Open Surgical Techniques for Renal Artery Revascularization

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Disclosures for Matthew Edwards

No Commercial Interests or Conflicts to Disclose
Surgical Renal Artery Revascularization

- Employed to treat a number of conditions
  - Renovascular occlusive disease
    - Renovascular Hypertension
    - Ischemic Nephropathy
  - Renal Artery Aneurysms
  - Congenital Renal Artery Lesions
Surgical Renal Artery Revascularization

- Renovascular Occlusive Disease
  - Atherosclerotic in the majority of cases
    - Disease predominantly ostial
  - FMD most common non-atherosclerotic cause

- Use of open surgical techniques has declined tremendously over past 20 years
Surgical Renal Artery Revascularization

- Renovascular Occlusive Disease
- Open techniques still useful for
  - Variant anatomy
    - Multiple renal arteries
    - Renal arteries with early branchpoints
  - Cases requiring concomitant open surgical management of aortic pathology
  - Recurrent stenosis after endovascular treatment
  - Cases requiring branch level treatment
    - Usually FMD and/or aneurysm cases
Surgical Renal Artery Revascularization

• Variant Anatomy
  • Multiple Arteries
    • Usually small
    • Technical problems for bypass
  • Early Branchpoints
  • Recurrent stenosis

• Aortic pathology
  • Adjacent aneurysm
  • Coral reef atheroma
  • Occlusive disease
Surgical Renal Artery Revascularization

• Renal Artery Aneurysms
  • Frequently associated with FMD
  • Most frequent site of involvement is primary bifurcation

• Congenital Lesions
  • Most frequently encountered in children and young adults
  • Multitude of anatomic conditions
Surgical Renal Artery Revascularization

• Techniques for Repair
  • Renal Artery Bypass
    • Aortorenal
    • Extra-anatomic
    • Branch Level Bypass/Replacement
  • Transaortic Renal Endarterectomy
  • Combined Aortic and Renal Replacement
Surgical Renal Artery Revascularization

- Aortorenal Bypass
  - Midline or transverse incisions can be used
- Complete mobilization of left renal vein
  - Division of adrenal, gonadal, and lumbar branches
- Conduit choices
  - Vein
  - Prosthetic
  - Hypogastric artery*
Surgical Renal Artery Revascularization

• Aortorenal Bypass
  • Proximal Anastomosis
    • Mannitol and heparin
    • Infrarenal control
    • Use aortic punch
    • Greater geometric freedom with lower site of origin
  • Distal Anastomosis
    • Minimally traumatic clamps
    • Can be end-to-side or end-to-end
Surgical Renal Artery Revascularization

• Extra-anatomic bypass
  • Can use iliac, common hepatic and splenic arteries as inflow
• Modifications of exposure but other principles remain the same
• Most frequently use vein for splanchno-renal
  • Can use a transposition of splenic artery
• Most frequently use prosthetic conduit for iliorenal
Surgical Renal Artery Revascularization

• Branch level bypass/replacement
  • Usually perform one side at a time
  • Subcostal incisions preferred
  • Visceral mobilization with kidney left in place but completely exposed
  • Loop ureter to control collateral blood flow
  • Topical cooling and cold perfusion of organ preservation solution
  • Saphenous vein preferred conduit*
  • Geometric planning of bypass course critical
Surgical Renal Artery Revascularization

- Trans-aortic Renal Endarterectomy
- Midline or transverse incisions can be used
- Transperitoneal or left medial visceral mobilization
- Complete mobilization of the left renal vein
- Exposure of SMA and celiac
  - Careful division of diaphragmatic and neural tissue for clamp placement and aortotomy
- Supraceliac or supra-SMA clamp placement
Surgical Renal Artery Revascularization

- Transaortic Renal Endarterectomy
  - Longitudinal aortotomy from just below SMA to below renals
  - Can do with transverse aortotomy
    - Infrarenal
    - Transrenal
  - Careful attention to last adherent point of plaque
Surgical Renal Artery Revascularization

• Intraoperative completion duplex in all cases
• Use high frequency ‘footprint’ probe in a sterile sleeve with direct application to artery
  • Greater reliance on US images
  • Duplex parameters altered by ischemia
    • Increased resistance
    • Decreased diastolic flow
• Revision required in ~7% of bypasses*

*Cherr et al, J Vasc Surg 2002
Surgical Renal Artery Revascularization

• Outcomes
  • Durability and patency excellent for all*
    • Aortorenal bypass: >95% patency at 5 years
    • Iliorenal bypass: ~95% patency at 5 years
    • Splanchnorenal bypass: ~95% patency at 5 years
    • Endarterectomy: ~95% patency long-term
    • Branch reconstructions: ~90% patency at 5 years
  • Functional outcomes depend upon indication
