Endovascular treatment of a patient with nutcracker syndrome and pelvic varices involving anterior and posterior renal veins

Sergio Quilici Belczak, PhD,[a] Felipe Coelho Neto, PhD,[b] Walter Junior Boim de Araújo, PhD,[c] Walter Kegham Karakhanian, PhD,[d] *and* Walter Zavem Karakhanian, PhD,[d] *São Paulo and Curitiba, Brazil*

ABSTRACT

We have reported a case of a 36-year-old woman with flank and pelvic pain and hematuria. She had posterior nutcracker syndrome and pelvic varices involving one anterior and three posterior renal veins (including one major vein). We used a complete endovascular approach, which included stent implantation in the major posterior renal vein and left gonadal vein embolization. During a 12-month follow-up period, the patient had had no symptoms and good computed tomography results. Endovascular treatment represents a safe and successful option for patients with nutcracker syndrome and pelvic varices involving the anterior and posterior renal veins. (J Vasc Surg Cases Innov Tech 2022;8:202-5.)

Keywords: Endovascular treatment; Nutcracker syndrome; Pelvic veins; Renal veins; Vascular surgery

Nutcracker phenomenon is often anterior and, when asymptomatic, is characterized by abnormal outflow from the left renal vein (LRV) into the inferior vena cava due to extrinsic LRV compression, often accompanied by demonstrable lateral (hilar) dilatation and medial (mesoaortic) stenosis.[1] Nutcracker syndrome (NS), in turn, is a well-characterized set of symptoms whose severity is related to the severity of the anatomic and hemodynamic findings. The most reported symptoms are flank and/or pelvic pain and hematuria. Pelvic congestion and varicocele can also occur in women and men, respectively, resulting from reflux in the gonadal vein, which, in this condition, will become the main collateral pathway for LRV drainage. Although NS is a well-defined condition, no consensus has been reached regarding the indications and treatment options. When symptoms are severe, surgical intervention could be necessary. In this setting, endovascular treatment has been widely accepted, with placement of a self-expanding stent, which can be combined with left gonadal vein embolization. This technique is not without complications, with reports of stent migration even into the cardiac chambers and pulmonary artery.[1-6]

More rarely, the nutcracker phenomenon will be posterior, resulting from LRV compression between the aorta and the spine or even in a circumaortic renal vein. Given that this condition is rare, defining the role of endovascular treatment has been difficult, because no evidence is available of the outcomes for these patients in the long term.[7-10]

In the present report, we have described an endovascular approach to NS and pelvic varices involving the anterior and posterior renal veins in a female patient. She provided written informed consent for the report of her case details and imaging findings.

CASE REPORT

A 36-year-old woman had been admitted with severe flank and pelvic pain and hematuria. The patient had previously been treated for iliac vein compression syndrome but reported long-lasting pelvic pain and dyspareunia. She had experienced some episodes of hematuria before the present admission. The renal function test results were normal. Contrast-enhanced computed tomography (CT) of the abdomen and pelvis showed a stent correctly placed for iliac vein compression syndrome and a circumaortic LRV, with the presence of one anterior and three posterior renal veins (including one major vein with NS), dilatation of the left gonadal vein, and pelvic varices (Fig 1).

She presented with multiple vein compression and retroperitoneal intradiaphragmatic reflux worsening her status. Although the iliac vein compression syndrome had been treated, she was experiencing severe flank pain and hematuria. Thus, we favored a surgical approach to the posterior NS. Endovascular treatment was proposed, and surgical planning was performed based on CT scan reconstruction.

The procedure was performed in a hybrid operating room. The right basilic and left femoral veins were accessed. LRV

From the IAPACE — Instituto de Aprimoramento e Pesquisa em Angiorradiologia e Cirurgia Endovascular, São Paulo[a]; the Pontifícia Universidade Católica do Paraná, Curitiba[b]; the Universidade Federal do Paraná, Curitiba[c]; and the Departamento de Cirurgia, Disciplina de Cirurgia Vascular e Endovascular, Faculdade de Ciências Médicas da Santa Casa de São Paulo, São Paulo.[d]

Correspondence: Sergio Quilici Belczak, PhD, IAPACE — Instituto de Aprimoramento e Pesquisa em Angiorradiologia e Cirurgia Endovascular, Avenida Pacaembu 1109, São Paulo, SP 01234-001, Brazil (e-mail: belczak@gmail.com).

The editors and reviewers of this article have no relevant financial relationships to disclose per the Journal policy that requires reviewers to decline review of any manuscript for which they may have a conflict of interest.

2468-4287

https://doi.org/10.1016/j.jvscit.2022.01.011

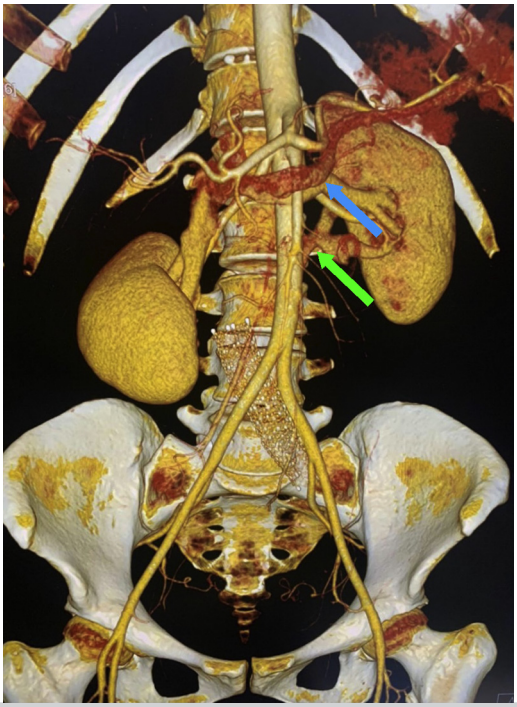

Fig 1. Contrast-enhanced computed tomography (CT) scan of the abdomen and pelvis showing iliac vein compression syndrome and a circumaortic left renal vein (LRV), with the presence of an anterior vein (*blue arrow*) and a major posterior renal vein (*green arrow*).

phlebography confirmed the presence of one anterior and three posterior renal veins (including one major vein with NS) and dilatation of the left gonadal vein (Fig 2). The renocaval pressure gradient was 5 mm Hg. Embolization of the gonadal vein was performed with eight MicroVention coils (Terumo, Tokyo, Japan) with smaller distal diameters (from 8 mm) and larger proximal diameters (≤14 mm).

After embolization, the major posterior renal vein diameter was measured using a Volcano intravascular ultrasound, and a 12 × 60-mm Venovo stent (BD, Franklin Lakes, NJ) was implanted in this vein. Postdilatation was performed using a 10 × 40-mm Conquest balloon (BD). Follow-up phlebography (Fig 3) and intravascular ultrasound showed good results, and the renocaval pressure gradient had decreased to 1 mm Hg. The patient had no complaints and received dual antiplatelet therapy (acetylsalicylic acid 100 mg and clopidogrel 75 mg) for 1 month, followed by monotherapy with acetylsalicylic acid (100 mg) for 6 months.

The patient was followed up for 12 months and had no additional complications. The follow-up CT angiography and Doppler ultrasound showed stent patency (Fig 4), complete obliteration of the gonadal vein, and the absence of dilated pelvic veins.

DISCUSSION

Typically, renal vein NS refers to LRV compression between the abdominal aorta and superior mesenteric artery. Some investigators have termed such compression "anterior (or type A) NS" and have used "posterior (or type B) NS" to designate LRV compression between the aorta and spine.[11-13] NS refers to the compression of the renal vein appearing like a lever-style nutcracker crushing a nut, and, in the absence of more specific nomenclature for compression between the aorta and spine, we have also used the terms anterior and posterior NS.

In a previous study reported in 2020, we reported a case of anterior NS in a 42-year-old woman with an anterior and a posterior NS successfully treated with endovascular stent implantation in the renal vein anterior to the aorta and left gonadal vein embolization.[14] She showed complete clinical improvement and remained asymptomatic at 12 months postoperatively. In the same report, we identified previous occurrences and discussed the diagnosis and treatment based on a careful literature search of the main databases regarding NS.

At that time and in a new search performed for the present report, we found only two cases of endovascular treatment of NS in patients with a circumaortic renal vein in the literature. Cohen et al[15] performed angioplasty of the renal vein anterior to the aorta with placement of a 12 × 40-mm self-expanding stent (Memotherm; CR Bard, Covington, GA) without embolization of the gonadal veins and reported good outcomes. Policha et al[16] performed angioplasty of the renal vein anterior to the aorta with placement of a 14 × 60-mm self-expanding stent (Wallstent; Boston Scientific, Marlborough, MA). Because the symptoms remained unchanged 3 months later, embolization was performed with coils (one 7-mm coil and one 9-mm coil) and injection of 1% sodium tetradecyl sulfate. The patient reported significant improvement in symptoms 7 months after the procedure.[16]

In both our previous case and our present report, we used a new self-expanding stent designed for the venous system (Venovo).[14] Because an important concern is stent fracture resulting from the extrinsic force caused by compression between the aorta and spine, we chose the Venovo stent because its physical characteristics of good radial force and stent deployment precision minimize the risk of fracture.

As reported in the three previous cases, we also chose stent implantation in the renal vein portion anterior to the aorta for our present case, because external compression between the superior mesenteric artery and the aorta (the classic anterior NS) is certainly less significant than that between the aorta and spine.[10] Femoral access proved to be a more favorable option owing to the angulation, which provided greater support for the guide wire to navigate the stent with correct positioning for its release. Based on our previous experience, we chose 3% polidocanol as the sclerosing agent because it is widely used in Brazil for sclerotherapy.

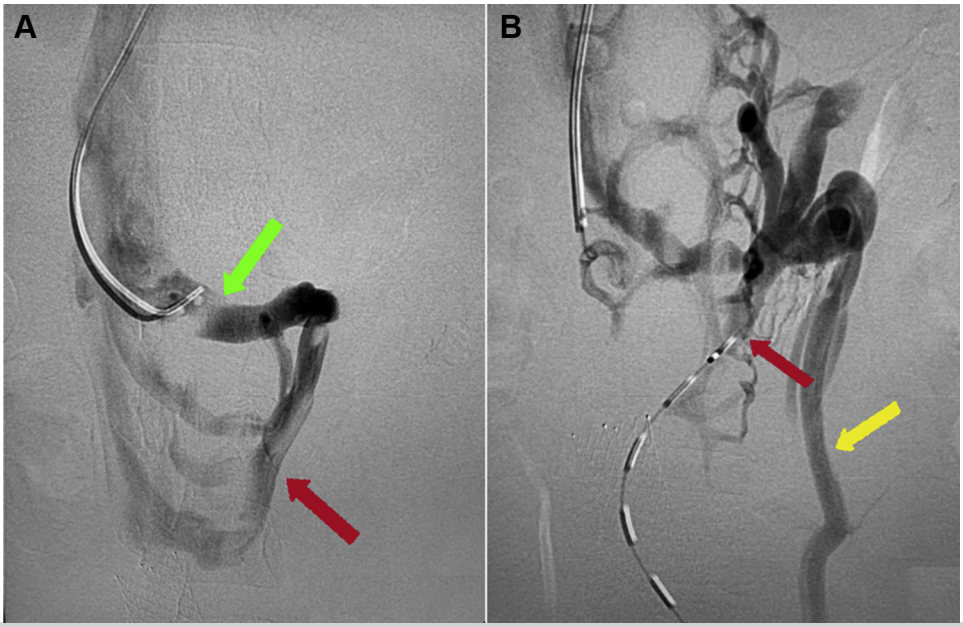

Fig 2. Left renal vein phlebography confirmed the presence of one anterior vein (*green arrow*; **A**) and three posterior renal veins **(B)**, including one major vein (*red arrow*) with nutcracker syndrome (NS) and dilatation of the left gonadal vein (*yellow arrow*), indicating good outcomes.

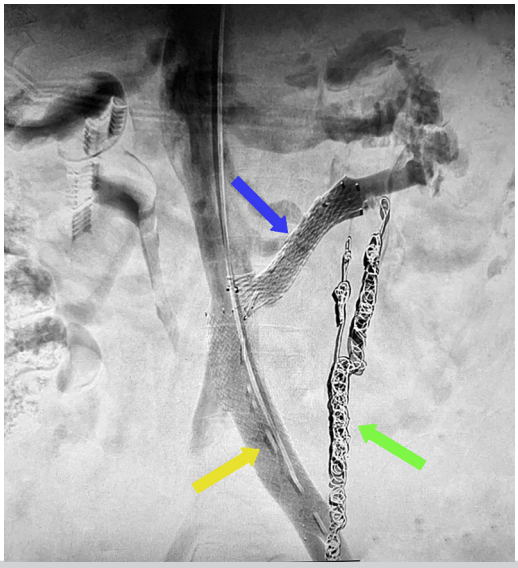

Fig 3. Follow-up phlebography showing coil embolization of the gonadal vein (*green arrow*), treated posterior renal vein (*blue arrow*), and previously treated (angioplasty) common iliac vein (*yellow arrow*).

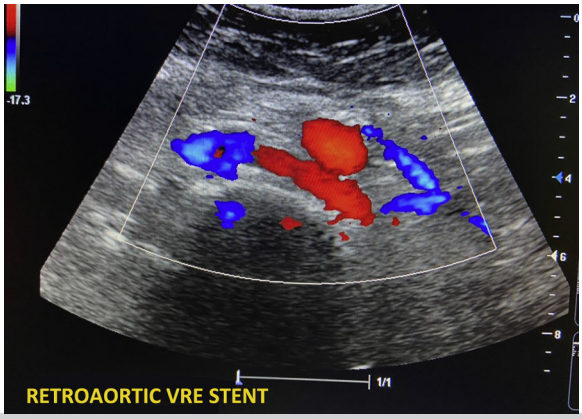

Fig 4. Follow-up Doppler ultrasound at 1 year showing stent patency. *VRE,* left renal vein.

Based on this new rare case of a patient with an anterior and a posterior renal vein and NS, we strongly suggest that endovascular treatment with gonadal vein embolization and stent implantation in the anterior or posterior renal vein a priori has no significant differences compared with the endovascular approach for regular anterior NS from a technical viewpoint.

CONCLUSIONS

The treatment of a patient with an anterior and a posterior renal vein and NS had good 1-year outcomes with resolution of the symptoms.

REFERENCES

1. Granata A, Distefano G, Sturiale A, Figuera M, Foti PV, Palmucci S, et al. From nutcracker phenomenon to nutcracker syndrome: a pictorial review. Diagnostics (Basel) 2021;11:101.
2. Chen S, Zhang H, Shi H, Tian L, Jin W, Li M. Endovascular stenting for treatment of nutcracker syndrome: report of 61 cases with long-term follow-up. J Urol 2011;186:570-5.
3. Wang X, Zhang Y, Li C, Zhang H. Results of endovascular treatment for patients with nutcracker syndrome. J Vasc Surg 2012;56:142-8.
4. Sebastian T, Erdoes G, Bratu VA, Baumgartner I, Kucher N. Endovascular extraction of a migrated large self-expanding laser-cut renal

venous stent from the right ventricle. J Vasc Surg Cases Innov Tech 2017;3:79-82.
5. Wu Z, Zheng X, He Y, Fang X, Li D, Tian L, et al. Stent migration after endovascular stenting in patients with nutcracker syndrome. J Vasc Surg Venous Lymphat Disord 2016;4:193-9.
6. Zhang X, Wang S, Wei J. Prosthetic left renocaval bypass for posterior nutcracker syndrome. Indian J Surg 2015;77(Suppl 1):103-5.
7. Li X, Ji C, Guo H. Abdominal aortic transposition as a treatment alternative for posterior nutcracker syndrome. Int J Urol 2012;19:1043-4.
8. Marone EM, Psacharopoulos D, Kahlberg A, Coppi G, Chiesa R. Surgical treatment of posterior nutcracker syndrome. J Vasc Surg 2011;54:844-7.
9. Allam SR, Livingston TS, Kalaria V, Diaz-Calderon W, Pumphrey JA, Patel L, et al. Posterior nutcracker syndrome: an infrequent cause of hematuria. Kidney Int 2014;85:985-6.
10. Rodríguez-Morata A, Robles-Martín ML, Reyes-Ortega JP. Endovascular treatment of posterior nutcracker syndrome with a new autoexpandable stent. J Vasc Surg Venous Lymphat Disord 2019;7:118-21.
11. Ufuk F. CT angiography of posterior nutcracker syndrome. Radiology 2021;298:295.
12. Park JH, Lee GH, Lee SM, Eisenhut M, Kronbichler A, Lee KH, et al. Posterior nutcracker syndrome—a systematic review. Vasa 2018;47:23-9.
13. Gulleroglu K, Gulleroglu B, Baskin E. Nutcracker syndrome. World J Nephrol 2014;3:277-81.
14. Belczak SQ, Coelho Nero F, Araújo WJB, Godoy JMP. Endovascular treatment of anterior nutcracker syndrome and pelvic varices in a patient with an anterior and posterior renal vein. BMJ Case Rep 2020;13:e235284.
15. Cohen F, Amabile P, Varoquaux A, Piquet P, Bartoli J-M, Vidal V, et al. Endovascular treatment of circumaortic nutcracker syndrome. J Vasc Interv Radiol 2009;20:1255-7.
16. Policha A, Lamparello P, Sadek M, Berland T, Maldonado T. Endovascular treatment of nutcracker syndrome. Ann Vasc Surg 2016;36:295.e1-7.

Submitted Sep 2, 2021; accepted Jan 31, 2022.