

Renal Vein Stenting for Nutcracker Syndrome

A potentially less-invasive treatment for a rare but debilitating condition.

BY JAMES L. GUZZO, MD, AND HEITHAM T. HASSOUN, MD, FACS

Entrapment of the left renal vein (LRV) between the abdominal aorta and superior mesenteric artery (SMA) causing the classic clinical triad of hematuria, varicocele, and left abdominal or flank pain was first described in 1950.¹ Later, this array of symptoms was termed “the nutcracker syndrome” by De Schepper in 1972.² Endovascular technology has evolved as a potential minimally invasive therapy for relief of symptoms caused by this compression syndrome. We report a case of successful percutaneous LRV stenting for treating nutcracker syndrome and review the current literature.

CASE REPORT

A healthy 26-year-old man was referred for a second opinion regarding nutcracker syndrome. He described a several-month history of intermittent left flank pain, progressing to left testicular pain with onset of microscopic hematuria. Urologic evaluation for this constellation of symptoms led to a contrast-enhanced computed tomography (CT) scan of his abdomen/pelvis. The CT scan identified compression of the LRV between the SMA and aorta, with an abundance of venous collaterals in the retroperitoneum (Figure 1). A left renal venography performed at an outside facility confirmed the diagnosis and demonstrated an LRV-inferior vena cava (IVC) pressure gradient of 6 mm Hg (normal value < 1–2 mm Hg).

The patient was counseled regarding the risks, benefits, and alternatives of surgical versus endovascular therapeutic alternatives, and he opted for LRV stenting. After obtaining appropriate informed consent, he was taken to the endovascular suite where the right common femoral vein was accessed under ultrasound guidance and local anesthesia. After sheath insertion and systemic administration of heparin (0.8 mg/kg body weight), a marker pigtail catheter was placed into the IVC and a vena cavagram was obtained. The catheter and sheath were then exchanged for a 7-F Pinnacle Destination sheath (Terumo Interventional Systems, Somerset, NJ), which was advanced to the LRV-IVC junction.

The LRV was selected with a Cobra 2 catheter (Cook Medical, Bloomington, IN) and a 0.035-inch hydrophilic Glidewire (Terumo Interventional Systems), and the Cobra 2 catheter was exchanged for a straight flush catheter. A selective left renal venogram was then obtained, which identified abundant large collaterals of the left adrenal and renolumbar veins and an LRV diameter of 12 mm (Figure 2). A 0.035-inch Storq wire (Cordis Corporation, Bridgewater, NJ) was then selectively advanced into the left gonadal vein, and the Destination sheath was advanced into the LRV. Pre-stent 8-mm balloon angioplasty was performed to facilitate sheath and stent advancement across the stenosis. A 14-mm X 6-cm SMART control stent (Cordis Corporation) was then deployed from the left gonadal vein origin, with 1-cm extension into the IVC. Post-stent 10-mm balloon angioplasty was performed to dilate the vein. Completion venography demonstrated a widely patent LRV with decreased collateral filling and disappearance of an LRV-IVC pressure gradient (Figure 2).



Figure 1. CT angiography demonstrating compression of the proximal LRV between the aorta and SMA, with poststenotic dilatation (arrow) and prominent renolumbar collaterals.

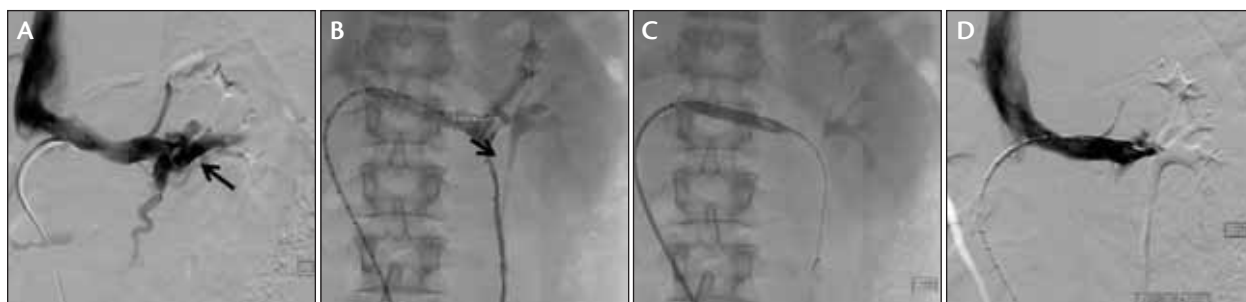


Figure 2. Venogram demonstrating LRV compression with “double-density” and prominent renolumbar collaterals (arrow) (A). The gonadal vein is selected to facilitate flush catheter angiography and for tracking of the sheath across the lesion (B). The lesion is predilated (C), and a 14-mm, self-expanding nitinol (SMART) stent is deployed (D).

After the procedure, the patient was started on aspirin (81 mg/day) and low-molecular-weight heparin (1 mg/kg subcutaneously twice/day). He had no postoperative complications but did report new onset back and left flank pain, which was relieved with analgesics and anti-inflammatory medication. The patient underwent LRV duplex imaging, which demonstrated a patent stent, and he was discharged to home on postoperative day 1. At 1-month follow-up, the patient had resolution of his symptoms, and repeat CT demonstrated a widely patent LRV (Figure 3). Anticoagulation was discontinued, and the patient remained symptom-free at 6 months. He is scheduled to undergo annual duplex examination for surveillance.

DISCUSSION

Nutcracker syndrome describes an array of incapacitating symptoms caused by LRV hypertension secondary to vein compression between the SMA and the aorta. Diagnosis of this syndrome requires a high index of suspicion and can be accomplished with duplex sonography, CT, magnetic resonance imaging, or venography, and it is confirmed by measured pressure gradient across the lesion. Treatment of nutcracker syndrome is controversial, with a wide array of therapeutic options. Most reports consist of small case series, and long-term results are limited. Surgical approaches reported include venolysis and anterior nephropexy, renal vein bypass or interposition grafting, renocaval reimplantation, and autotransplantation.³⁻⁷

More recently, endovascular approaches have been reported for this uncommon problem. The first case report of endovascular stent placement for renal vein hypertension was in 1996 by Neste et al who described a 58-year-old man successfully treated with a Wallstent (Boston Scientific Corporation, Natick, MA).⁸ Additional early reports described successful stenting for nutcracker syndrome,⁹⁻¹² and the largest series of five patients was reported by Hartung et al in 2005, in which five patients were treated with Wallstents for pelvic vein congestion.¹³

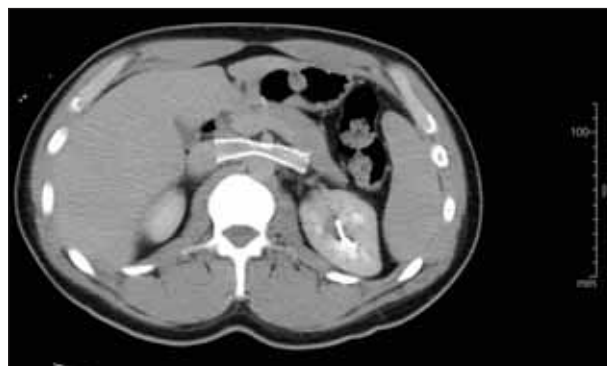


Figure 3. Follow-up CT demonstrates a widely patent LRV stent with decrease in the retroperitoneal venous collaterals.

All were asymptomatic at 1 month, and two patients had recurrence at 3 to 4 months, with repeat imaging showing stent migration. One patient had recurrent pain that later demonstrated to be related to endometriosis, and the remaining two were symptom free at 4 months and 2 years, respectively. Interestingly, Hartung et al reported success with 60-mm-long stents, whereas both patients with recurrence due to migration had placement of shorter 40-mm-long devices.

To prevent potential stent migration, either during deployment or afterward, we also chose to use a longer (ie, 60 mm) stent, with extension from the gonadal vein to 1 cm into the IVC. We used a 14-mm, self-expanding nitinol SMART stent, which allowed for approximately 15% vessel oversizing. Because this is the largest diameter SMART stent available in the United States, larger-diameter renal veins, although unusual, would require a Wallstent or other device. Another technical point is the importance of using a stiff guidewire advanced distally into the gonadal vein to facilitate stent tracking from the groin. Once across the lesion, the wire can be retracted and carefully advanced distally into the renal vein before stent deployment.

Most venous interventions call for a 3- to 6-month period of systemic anticoagulation, although there are limited data on the necessity of this algorithm in the absence of an acute thrombotic event. We arbitrarily chose to treat this patient with 1 month of low-molecular-weight heparin followed by long-term antiplatelet therapy with low-dose aspirin to reduce the risk of stent thrombosis. Clearly, long-term data are needed to help guide future treatment protocols.

CONCLUSION

Although it is in its infancy, endovascular therapy for nutcracker syndrome is a viable option that may circumvent more invasive procedures. Percutaneous angioplasty and stenting for symptomatic LRV compression and the nutcracker syndrome is an excellent alternative to more invasive approaches. However, further follow-up and investigation will be required to determine if the durability of this approach compares favorably to current open options for this rare condition. ■

James L. Guzzo, MD, is a Vascular Fellow, Department of Surgery, Division of Vascular & Endovascular Surgery, Johns Hopkins University School of Medicine in Baltimore, Maryland. He has disclosed that he holds no financial interest in any product or manufacturer mentioned herein. Dr. Guzzo may be reached at jguzzo1@jhmi.edu.

Heitham T. Hassoun, MD, FACS, is Associate Professor of Cardiovascular Surgery, The Methodist Hospital Physician Organization & DeBakey Heart & Vascular Center in Houston, Texas. Dr. Hassoun has disclosed that he holds no financial interest in any product or manufacturer mentioned herein.

1. El Sadr AR, Mina A. Anatomical and surgical aspects in operative management of varicoceles. *Urol Cutaneous Rev.* 1950;54:257-262.
2. De Schepper A. Nutcracker phenomenon of the renal vein causing left renal vein pathology. *J Belg Rad.* 1972;55:507-511.
3. Wendel RG, Crawford ED, Hehman KN. The "nutcracker" phenomenon: an unusual case for renal varicosities with hematuria. *J Urol.* 1980;123:761-763.
4. Shaper KR, Jackson JE, Williams G. The nutcracker syndrome: an uncommon cause of hematuria. *Br J Urol.* 1994;74:144-146.
5. Coolsaet BL. Ureteric pathology in relation to right and left gonadal veins. *Urology.* 1978;12:40-49.
6. Stewart BH, Reiman G. Left renal venous hypertension "nutcracker" syndrome managed by direct renocaval reimplantation. *Urology.* 1982;20:365-369.
7. Chuang CK, Chu SH, Lai PC. The nutcracker syndrome managed by autotransplantation. *J Urol.* 1997;157:1833-1834.
8. Neste MG, Narasimhan DL, Belcher KK. Endovascular stent placement as a treatment for renal venous hypertension. *J Vasc Interv Radiol.* 1996;7:859-861.
9. Segawa N, Azuma H, Iwamoto Y, et al. Expanding metallic stent placement for nutcracker phenomenon. *Urology.* 1999;53:631-633.
10. Park YB, Lim SH, Ahn JH, et al. Nutcracker syndrome: intravascular stenting approach. *Nephrol Dial Transplant.* 2000;15:99-101.
11. Chiesa R, Anzuini A, Marone EM, et al. Endovascular stenting for the nutcracker phenomenon. *J Endovasc Ther.* 2001;8:652-655.
12. Wei SM, Chen ZD, Zhou M. Intravenous stent placement for the treatment of nutcracker syndrome. *J Urol.* 2003;170:1934-1935.
13. Hartung O, Grisoli D, Boufi M, et al. Endovascular stenting in the treatment of pelvic vein congestion caused by nutcracker syndrome: lessons learned from the first five cases. *J Vasc Surg.* 2005;42:275-280.

Cordis S.M.A.R.T.® CONTROL® Iliac Stent System ESSENTIAL PRESCRIBING INFORMATION

INDICATIONS: The Cordis S.M.A.R.T.® CONTROL® Iliac Stent System is indicated for improving luminal diameter in patients with symptomatic atherosclerotic disease of the common and/or external iliac arteries up to 126 mm in length, with a reference vessel diameter of 4 to 9 mm, and angiographic evidence of a patent profunda or superficial femoral artery.

CONTRAINDICATIONS: There are no contraindications known at this time based on the clinical data. **WARNINGS/PRECAUTIONS:** It is not recommended that stents be used in patients with a history of contrast not amenable to pretreatment with steroids and/or antihistamines, or a hypersensitivity to Nitinol (nickel titanium). • Safety and effectiveness has not been demonstrated in patients with: Lesions that are either totally or densely calcified. • Uncontrollable hypercoagulability and/or other coagulopathy. • Confirmed pregnancy. • Pediatric patients. • Caution should be taken when stenting patients with poor renal function who, in the physician's opinion, may be at risk for a contrast medium reaction. • It is important to use the correct stent size, as recommended in the Stent Size Selection Table provided in Section VIII - Directions for Use of the IFU. The stent may cause a thrombus or distal embolization, or it may migrate from the site of an implant down the arterial lumen. • The device should only be used by physicians who are trained in such interventional techniques as percutaneous transluminal angioplasty and placement of intravascular stents. • The long-term outcome following repeat dilatation of endothelialized stents is unknown at present. • To avoid the possibility of dissimilar metal corrosion, do not implant stents of different metals in tandem where overlap or contact is possible, with an exception of stents made of 316L stainless steel which are compatible with stents made of nickel titanium alloy. • Before insertion of the primary dilatation catheter, the appropriate antiplatelet and anticoagulant therapy should be administered. Aspirin may be used as antiplatelet therapy. • When catheters are in the body, they should be manipulated only under fluoroscopy. Radiographic equipment that provides high quality imaging is needed. • Do not use the delivery system with a power injection system. Stent Handling: Avoid contaminating the stent. As with any type of vascular implant, infection, secondary to contamination of the stent, may lead to thrombosis or pseudoaneurysm. • Do not use with Ethiodol or Lipiodol® contrast media to avoid possible damage to the stent delivery system components. • Do not expose the delivery system to organic solvents (e.g. alcohol). • Store in a cool, dark, dry place. • Do not use if entire temperature exposure indicator is completely black as the unconstrained stent diameter may have been compromised. The black dotted pattern on the gray temperature exposure indicator, found on the pouch, must be clearly visible. The S.M.A.R.T.® CONTROL® Iliac Stent System is intended for single use only. DO NOT re-sterilize and/or reuse the device. • Do not use if the pouch is opened or damaged. If it is suspected that the sterility or performance of the device has been compromised, the device should not be used. Use the stent system prior to the "Use By" date specified on the package. Stent Placement: Do not attempt to drag or reposition the stent, as this may result in unintentional stent deployment. • Once the stent is partially deployed, it cannot be recaptured using the stent delivery system. Do not attempt to recapture the stent once the stent is partially deployed. • Avoid stent placement that may obstruct access to a vital side branch. • Overstretching of the artery may result in rupture and life threatening bleeding. Do not overstretch the stent. • In the event of thrombosis of the expanded stent, thrombolysis and PTA should be attempted. • When treating multiple lesions, the most distal lesion should be stented first followed by the stenting of proximal lesions. Stenting in this order eliminates the need to cross and reduces the chance of dislodging stents, which have already been placed. Overlap of sequential stents is necessary but the amount of overlap should be kept to a minimum. • Fractures of this stent may occur. Fractures may also occur with the use of multiple overlapping stents. In the S.M.A.R.T.® CONTROL® Iliac Stent System, they have been reported most often in clinical uses for which the safety and effectiveness have not been established. The causes and clinical implications of stent fractures are not well characterized. Care should also be taken when deploying the stent as excessive force could, in rare instances, lead to stent deformation and/or fracture. Stent / System Removal: In the event of complications such as infections, pseudoaneurysm or fistulization, surgical removal of the stent may be required. Standard surgical procedure is appropriate. Post Implant: Re-crossing a stent with adjunct devices must be performed with caution to avoid stent damage or migration. • In patients requiring the use of antacids and/or H2-antagonists before or immediately after stent placement, oral absorption of antiplatelet agents (e.g. aspirin) may be adversely affected. • Antiplatelet therapy should be maintained for at least three months post-procedure. **ADVERSE EVENTS:** Potential adverse events of intravascular stent implantation: Allergic / anaphylactoid reaction • Aneurysm • Angina / coronary ischemia • Arterial occlusion / thrombus, puncture site • Arterial occlusion / thrombus, remote from puncture site • Arterial occlusion / restenosis of the treated vessel • Arteriovenous fistula • Arrhythmia • Death related to procedure • Death unrelated to procedure • Embolization, arterial • Embolization • Stent fever • Hematoma bleed, remote site • Hematoma bleed at needle, device path: nonvascular procedure • Hematoma bleed, puncture site: vascular procedure • Hypotension / hypertension • Intimal injury / dissection • Ischemia / infarction of tissue/organ • Local infection • Malposition (failure to deliver the stent to the intended site) • Migration • Pulmonary embolism • Pseudoaneurysm • Renal failure • Septicemia / bacteremia • Stroke • Vasospasm • Venous occlusion / thrombosis, remote from puncture site • Venous occlusion / thrombosis, puncture site

CAUTION: Federal (USA) law restricts these devices to sale by or on the order of a physician.

See package insert for full product information.

*The third-party trademarks used herein are trademarks of their respective owners.

Cordis Corporation

© Cordis Corporation 2010 155-7289 21463 03/2010

Cordis
a Johnson & Johnson company