Late Stent Migration into the Right Ventricle in a Patient with Nutcracker Syndrome

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Background: Stent migration into the right ventricle is rare in patients treated with endovenous stenting, but can have potentially serious complications including endocarditis, cardiac arrhythmias, and heart failure.
Methods: We present a case of stent migration into the right ventricle 5 months after stent placement in a patient with nutcracker syndrome.
Results: Echocardiography revealed a stent caught within the subvalvular chordal structures, with significant tricuspid regurgitation. Subsequent severe damage to the tricuspid apparatus necessitated prosthetic valve replacement, as tricuspid valvuloplasty failed after stent removal.
Conclusions: Because stent migration is a potential complication in left renal vein stenting that can occur up to 5 months after intervention therapy, follow-up using ultrasonography is necessary. In addition, knowing the precise location of the stent, which is important for subsequent treatment, is essential when transabdominal ultrasonography reveals the absence of the stent in the left renal vein.

Placement of an endovascular stent in the left renal vein (LRV) for the treatment of nutcracker syndrome has recently increased in popularity, owing to the minimally invasive nature of the procedure.[1,2] Although stent migration rarely eventuates, migration of the stent into the right ventricle is a potentially life-threatening complication, and can result in damage to the tricuspid valve and other anatomic structures of the heart. Prompt diagnosis and removal of the stent are essential.

The available literature demonstrates that most cases of stent migration into the heart occurred within several days after stent placement.[3] Moreover, migration that occurred 3 months later was almost always over a short distance,[4] because the stent can be located within the vein from 2 to 3 months as a result of endothelialization. Here, we report a case of stent migration into the right ventricle, diagnosed using echocardiography, that occurred 5 months after interventional therapy. The distant migration was the latest phase of a serious complication developing in a patient with nutcracker syndrome.

CASE REPORT

A 20-year-old Chinese male patient who presented with recurrent gross hematuria of 8 years duration was diagnosed with nutcracker syndrome in our hospital. A 14 × 40 mm, self-expandable, endovascular stent was deployed successfully in the LRV, and the gross hematuria disappeared. At the 4-month postoperative follow-up, no complications were recorded. The patient was again transferred to our department for LRV examination 5 months after stent placement, with left flank pain for 4 days and dyspnea on exertion for 1 day. Transabdominal ultrasonography revealed absent echogenicity of the metallic stent in the LRV and inferior vena cava (IVC) (Fig. 1A). Moreover, a pipe-shaped structure was found in the right ventricle with highly eccentric tricuspid regurgitation on transthoracic echocardiography (Fig. 1B), which revealed restricted motion of the anterior tricuspid leaflet and

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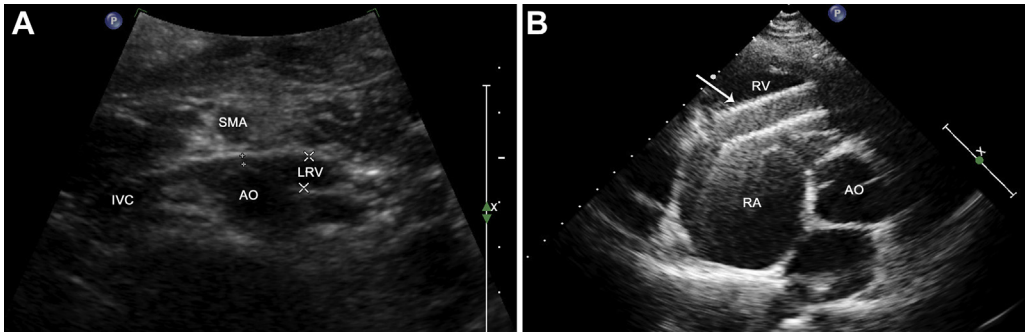

Fig. 1. Ultrasonography showing stent migration. (**A**) Transabdominal ultrasonography showing the absence of the stent in the left renal vein. (**B**) Transthoracic echocardiography showing the stent (*arrow*) lodged in the tricuspid valve apparatus. AO, aorta; RA, right atrium; RV, right ventricle; SMA, superior mesenteric artery.

enlargement of the right heart. The migrated stent was relatively stable throughout the cardiac cycle, and appeared to be trapped within the subvalvular chordal structures. Because of the risk of thrombosis, tricuspid valve injury, and congestive heart failure, the patient was hospitalized and scheduled to undergo emergency open cardiac surgery for stent removal.

During surgery, the migrated stent was found to be entangled in the tricuspid valvular apparatus (Fig. 2A). Rupture of the papillary muscle and several chordae tendineae was also observed. The cardiac surgeon attempted to reconstruct the tricuspid apparatus after stent removal (Fig. 2B), but failed, and switched to a mechanical prosthetic valve replacement procedure instead. Intraoperative transesophageal echocardiography was performed and revealed no significant prosthetic valve stenosis or perivalvular leakage. The patient had an uneventful postoperative recovery.

DISCUSSION

Nutcracker syndrome, which involves compression of the LRV by the superior mesenteric artery and aorta, was initially described in 1950.[5] Open surgical interventions, including LRV transposition, kidney autotransplantation, transposition of the superior mesenteric artery, and gonadocaval bypass, have been successful in the treatment of LRV compression. Since 1996, when Neste et al.[6] described the first case of nutcracker syndrome treated with LRV stenting, endovascular stent placement has been reported as a successful primary alternative in numerous studies. The endovascular approach is especially popular in otherwise healthy young patients, owing to the minimally invasive procedures involved. However, stent migration is a potential complication which, although a rare occurrence, has been reported in several cases involving migration into the IVC, distal LRV, and right heart.[1–4] Comprehensive monitoring was undertaken in the former 2 situations. A successful endovascular removal of a dislodged stent in the IVC has also been described.[7] However, for stent migration into the heart, cardiac surgery was required.[3] To the best of our knowledge, this is the first report of a patient who eventually underwent mechanical prosthetic valve replacement to correct severe damage to the tricuspid valvular apparatus caused by a dislocated stent in the right ventricle.

This complication of LRV stenting was likely caused by the anatomy of the LRV, the size of the stent, and the patient's early activity, although this may not have been the primary cause in this case. The stent has a mesh structure that should endothelialize within 2–3 months after insertion,[8] but the stent in our case completely failed to endothelialize, which was likely the major contributing factor in late stent migration. Without stent endothelialization, the tricuspid valvular apparatus, especially chordae tendineae and the papillary muscle, can become easily entangled within the stent frames. Thus, stent removal was more difficult and the damage to the cardiac structures was more serious in this patient. Cohen and Kyriazis[9] reported a case whereby a migrated stent in the right ventricle for >2 months had epithelialized, but the leaflets of the tricuspid valve appeared to be intact. This finding indicates that the severity of injury caused by a migrating stent might be negatively correlated with the degree of endothelialization in the right ventricle.

Stent migration into the heart has been reported more frequently in endovenous stenting for other obstructive venous diseases such as superior vena caval syndrome and May–Thurner syndrome. Schefold and Krackhardt[10] reported the case of a 51-year-old patient with dislocation of a metal stent into the right ventricle who refused intervention or surgical