Nutcracker Syndrome: Favorable Outcomes With Endovascular Intervention (Over Open Repair)

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Disclosures
• NONE

Nutcracker Phenomenon

• Entrapment of the LRV between the aorta and the SMA
• First described by Grant in 1937
• Venous hypertension in the left kidney caused by mesoaortic compression of the LRV and the development of varicose veins and collateral pathways

Anatomy: collaterals

• In 0.5-3% of the population the LRV can take a retroaortic course

Anatomy

• In 0.3-5.7% the LRV can be doubled in a preaortic and retroaortic course as a circumaortic LRV
Clinical Findings

- Nutcracker syndrome occurs most frequently in women in the third and fourth decade of life.
- The symptoms reported most commonly are left flank pain and hematuria.
- Pelvic congestion and varicocele formation can occur in women and men respectively, as a result of reflux into the left gonadal vein.

Diagnostic Evaluation

Venography

- Renocaval pressure gradient can be measured.
- A gradient < 1 mmHg is normal.
- ≥3 mmHg is considered indicative of renal hypertension.

CT and MRI

- Distinguish nutcracker syndrome from other causes of pain and hematuria.

Duplex Scanning

- LRV diameter, peak velocity at the stenosis.
- The sensitivity and specificity of duplex scanning is 78% and 100% when flow reversal in the collateral veins is included in the diagnostic criteria.

Urinalysis

- 90% of RBC should be isomorphic for a glomerular cause of hematuria to be excluded.
- Cystoscopy, flexible ureteroscopy or renal biopsy may be indicated.

Additional Studies

- When symptoms are severe, operative intervention may be necessary.
- Children should be treated conservatively because spontaneous remission can occur during growth.
- 75% of patients younger than 18 years old will have complete resolution of hematuria within 2 years.
- Both open and endovascular approaches to the treatment of this condition have been described in the literature.

Open Surgical Treatment

- First reported by Pastershank in 1974.
- Most common surgical techniques include:
  - Reimplantation of the LRV into the IVC 3-5 cm below previous origin.
  - Renal autotransplantation.
  - LRV bypass.
LRV Transposition

LRV Transposition with Patch Venoplasty

Left Gonadal Vein Transposition

Left Renal Vein Bypass

Surgical Treatment of Nutcracker Syndrome

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Endovascular Treatment

- First reported by Neste et al. (1996)
- Ideal Stent:
  - high radial strength
  - conformable
  - minimal foreshortening to allow accurate placement
Stenting for Nutcracker Syndrome: 126 cases reported.....

### Outcomes of 126 cases of LRV Stenting

- Most patients improved with stenting
- One case of stent compression by the SMA that required open surgical reconstruction by prosthetic bypass
- 7 (5%) reported cases of stent migration

Factors affecting stent migration may include:
- Distance between the ostium and the first large branch of the left renal vein
- The increase in the left renal vein intraluminal pressure may affect stabilization of the stent
- Pulsatility of the abdominal aorta and its close proximity to the stent

### Long term results: Do stents last?

61 patients who underwent LRV stenting between 10/1998-10/2009
- Median age of 26 years (range 16-46 years); 75% male
- Symptoms were hematuria, proteinuria or flank pain
- Median follow-up was 66 months

Stents used: 1 Palmaz stent, 15 Wallstents®, and 45 SmartControl™ stents that were 10, 12, 14 or 16 × 40 mm

### Endovascular stenting in the treatment of pelvic vein congestion caused by nutcracker syndrome: Lessons learned from the first five cases

Olivier Hartung, MD, Dominique Grisot, MD, Monzad Rouh, MD, Ivo Maarani, MD, Fabrice Bakaou, MD, Pierre Barthelemy, MD, PhD, and Yoann Ahtani, MD, PhD, Marseille, France

- Longer self expanding stents preferred
- (60mm at minimum) 14mm or 16mm diameter
- Protrusion into IVC is acceptable and often necessary

Median followup was 66 months (range 12 to 144).
Symptoms resolved or improved in 15 patients by 1 week, in another 24 by 1 month and in another 20 by 6 months.
Division of Vascular and Endovascular Surgery

- One perioperative complication: stent deployed in an LRV collateral, required operative intervention
- Three postoperative complications: stent migration into the right atrium, stent protrusion into the IVC, and stent migration into LRV hilum

Chen et al. 2011

Three women (age range 28-43 years) presented with symptoms including pelvic and flank pain (3 patients) and episodes of hematuria (1 patient)

Imaging studies demonstrated compression of the LRV between the SMA and aorta in two patients. The third patient was noted to have a circumaortic LRV

All three underwent LRV stenting (stents included a 12 x 40 mm self-expanding nitinol stent, 14 x 60 mm Wallstent, and 16 x 40 mm Wallstent)

Intravascular ultrasound was utilized in 2 cases

NYU Case Series

Case 1

Case 2
Case 3

NYU Case Series

• Technical and clinical success
• No complications
• The duration of follow-up ranged from one to two years
• At follow up, all three patients reported significant symptomatic improvement or resolution of symptoms, and duplex ultrasonography demonstrated stent patency in all

Conclusions

• Results for LRV stenting appear safe, effective and durable
• Stent migration is rare and may be avoided with proper planning and stent selection
  • The ideal stent:
    • high radial strength, conformable with minimal foreshortening to allow accurate placement
    • 6-8-cm long stent be used, positioned at the first division of the renal vein to minimize the risk of migration
    • Protrusion to IVC acceptable
• Improvement in technology for venous stents is expected and will result in minimally invasive therapy for most patients with NCS