Hybrid Management for Anterior Nutcracker Syndrome: Left Renal Vein Stenting with Laparoscopic Stent Exofixation

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Introduction: Left renal vein stenting (LRVS) for the treatment of anterior nutcracker syndrome (NCS) has been associated with a significant risk of stent migration into the inferior vena cava or right ventricle.

Surgical technique: A hybrid technique is reported for the treatment of NCS to prevent stent migration. The first part of the procedure consists of LRVS at the level of the aortomesenteric compression. The second part consists of laparoscopic stent exofixation through a transperitoneal direct approach. The left renal vein is exposed in order to visualise the stent meshes through the venous wall. Stent exofixation is performed with a simple transfixing polypropylene stitch, reinforced with a Teflon pledget.

Discussion: The hybrid treatment of anterior NCS combining laparoscopic stent exofixation with left renal vein stenting is a simple and low morbidity technique. Further follow up data are needed to evaluate its potential benefit in reducing the risk of left renal vein stent migration.

INTRODUCTION

Left renal vein stenting (LRVS) was reported for the first time by Neste in 1996 for the treatment of anterior nutcracker syndrome (NCS).1 Nowadays, this technique is the first choice treatment for symptomatic NCS2 over invasive open surgical procedures. The most serious complication of the LRVS is intracaval or right ventricular stent migration.3 Here hybrid management is described for the treatment of anterior NCS (Fig. 1) associating an LRVS with laparoscopic stent exofixation during the same procedure. This strategy aims to eliminate the risk of stent migration.

Radiological technique

The patient is positioned in a dorsal decubitus position with an inflatable pillow (Pelvic-Tilt, O.R. Comfort, LLC, Glen Ridge, NJ, USA) placed behind the left flank. The right femoral vein is punctured under general anaesthesia. After systemic heparinisation (50 UI/Kg), an 8 Fr. — 55 cm Flexor sheath (Cook Medical, IN, USA) is inserted into the inferior vena cava (IVC), to the level of the left renal vein (LRV) ostium.

The LRV is catheterised and phlebography performed to visualise the venous compression. It is pre-dilated at the aortomesenteric portion with an Armada 35 8 × 40 mm semi-compliant balloon (Abbott Vascular, CA, USA). A Wallstent (Boston Scientific, MA, USA) is deployed without protrusion in the IVC. The stent length depends on the distance between the gonadal vein ostium and the LRV-IVC junction.

Surgical technique

The second part of the procedure consists of laparoscopic stent exofixation. This technique uses a laparoscopic transperitoneal direct (TPD) approach.4 Based on this TPD approach to the infrarenal aorta, a 90° right rotation of the table allows the greater omentum and small bowel to be moved to the right side of the abdomen, and a laparoscopic retractor is not necessary. The pneumoperitoneum is inflated up to 14 mmHg through a Veress needle before

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Positioning four trocars (Fig. 2). A 45° endoscope (Karl Storz Endoscopie, France) is positioned along the left anterior axillary line two finger breadths below the costal margin. Two 10 mm trocars are positioned at the supraumbilical and left paramedian level for operator instruments. One 10 mm trocar is positioned two finger breadths below the umbilicus along the left paramedial line for assistant instrumentation. The dissection then is conducted under the transverse mesocolon using an Ultracision Harmonic Scalpel (Ethicon, NJ, USA) until the LRV is exposed. The stent meshes can be visualised through the venous wall, allowing stent exofixation to be performed with a simple transfixing 5/0 polypropylene stitch, reinforced with a Teflon pledget (Fig. 3).

The retroperitoneum is left open. Horizontalisation of the patient allows the small bowel to fall back into place.

Post-operative phlebography and computed tomography scans are presented in Figure 4 and Figure 5.

This hybrid procedure was performed in two female patients (26 and 36 years old). At 12 month follow up, both had excellent clinical and radiological results without complication or stent migration.

**DISCUSSION**

LRVS has now replaced open surgery as the first choice treatment for anterior NCS, thanks to its good long term results and less invasive approach. However, the most serious complication of this procedure is stent migration into the IVC or right ventricle. According to the three largest series of endovascular treatment for NCS (30, 61, and 75 patients), stent migration occurred in 4.9%–6.7% of cases between the immediate post-operative period and several months after the intervention. The stent can sometimes be retrieved easily with a snare catheter. In other cases, its

![Figure 1. Pre-operative CT scan. A: The narrow aortomesenteric angle is shown (10° angle). B: Coronal view of the dilated left gonadal vein (white arrow).](image)

![Figure 2. Placement of the laparoscopic trocars. 1, Camera; 2 and 3, operator instrument; 4, assistant instrumentation.](image)
extraction requires cardiac surgery. Two cases of tricuspid valve replacement have been reported.3,7

Because of the narrow aortomesenteric angle and the aortic pulse, the left renal vein stent deployed at aortomesenteric level acts like a bar of soap. The hypothesis is that every aortic pulse would weaken the stent anchoring in the venous wall, until migration. This inconvenience necessitated development of a new hybrid technique in order to avoid the stent migration.

Laparoscopic stent exofixation limits the risk of migration and is a low morbidity procedure. This strategy consists of anchoring the stent to the left renal vein with a unique and simple transfixing polypropylene stitch put through one of its meshes. The TPD approach has been described. Two other laparoscopic approaches exist: transperitoneal retrocolic (TPRC) and retroperitoneoscopic (RP).3,9 Through these three approaches, the entire LRV is exposed without mobilising the left kidney. The transperitoneal left retrorenal approach (TPRR) should be avoided because the kidney rotation to the right, associated with a LRV mobilisation, potentially induces stent migration. The best approach depends on the medical history, anatomical variants, and morphology of the patient. In most cases, those who present an anterior NCS have little intra-abdominal and retroperitoneal fat, including mesentery and perirenal fat. For these patients without a history of abdominal surgery, the TPD approach seems to be the safest and fastest approach.7 Right lateral decubitus is sufficient to move the small bowel to the right in order to obtain a large and stable operative space. The TPD approach does not mobilise the LRV and limits the dissection. The two other approaches (TPRC and RP) are also possible but increase the risk of mesocolic breach.7 For obese patients, the TPD approach can be challenging because of the volume of intra-abdominal fat and the difficulty keeping the small intestine to the right. In this case, the TPRC approach allows a

Figure 3. Per-operative laparoscopic view. A: Transfixing polypropylene stitch through the renal vein wall and the stent meshes (shown in the red box). B: Polypropylene stitch reinforced with a Teflon pledget.
good and stable exposure of the operative space. For patients with a history of abdominal surgery, the RP approach allows sufficient visualisation of the LRV to place a stitch for the stent exofixation. Its main disadvantages are a reduced operative space and a conflict between laparoscopic instruments if the distance between left rib cage and iliac crest is short.

The left pelvic varicose veins can be managed by preoperative embolisation or an intra-operative clip ligation of the left gonadal vein during the laparoscopic procedure. Furthermore, the stent exofixation allows use of a short stent in order to preserve the left gonadal vein ostium if a subsequent embolisation is scheduled.

The risk of migration could also be reduced by using intravascular ultrasound (IVUS) to accurately measure the LRV diameter at the aortomesenteric portion. An important stent oversizing is still needed and is associated with the risk of intimal hyperplasia and subsequent intrastent restenosis. Laparoscopic stent exofixation decreases this oversizing and limits these complications and the risk of stent migration.

**CONCLUSION**

Hybrid treatment associating LRVS and laparoscopic stent exofixation during the same procedure is a quick, simple,
and low morbidity technique. Its purpose is to avoid the risk of stent migration into the IVC or right ventricle. Further follow up data are needed to evaluate this technique in reducing the risk of this severe complication.

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