Stenting Is The Ideal Treatment For Nutcracker Syndrome

Thomas S. Maldonado MD
Professor of Surgery
Director of Venous Thromboembolic Center
New York University Langone Medical Center
Division of Vascular and Endovascular Surgery

Disclosures
• None

Nutcracker Syndrome
• 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

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
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

CT and MRI
• Distinguish nutcracker syndrome from other causes of pain and hematuria

Venography
• Renocaval pressure gradient can be measured:
  - A gradient < 1 mmHg is normal
  - ≥3 mmHg is considered indicative of renal hypertension
Treatment - General Considerations

- 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.

Surgical Treatment of Nutcracker Syndrome

<table>
<thead>
<tr>
<th>Technique</th>
<th>Number of Patients</th>
<th>Complications</th>
<th>Outcome</th>
<th>Reinterventions</th>
</tr>
</thead>
<tbody>
<tr>
<td>LRV transposition (STENTS)</td>
<td>30</td>
<td>36%</td>
<td>34</td>
<td>1</td>
</tr>
<tr>
<td>LRV transposition (open)</td>
<td>13</td>
<td>11%</td>
<td>11</td>
<td>1</td>
</tr>
<tr>
<td>LRV bypass</td>
<td>4</td>
<td>3</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>Renal autotransplantation</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Open surgery</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

15% complication rate

- Distal transposition of the LRV into the inferior vena cava (IVC) was performed in 31 patients.
- Follow-up was 36.8 ± 52.8 months (range, 1-216 months).

Primary ASSISTED patency......

- Early Reintervention at 30 Days: n=3
  (STENTS = 2; open revision = 1)
- Reinterventions after 30 days: n=8
  - LRV stenosis (n = 7)
  - LRV occlusion (n = 1).

1 IN 3 PATIENTS UNDERGOING OPEN REPAIR REQUIRED REINTERVENTION MOST FREQUENTLY RENAL VEIN STENTING!
Endovascular Treatment

- First reported by Neste et al. (1996)
- The ideal stent: high radial strength, conformable with minimal foreshortening to allow accurate placement
- Self-expanding stents are used most frequently
- 6-8-cm long stent be used, positioned at the first division of the renal vein to minimize the risk of migration

To date, more than 200 cases have been reported......

<table>
<thead>
<tr>
<th>Series</th>
<th>Number</th>
<th>Symptoms</th>
<th>Stent</th>
<th>Follow-up (mo)</th>
<th>Complications</th>
<th>Outcome</th>
<th>Death Migration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neste et al.</td>
<td>1</td>
<td>H</td>
<td>NS</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sogina et al.</td>
<td>1P</td>
<td>H</td>
<td>70</td>
<td>0</td>
<td>26</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Schmidt et al.</td>
<td>1P</td>
<td>PES</td>
<td>H</td>
<td>6</td>
<td>26</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Pirt et al.</td>
<td>1M</td>
<td>Nectoscrope</td>
<td>H</td>
<td>26</td>
<td>4</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Chiu et al.</td>
<td>1M</td>
<td>Pulmonary embolism</td>
<td>H</td>
<td>26</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Lin et al.</td>
<td>1F</td>
<td>Femoral</td>
<td>H</td>
<td>26</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Wang et al.</td>
<td>1F</td>
<td>Femoral</td>
<td>H</td>
<td>26</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

Wang et al. 2012

Retrospective review of 30 patients treated from 1/2004-8/2010

Patient Data:
- 30 patients; Median follow-up was 36 mos (range 12-80 mos)
- Each patient received a 14 x 60 mm self-expanding nitinol stent (SMART stent, Cordis)
- Three patients with severe left-sided varicoceles underwent gonadal vein embolization

Results:
- Technical success was achieved in all patients
- No perioperative complications occurred
- Two cases of stent migration were found at 12 mos; both stents protruded into the IVC; they were left in situ with uneventful follow-up (49 and 56 mos)
- All stents were patent on duplex scan and there was no secondary recurrence of the symptoms at the end of the follow-up period
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

- Median follow up was 66 months (range 12 to 144)
-No perioperative complications
-Symptoms resolved or improved in all patients
-All stents patent on duplex

Stent migration after endovascular stenting in patients with nutcracker syndrome

Zhihong Wu, MD, PhD; Xingmin Zhang, MD, PhD; Tongyan He, M.D.; Xiu Feng, MD

Objective: It is unclear whether the incidence of stent migration after endovascular stenting is related to the type of stent used.

Methods: We retrospectively evaluated the data of all patients with SCS who were treated by EVS at our single center between 2001 and 2015. Clinical data of patients with stent migration were compared with those without stent migration. Collected data included demographics, clinical findings, diagnostic imaging, laboratory results, EVS procedure, stent type, and the position of the stent relative to the aorta, inferior vena cava, and renal vein. A Kruskal-Wallis test was used to compare the differences between groups.

Results: Of 70 patients (69 men) with a median age of 26 years (range, 16-43 years) who underwent EVS for NCS, 17 (24.3%) had stent migration. During a mean 15 months (range, 6-120 months) of follow-up, migration occurred in 16 of the patients (60.7%), and all of their renal units. The mean migration time was 20 months.

Conclusions: Stent migration is a common problem after renal vein reconstruction. Stents with a higher incidence of migration may be better avoided.

-75 patients (49 men) with a median age of 27 years (range, 16-43 years) underwent EVS for NCS
-Mean 55 months (range, 6-126 months) of follow-up
-Stent migration occurred in five patients (6.7%), and all of them were male
Endovascular stenting in the treatment of pelvic vein congestion caused by nutcracker syndrome: Lessons learned from the first cases

Oliver Hartung, MD, Dominique Giron-dis, MD, Mounir Bejjani, MD, Ivo Marani, MD, Fulvio Hukata, MD, Pierre Barboudjety, MD, PhD, and Eco E. Allini, MD, PhD, Marseille, France

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

NYU Experience...

Endovascular Treatment of Nutcracker Syndrome

Aliakhmer Polichia, Archie Lammersen, Abid Qaddour, Todd Linden, and Thomas Malinowski, New York, New York

Background: Nutcracker syndrome, or mesenteric compression of the left renal vein (LRV) with resultant hypertension in the left kidney, is a rare entity that can lead to significant morbidity and mortality if left untreated. The aim of this study was to present our experience with 75 patients who presented with nutcracker syndrome, including one patient with a concomitant LRV resulting in parietal nutcracker syndrome, who underwent successful endovascular treatment with novel venous stenting. A review of existing literature on endovascular management of nutcracker syndrome was also performed.

NYU Experience:

- Straddle the Lesion: prevent/avoid “toothpasting”
Conclusions

Important tips and tricks/lessons learned

- Oversizing by 20% and specifically to the renal vein measured distally in the renal hilum (with patient in standing position by duplex)

- IVUS may be more accurate: can allow accurate measurement during valsalva

- Self-expanding 16x60 stents are usually adequate

- Engaging distally into beyond 1st order branch
Conclusions

Important tips and tricks/lessons learned

• Oversizing by 20% and specifically to the renal vein measured distally in the renal hilum (with patient in standing position by duplex)

• IVUS may be more accurate: can allow accurate measurement during valsala

• Self-expanding 16x60 stents are usually adequate

• Engaging distally into beyond 1st order branch

• Avoid deploying stents asymmetrically, straddle the “lesion” to avoid “toothpasting” of stent

Conclusions

• We are in the early days of Endovascular Treatment for NS

• Surgical treatment continues to be benchmark…(for now)

• But…

• up to 15% perioperative complication rate

• 1 in 3 requires reintervention within 30 days…….usually with stenting…

Conclusions

• We are in the early days of Endovascular Treatment for NS

• Surgical treatment continues to be benchmark…(for now)

• But…

• Results for LRV stenting appear safe, effective and durable

Conclusions

• We are in the early days of Endovascular Treatment for NS

• Surgical treatment continues to be benchmark…(for now)

• But…

• up to 15% perioperative complication rate

• 1 in 3 requires reintervention within 30 days…….usually with stenting…

• Results for LRV stenting appear safe, effective and durable

• Improvement in technology for venous stents is expected and will result in venous stents to replace open surgery as the standard of care for treatment of Nut Cracker Syndrome