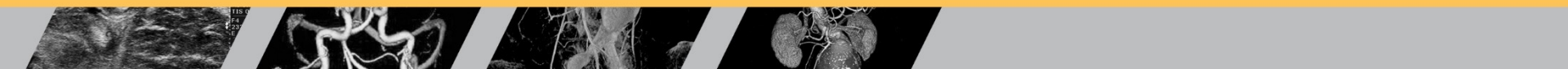
J Webster, F Marshall, M Abdalla, A Dominiczak, R Edwards, CG Isles, H Loose, J Main, P Padfield, IT Russell, B Walker, M Watson and R Wilkinson, on behalf of the Scottish and Newcastle Renal Artery Stenosis Collaborative Group



THE EFFECT OF BALLOON ANGIOPLASTY ON HYPERTENSION IN ATHEROSCLEROTIC RENAL-ARTERY STENOSIS

), M.D., Pieta Krijnen, M.Sc., Herman Pieterman, M.D., Frans H.M. Derkx, M.D., .D., Cornelis T. Postma, M.D., Ad Dees, M.D., Arend J.J. Woittiez, M.D., ik, M.D., Arie J. Man in 't Veld, M.D., and Maarten A.D.H. Schalekamp, M.D., itch Renal Artery Stenosis Intervention Cooperative Study Group*

- 59-210 pts with unilateral or bilateral >50% renal artery stenosis.
- Primary outcomes: BP in one and BP + creatinine in the others.
- No difference in BP control or renal function improvement between groups.
- High procedural complication rate (up to 28%).
- Biased study designs, filtering our eligible patients…



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ORIGINAL ARTICLE

Revascularization versus Medical Therapy for Renal-Artery Stenosis

The ASTRAL Investigators*

N Engl J Med 2009;361:1953-62.

Revascularization versus Medical Therapy for Renal-Artery Stenosis

The ASTRAL Investigators*

- 806 patients with RAS: BMT or revascularization+BMT.
- Primary outcome: renal function. Secondary outcome: HTN.
- 5 years follow-up.
- Procedure related complications occurred in 23 patients: 2 deaths and 3 amputations.
- Results:

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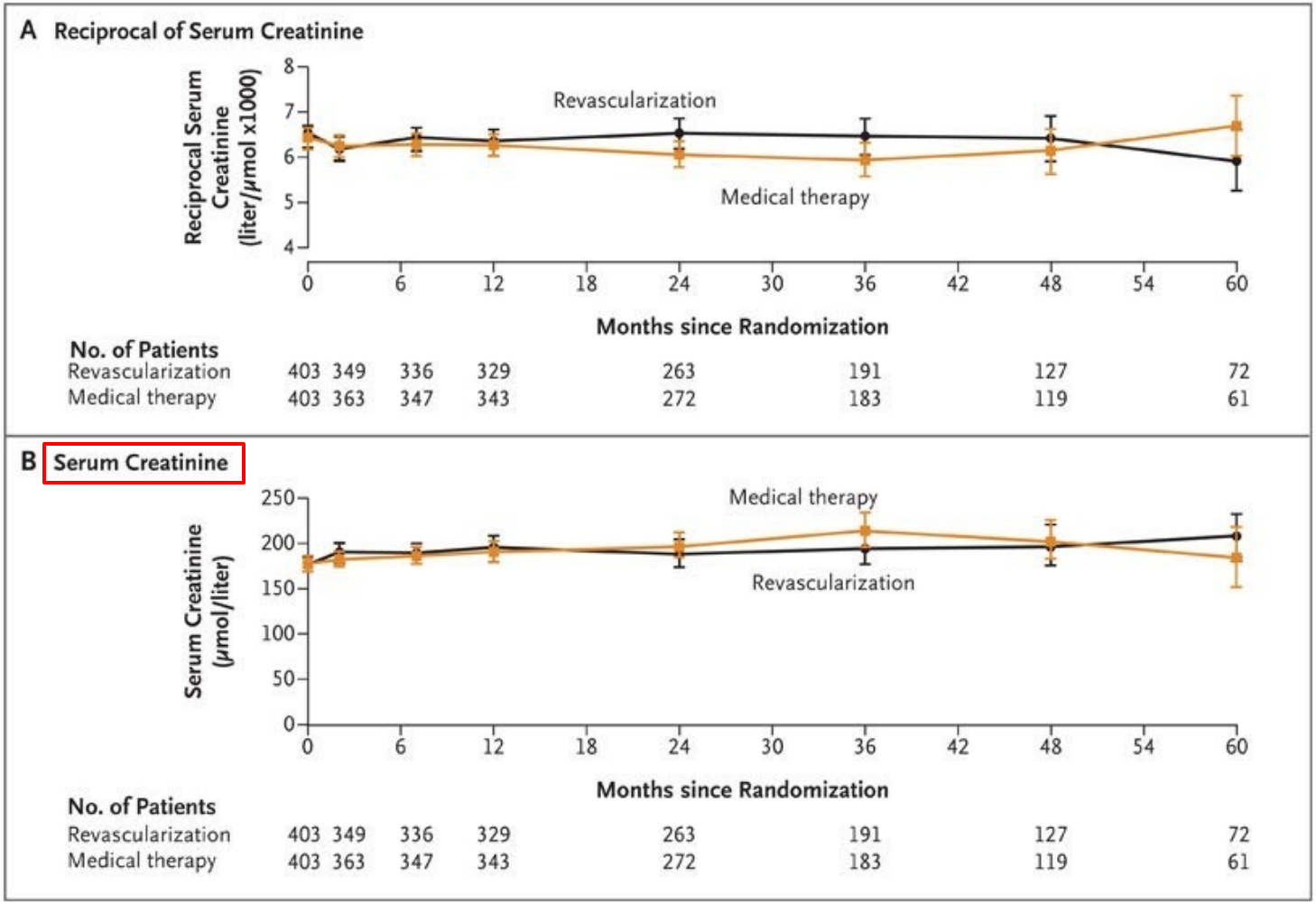
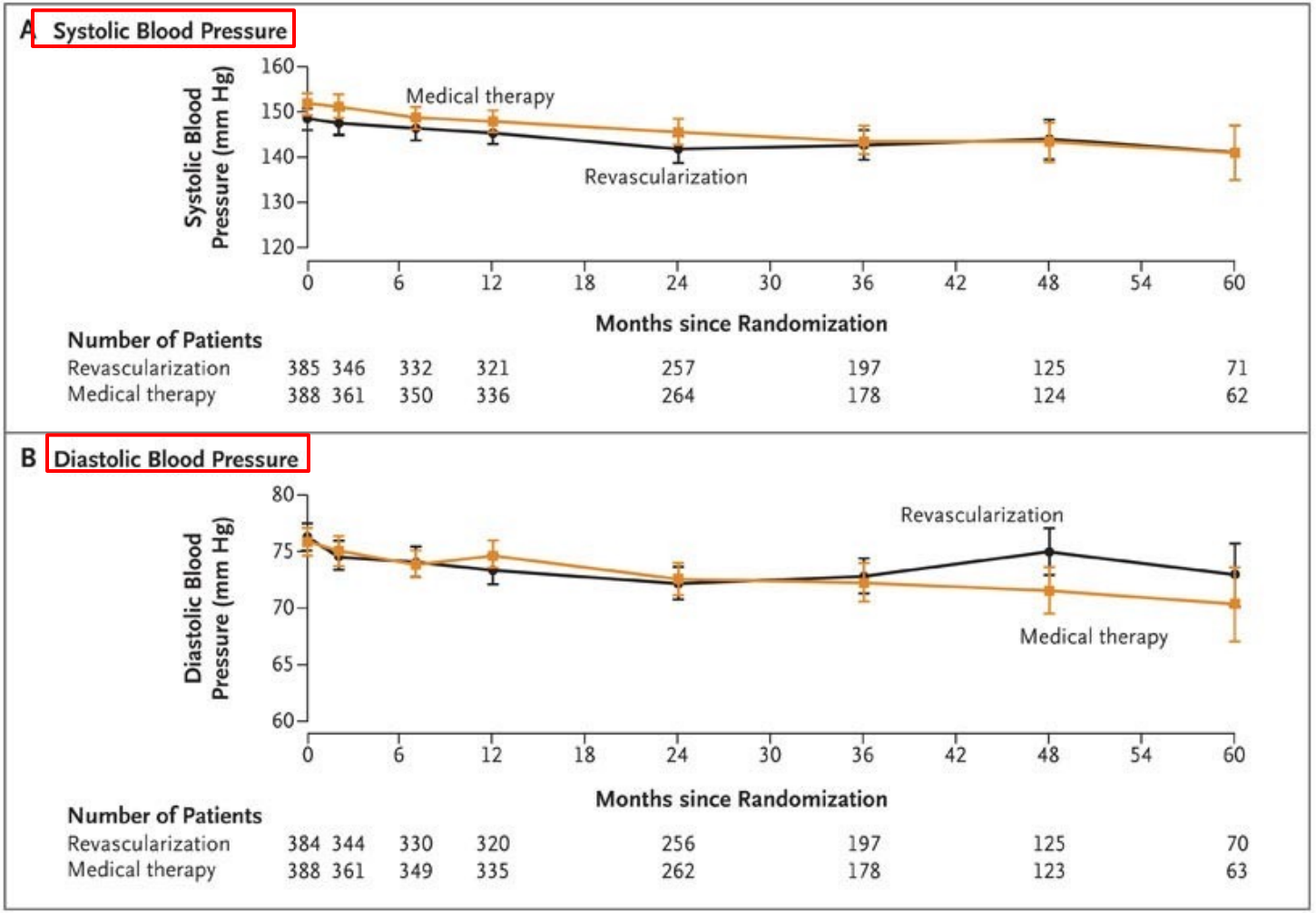

A Reciprocal of Serum Creatinine
Reciprocal Serum Creatinine (liter/μmol x1000)
8
7
6
5
4
Revascularization
Medical therapy
0 6 12 18 24 30 36 42 48 54 60
Months since Randomization
No. of Patients
Revascularization 403 349 336 329 263 191 127 72
Medical therapy 403 363 347 343 272 183 119 61
B Serum Creatinine
Serum Creatinine (μmol/liter)
250
200
150
100
50
0
Medical therapy
Revascularization
0 6 12 18 24 30 36 42 48 54 60
Months since Randomization
No. of Patients
Revascularization 403 349 336 329 263 191 127 72
Medical therapy 403 363 347 343 272 183 119 61


A Systolic Blood Pressure
Systolic Blood Pressure (mm Hg)
160
150
140
130
120
Medical therapy
Revascularization
0 6 12 18 24 30 36 42 48 54 60
Months since Randomization
Number of Patients
Revascularization 385 346 332 321 257 197 125 71
Medical therapy 388 361 350 336 264 178 124 62
B Diastolic Blood Pressure
Diastolic Blood Pressure (mm Hg)
80
75
70
65
60
Revascularization
Medical therapy
0 6 12 18 24 30 36 42 48 54 60
Months since Randomization
Number of Patients
Revascularization 384 344 330 320 256 197 125 70
Medical therapy 388 361 349 335 262 178 123 63

- Patients excluded were those most likely to gain benefit
  - Patients with:
    - High-grade stenosis
    - Poorly controlled hypertension
    - Rapidly declining renal function
- Likely significant selection bias

Catheterization and Cardiovascular Interventions 75:305–307 (2010)

Editor's Page

Kiss My Astral: One Seriously Flawed Study of Renal Stenting After Another

Christopher J. White,* MD
Editor-in-Chief, Catheterization and Cardiovascular Interventions

- Patients where role of angioplasty was unclear
- BP was not severe (2 meds, mean 149/76)
- 40% patients had stenosis <70%
- Primary end-point decline in renal function
  - 25% had normal renal function
  - Only 12% had recent rapid decline in fcn.

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ESTABLISHED IN 1812 JANUARY 2, 2014 VOL. 370 NO. 1

Stenting and Medical Therapy for Atherosclerotic Renal-Artery Stenosis

Christopher J. Cooper, M.D., Timothy P. Murphy, M.D., Donald E. Cutlip, M.D., Kenneth Jamerson, M.D., William Henrich, M.D., Diane M. Reid, M.D., David J. Cohen, M.D., Alan H. Matsumoto, M.D., Michael Steffes, M.D., Michael R. Jaff, D.O., Martin R. Prince, M.D., Ph.D., Eldrin F. Lewis, M.D., Katherine R. Tuttle, M.D., Joseph I. Shapiro, M.D., M.P.H., John H. Rundback, M.D., Joseph M. Massaro, Ph.D., Ralph B. D'Agostino, Sr., Ph.D., and Lance D. Dworkin, M.D., for the CORAL Investigators*

Stenting and Medical Therapy for Atherosclerotic Renal-Artery Stenosis

- 947 patients with 60-90% stenosis → BMT vs stenting + BMT.
- 43 months follow-up.
- Inclusion criteria:
  - SBP>160 on >2 medications.
  - CKD with GFR < 50
- Exclusion criteria:
  - RAD due to fibromuscular dysplasia
  - CKD from a cause other than ischemic nephropathy
  - Kidney length <7 cm

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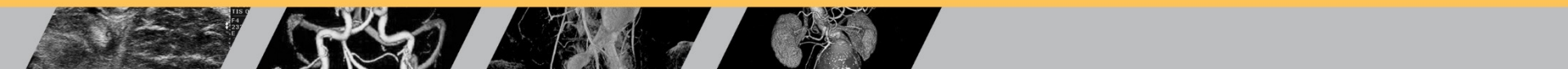

Stenting and Medical Therapy for Atherosclerotic Renal-Artery Stenosis

- Primary end point:
  - Composite outcome (death from CV or renal causes, MI, stroke, need for dialysis).
- Results:
  - No difference in primary end points

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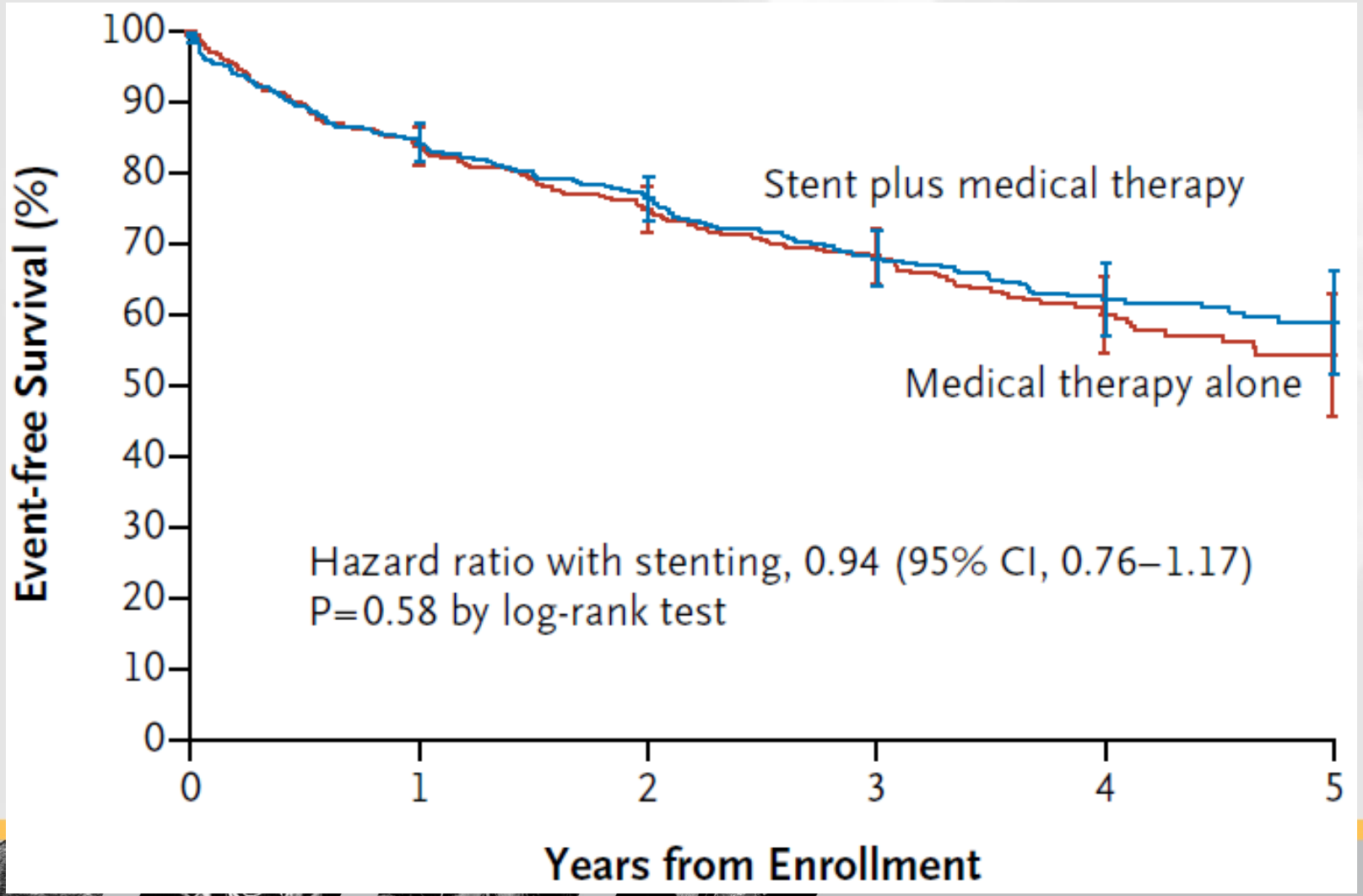
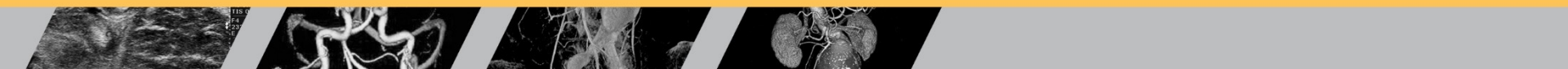
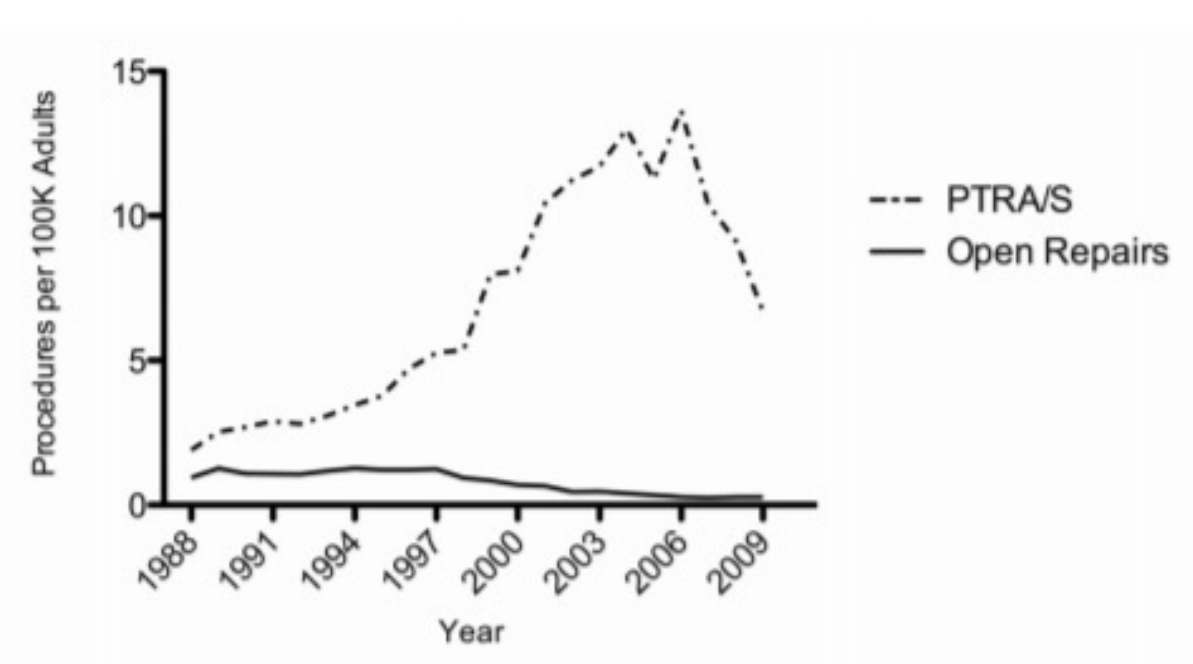

Event-free Survival (%)
100
90
80
70
60
50
40
30
20
10
0
0
1
2
3
4
5
Years from Enrollment
Stent plus medical therapy
Medical therapy alone
Hazard ratio with stenting, 0.94 (95% CI, 0.76–1.17)
P=0.58 by log-rank test

- 3 RCT's show no effect to stenting on BP:
  - van Jaarsveld BC, Krijnen P, Pieterman H, et al. The effect of balloon angioplasty on hypertension in atherosclerotic renal- artery stenosis. N Engl J Med 2000;342: 1007-14.
  - Plouin PF, Chatellier G, Darné B, Raynaud A. Blood pressure outcome of angioplasty in atherosclerotic renal artery stenosis: a randomized trial. Hyperten- sion 1998;31:823-9.
  - Webster J, Marshall F, Abdalla M, et al. Randomised comparison of percuta- neous angioplasty vs continued medical therapy for hypertensive patients with atheromatous renal artery stenosis. J Hum Hypertens 1998;12:329-35.
- 2 RCT's show no benefit on progression of CKD:
  - **15.** The ASTRAL Investigators. Revascu- larization versus medical therapy for re- nal-artery stenosis. N Engl J Med 2009; 361:1953-62.
  - **16.** Bax L, Woittiez AJ, Kouwenberg HJ, et al. Stent placement in patients with atherosclerotic renal artery stenosis and im- paired renal function: a randomized trial. Ann Intern Med 2009;150:840-8.



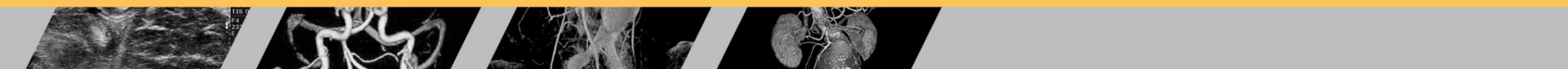
The rise and fall of renal artery angioplasty and stenting in the United States, 1988-2009

Patric Liang, BA*, **Rob Hurks, MD PhD***, **Rodney P Bensley, MD**, **Allen Hamdan, MD**, **Mark Wyers, MD**, **Elliot Chaikof, MD PhD**, and **Marc Schermerhorn, MD**
Department of Surgery, Division of Vascular and Endovascular Surgery, Beth Israel Deaconess Medical Center and Harvard Medical School, Boston, MA



Why does renal artery stenting not work?

- 1. In addition to main renal artery, disease involves intrarenal arteries and arterioles.
- 2. Stenosis may protect intrarenal vessels from ill effects of the high BP and stenting will remove it.
- 3. Stenting can cause distal embolism, dissection that accelerate renal damage.
- 4. There may be such a large burden of atherosclerotic disease by the time patient presents that it is too late for an intervention in a single vascular bed to alter outcomes.



ACCF/AHA Practice Guidelines

Management of Patients With Peripheral Artery Disease (Compilation of 2005 and 2011 ACCF/AHA Guideline Recommendations)

- Pharmacological therapy is the first-line treatment for renal artery stenosis (class Ia indication)
  - ACE inhibitors, ARBs, and calcium channel blockers for unilateral* RAS.

* ACEI/ARB are contraindicated in patients with a single functioning kidney or bilateral lesions as they can cause efferent arteriolar vasodilatation leading to interruption in autoregulation and thereby decreasing glomerular filtration.

ACCF/AHA Practice Guidelines

Management of Patients With Peripheral Artery Disease (Compilation of 2005 and 2011 ACCF/AHA Guideline Recommendations)

Intervention is recomended

- Unilateral or bilateral RAS>60% **AND**
  - Recurrent flash pulmonary edema or otherwise unexplained CHF (class Ia).
  - Severe/malignant HTN despite optimal medical therapy (>3-4 BP medications) (class IIa).
  - Rapidly declining GFR (class IIa).
  - Salvagable renal mass.

ASN American Society of Nephrology

ACCF/AHA Practice Guidelines

Management of Patients With Peripheral Artery Disease (Compilation of 2005 and 2011 ACCF/AHA Guideline Recommendations)

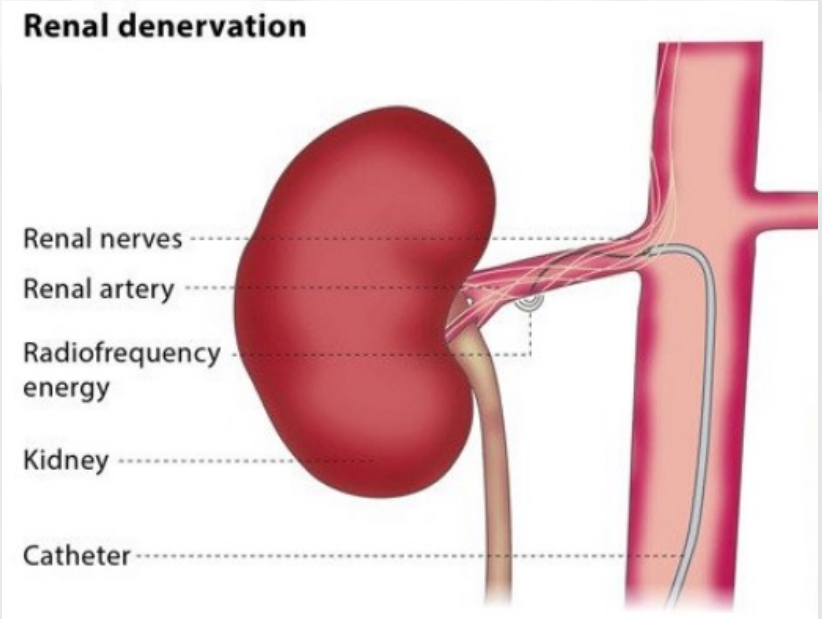
Intervention is not recomended

- Any degree RAS with stable renal function or whose HTN is controlled medically.
- Preexisting long standing HTN (>3 years).
- Kidney size < 8 cm or resistive index > 0.8 on renal duplex.
- Advanced age or low life expectancy.

ASN American Society of Nephrology

Renal denervation

- Minimally invasive procedure that uses radiofrequency ablation to burn the nerves going along the renal arteries.



3 RCT

- Symplicity HTN-1 trial (2009)
  - 45 pts with SBP>160 on at least 3 BP medications and preserved renal function (GFR>45).
  - BP checked in the office in 0, 3, 6, 9 and 12 months.
  - 9 patients had reduction of BP from baseline of 27/10 mm Hg
  - Small number of patients, office based BP measurements, industry sponsored

ASN
American Society of Nephrology

Symplicity HTN-2 trial (2011)

- 106 patients, same criteria
- Mean decrease of SBP/DBP of 32/12 mm Hg, whereas the control group had no change in blood pressure.
- Benefit sustained at 12 months.
- Small number of patients, industry sponsored.

Symplicity HTN-3 trial (2014)

- 535 patients with resistant hypertension (at least 3 BP drugs, including a diuretic).
- The mean change in systolic blood pressure at 6 months was 14.13 mm Hg in the denervation group as compared with 11.74 mm Hg in the sham-procedure group ($P<0.001$).
- No significant reduction of SBP compared with a sham control.
- Industry funded.

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Conclusion

- Published randomized trials provide no support that:
  - Renal stenting or renal denervation improve BP, preserves renal function or reduces episodes of CHF.
- Properly selected patient will benefit from the intervention.
- Procedure itself is associated with procedure related morbidity.
- Agents that block RAAS, control atherosclerosis at all levels of vasculature and improve outcomes and should be a part of best medical therapy.

ASN
American Society of Nephrology

THANK YOU