MRI of the renal arteries

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Disclosures

Off-label use: gadolinium enhanced MRI of the blood vessels
Screening for Renal Artery Stenosis:

- Low morbidity - no contrast reactions
- Rapid exam - 15 minutes
- Low nephrotoxicity compared to iodine agents
<table>
<thead>
<tr>
<th>Study</th>
<th>Yr</th>
<th># arteries</th>
<th>Sens.</th>
<th>Spec.</th>
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<td>‘00</td>
<td>92</td>
<td>100%</td>
<td>85%</td>
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<tr>
<td>De Cobelli</td>
<td>‘00</td>
<td>103</td>
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<tr>
<td>Hany</td>
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<tr>
<td>Postma</td>
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</tr>
</tbody>
</table>
Fluoroscopic MRA trigger
Fluoroscopic MRA trigger
MRA: Venous phase
3d VIBE, SPGR
MRA: 2\textsuperscript{nd} run
MRA - Aorta
• 3D acquisition, 2mm slice thickness
• 0.15 mmol/kg gad @ 2ml/sec
• Automated timing bolus
• 15 sec breath-hold
Renal MRA ?
Renal MRA: data analysis

- MIP image
- most common “data reduction” method
MRA - reformat

- **Axial**
- **Coronal**
- **Sagittal**
3T Renal MRA
MRA - reformat
Eccentric plaque - MIP pitfall
Volume Rendering

- retains “3d” information
MR angiogram: accurate / rapid anatomy

Maximum intensity projection and surface displays
Aorto-enteric fistula repair, aneurysm
Renal MRA: Aneurysm

Dynamic MRA (TREAT)
MRA - variant anatomy
MRA - document variant anatomy

• Early arterial branching
MRA: variant anatomy
Pitfall - susceptibility
Pitfall - stent
Pitfall: adenoma
Pitfall: adenoma
Pitfall: adenoma
Renal MRA: size matters

• 3D renal size
• Is there sufficient renal mass for revascularization?
• > 1 cm L/R renal size difference
Renal Artery MRA: disadvantages?

• tendency to overestimate (calcification, turbulence)

• "unsuccessful" exams (2%-4%)

• lower sensitivity for accessory vessels, or intra-renal abnormalities

• pacemakers, claustrophobia
Female, long standing hypertension
“Hypertension”

Fibromuscular dysplasia
Fibromuscular dysplasia
Pressure gradient

- By convention, 50% stenosis “physiologically significant”

- Experimentally, 70-80% required for a pressure gradient
MRA: Phase contrast

- Improved specificity for stenosis detection
- After 3D MRA
Eccentric plaque - MIP pitfall
Renal MRA: phase contrast

Mild stenosis
3T Renal MRA: phase contrast
3T Renal abnormality
Renal transplant

Increasing creatinine:

• Vascular insufficiency?
• Rejection?
• Concern for NSF
Renal transplant - multiple reformations

3D volume

Targeted MIP

Oblique MIP - early branching
Renal transplant

“Normal” anastomotic narrowing
### Associations with NSF

- Prior gadolinium administration
- Severe renal failure, dialysis

<table>
<thead>
<tr>
<th>Stage</th>
<th>GFR</th>
<th>Description</th>
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<td>1</td>
<td>90+</td>
<td>Normal kidney function but urine or other abnormalities point to kidney disease</td>
</tr>
<tr>
<td>2</td>
<td>60-89</td>
<td>Mildly reduced kidney function, urine or other abnormalities point to kidney disease</td>
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<tr>
<td>3</td>
<td>30-59</td>
<td>Moderately reduced kidney function</td>
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Associations with NSF

• Prior gadolinium administration
• Severe renal failure, dialysis

• Pro-inflammatory events
  - surgery
  - infection
  - trauma
Gadolinium MRA: options in at risk patients

1. Noncontrast time of flight MRA
2. 3T MRA: 50% reduction of contrast dose
3. Contrast agent with increased relaxivity (Multihance); allows dose reduction
4. both (2) and (3)
Gadolinium MRA: Time of Flight
Steady State Free Precession (SSFP) TrueFISP, NATIVE

- Blood is imaged as a fluid (long T2* time) using a balanced GRE sequence
- ECG and navigator gated
Steady State Free Precession (SSFP): TrueFISP, NATIVE
Steady State Free Precession (SSFP): TrueFISP, NATIVE
Renal MRA (3T): with 3d T1
Acknowledgements

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