Case Based Review of Renal Artery Interventions

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Overview

- Atherosclerotic Renal vascular disease
- Fibromuscular Dysplasia
- Transplant Renal Artery Stenosis
- A unique case referred for Renal Denervation trial
72 y/o WF with a pmh of HTN, CKD and pulmonic valve stenosis presents for eval of RAS.

- Pt with one year of increasing heart failure symptoms including shortness of breath and one week of increasing peripheral edema.

- She was admitted to the CCU with respiratory failure and pulmonary edema in the setting of hypertensive urgency and acute kidney injury requiring hemodialysis.

- Found to have labile BP requiring intermittent vasodilators and pressors.
Doppler Ultrasound

- The peak systolic velocities at the origins the right and left renal arteries and aorta were 370 cm/sec, 265 cm/sec, and 103 cm/sec, respectively. These velocities and the renal to aortic ratios are elevated, consistent with bilateral renal artery stenosis.
Diagnostic
Diagnostic
Right Renal Intervention

IVUS to mark ostium
Right Renal Intervention

Post predilatation with NC balloons

Final Result
Left Renal Artery

Chocolate Balloon Angioplasty
Left Renal Artery

Final Result
Clinical Follow up

- Cr has decreased to 2.2 mg/dL

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Revascularization for Atherosclerosis

- **CORAL**
  - 947 patients with RAS, HTN and/or chronic kidney disease
  - Palmaz gensis(cordis) stent
  - Outcomes: Death, Stroke, MI, CHF, progressive renal dysfunction or HD

- **ASTRAL**
  - 806 patients with RAS, HTN and/or chronic kidney disease
  - Angioplasty only
  - Outcomes: Change in renal function

SBP significantly improved with revascularization.

Excluded Fibromuscular dysplasia and patients with recurrent pulmonary edema and malignant HTN.

Endpoints
Evidence / Guidelines

- CHF / Flash Pulmonary Edema (Pickering Syndrome)
- Rapidly decreasing renal function / salvage
- Post transplant RAS
- Others:
  - RAS > 80% with significant tranlesional gradient
  - Young patients with >/= 3 Meds uncontrolled HTN
  - Truncal than Ostial stenosis
65-year-old white female with a history of CML, labile hypertension, congestive heart failure and history of fibromuscular dysplasia now presenting with severe headaches and hypertension requiring escalating doses of clonidine.

- 08/2014 presented to OSH with malignant hypertension, unstable angina, and congestive heart failure.

- The patient was found to have bilateral renal artery stenosis and underwent intervention with placement of bare metal stents in the bilateral renal arteries.

- 03/2015 when she presented with malignant hypertension and was found to have bilateral restenosis of her renal stents. She underwent successful intervention with Resolute DES x2
Diagnostic
Right Renal Artery

Chocolate Balloon Angioplasty

In.Pact Admiral DEB
Left Renal Artery

Chocolate Balloon Angioplasty

In.Pact Admiral DEB
Final result
Clinical Follow up

- Cr has decreased to normal value
- BP now in the 140-150’s systolic on home BP log.
- Headaches, clonidine use and dyspnea have markedly improved.
- She is scheduled to return in 6 months for repeat renal angiogram
Fibromuscular Dysplasia (FMD)

- First described by Leadbetter and Burkland in 1938.
- FMD affects mid/distal arterial segments
- 3 distinct types based on involved arterial layer:
  - Medial (most common; “beads on a string”, perimedial subtype)
  - Intimal (10% of FMD, focal concentric stenosis that are long and smooth)
  - Adventitial (very rare, focal, sharply tubular stenosis)

**Angioplasty is mainstay of treatment**

53 y/o WM with a pmh of AD polycystic kidney disease and renal transplantation 6 months prior presents for evaluation of TRAS

- Pt presented 1 month prior with acute kidney injury and biopsy negative for rejection.
- His kidney function continued to decline and he was initiated on HD
- He was referred for angiogram to rule transplant renal artery stenosis
Diagnostic
Intervention

Herculink Elite Stents
Final Result
Clinical Follow up

- His urine output increased that day and he was off HD by discharge.
- He presented with Cr 1.67mg/dl 1 year later but with poorly controlled HTN.

Resolute DES
43-year-old white male with a history of end-stage renal disease secondary to possible IgA nephropathy, status-post deceased donor kidney transplant in 2001, hypertension, presents with severe malignant hypertension, and acute on chronic kidney injury requiring hemodialysis.

- Also with right lower extremity claudication
- Renal duplex ultrasound with high grade lesion in the mid transplant renal artery and was referred for a renal angiogram.
Diagnostic
Intervention

Semi-Compliant Balloon Angioplasty both limbs
Intervention

IVUS showed fibrotic hyperplasia

AngioSculpt Balloon Angioplasty
Intervention

Rewired and angioplasty
Final Result
…Fix that Iliac

8.0 Express LD Stent

Final Result
Clinical Follow up

- Cr 3 years later is 1.67mg/dL and is still off HD
- His BP is under excellent control
79-year-old white male with a history of Goodpasture syndrome status-post living related renal transplantation on 11/01/2001, hypertension, hyperlipidemia, aortic valve replacement, peripheral arterial disease presenting with worsening hypertension and acute kidney injury.

- 3 months prior - Renal duplex ultrasound described possible transplant renal artery stenosis with an elevated velocity of 316.

- He has been admitted 2 times for HTN urgency and his Cr has slowly risen to 2 md/dl.
Diagnostic

MRA
Diagnostic
Intervention

Crossed with Whisper Wire
Chocolate Balloon Angioplasty

Herculink Elite BMS
Final Result
Clinical Follow up

- Cr is now down to 1.2 mg/dl
- He has not been admitted to the hospital for HTN urgency and has had to stop medications due to hypotension
Stenosis in Transplant Renal Arteries (TRAS)

• TRAS prevalence of upwards of 23% of renal allograft recipients.
• Risk Factors: CMV+, DGF, age>50, cadaveric……..
• Can manifest as graft dysfunction or resistant HTN
• 4 primary causes:
  • Pre-anastomotic (atherosclerosis, vessel clamp injury)
  • Anastomotic (suture, perfusion injury, intimal)
  • Post-anastomotic (intimal hyperplasia, immune mediated, twist, kink or compression)
  • Distal (rejection)
• Percutaneous revascularization has become preferred management given the complexity of re-operation.

51 y/o WF with a pmh of longstanding HTN refractory to medical management

- Had HTN since her 20’s and has progressive worsened despite intense medical therapy
- Referred for Renal Denervation as a part of the SIMPLICITY trial
RFA pressure
Pressure Waveforms
CT Scan
CT Scan
Angiogram
Intervention
Intervention
Final Result
Conclusions

- Revascularization in atherosclerotic renal artery stenosis still has tremendous value in the right patients.
- Specialty balloons are extremely useful in treating many forms of stenosis in the renal arteries.
- Percutaneous revascularization of transplant renal artery stenosis (and iliac stenosis) can be graft saving.
- IVUS helps improve renal interventions and can markedly reduce IV contrast use.
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