Hybrid Endo-Open Surgery Is The Ideal Treatment for Nutcracker Syndrome

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Left Renal Vein Stenting

- High radial strength
- Good conformability
- Minimal shrinkage
  - Wallstent
  - SMART stent
- Large caliber
  - > length
- 14-16 mm X 60 mm

Endovascular Stenting for Treatment of Nutcracker Syndrome: Report of 61 Cases With Long-Term Followup

Chen et al, Wang et al, Wu et al

<table>
<thead>
<tr>
<th></th>
<th>Chen et al</th>
<th>Wang et al</th>
<th>Wu et al</th>
</tr>
</thead>
<tbody>
<tr>
<td>No of Patients</td>
<td>61</td>
<td>30</td>
<td>75</td>
</tr>
<tr>
<td>Technical success</td>
<td>98%</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>Symptom relief</td>
<td>95%</td>
<td>93%</td>
<td>?</td>
</tr>
<tr>
<td>Follow up</td>
<td>66 mths</td>
<td>36 mths</td>
<td>55 mths</td>
</tr>
<tr>
<td>Stent migration</td>
<td>1</td>
<td>2</td>
<td>5</td>
</tr>
</tbody>
</table>

patients with nutcracker syndrome

Stent Migration

- Recent flank/ back pain
- h/o pelvic congestion
- Multiple pregnancies
- B/L ovarian vein coiling
- LRV stenting
- Stent thrombosis
- Stent migration

- Too small?
- Too short?
- Space / Narrow?
- Between 2 pulsatile structures
Stent Migration

- 24 yr F 3 s/p days LRV stenting
- Recent flank/ back pain
- h/o pelvic congestion
- Multiple pregnancies
- B/L ovarian vein coiling
- LRV stenting
- Stent thrombosis
- Stent migration

- Too small?
- Too short?
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Recent flank/ back pain
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Stent Compression

- Initial excellent relief
- Recurrent flank/ back pain
- PTA for stenosis
- Stent thrombosis
- Mechanical thrombectomy
- Xeralto
- Acute symptomatic PE

- 17 yr F 3 years s/p LRV stenting

Surgical Exploration

Stent Removal
So Why a Hybrid Reconstruction?

Early Results

<table>
<thead>
<tr>
<th>Symptom</th>
<th>% Relief</th>
</tr>
</thead>
<tbody>
<tr>
<td>Left flank pain</td>
<td>33 (86.9%)</td>
</tr>
<tr>
<td>Hematuria</td>
<td>25 (96.2%)</td>
</tr>
<tr>
<td>Proteinuria</td>
<td>19 (100%)</td>
</tr>
<tr>
<td>Varicocele</td>
<td>2/4 (50%)</td>
</tr>
</tbody>
</table>

37 Patients

- Mortality: 0
- Kidney failure: 0
- Wound complications: 0
- Re-interventions in <30 days: 3 (2 endovascular / 1 open)

Long-term Results

Mean Follow up 37 mths

<table>
<thead>
<tr>
<th>Patients</th>
<th>n=37</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stenosis</td>
<td>7</td>
</tr>
<tr>
<td>Thrombosis</td>
<td>1</td>
</tr>
</tbody>
</table>

Primary Patency

Secondary Interventions

<table>
<thead>
<tr>
<th>Stents</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 stent migration</td>
<td>Retrieval+Restenting</td>
</tr>
<tr>
<td>2 in-stent stenosis</td>
<td>Restenting</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Open</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 saphenous vein re-implantation</td>
<td></td>
</tr>
<tr>
<td>1 gonadal vein re-implantation</td>
<td></td>
</tr>
</tbody>
</table>

Nutcracker Phenomenon: Etiology

- Narrow aorto-mesenteric angle
- Low or lateral origin of SMA
- High course of LRV
- Stretching of LRV over the aorta
- Asthenic body habitus
- Ptosis of the left kidney
- Lack of retroperitoneal fat
- Fibrous tissue aorto-mesenteric angle
- Wasted paraspinal muscles
**LRV Transposition: GSV patch**

- Tension free anastomosis
- Improve caliber of small LRV
- Excise fibro-fatty tissue from aorto-mesenteric space

**LRV Transposition: GSV cuff**

- 37 Patients
  - 36 OS
  - 1 ENDO
  - 31 LRV transposition
  - 3 GSV patch
  - 2 LGV transposition
  - 6 GSV cuff
  - 4 GSV patch
  - 4 GSV cuff & patch

**Hybrid Reconstruction**

- 52 Patients
  - 51 OS
  - 1 ENDO
  - 44 LRV transposition
  - 3 GSV patch
  - 2 LGV transposition
  - 6 GSV cuff
  - 0 GSV patch
  - 4 GSV cuff & patch
  - 7 Hybrid Reconstruction
  - 100% PPatency

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**Treatment of nutcracker syndrome with open and endovascular interventions**

Young Jho, MD; Peter Głowiczki, MD; Mune Kodama, MD; Harshil Ruparelia, MD;
Naruto H. Hase, MD; Atushi A. Honda, MD; Takehiko S. Okita, MD; and Thomas C. Brown, MD; Kingston, New York

20 year experience: 1994 - 2014

- Hybrid Endo – Open
- Stenting alone
Gonadal Vein Transposition

- Less invasive
- Good option in pts with PCS
- Abolishes GV reflux
- When GV small caliber, bypass with saphenous vein

Nutcracker Syndrome
Hybrid Reconstruction

- Provides the best decompression of the LRV and chance of long-term patency
  - Transposition removes vein from area of maximum compression
  - Patch allows use of large caliber stent (≥14mm)
  - Stent prevents LRV compression
  - No stent migration (shorter stents? No IVC protrusion)

- Early patency excellent / Long-term?
- Better venous stents (flexible with good radial force) still awaited