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Renal Artery Perforation Following Transcatheter Aortic Valve Replacement: Keeping the Eyes and Fluoroscopy Open

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INTRODUCTION

Transcatheter aortic valve replacement (TAVR) has become an important treatment modality of patients with severe aortic stenosis and whom was considered inoperable.[1,2] The reduction in diameter of the delivery systems and better preoperative vascular screening and increased operator experience have resulted in a decrease in incidence of vascular complications. Despite the reduced incidence, vascular complications remain to be the most frequent adverse events related with transfemoral TAVR procedures.[3] Previously, most of the complications required surgical intervention, however, combined with increased experience, endovascular therapy has become the preferred method for treatment of complications.[3] Here, we report a case of unexplained hypotension following transfemoral TAVR with subsequent aortography, demonstrating a perforation of the right renal artery with successfully treated with covered stent.

CASE

An 88-year-old woman with one year history of progressive dyspnea and fatigue, and a past medical history of hypertension only, was admitted to our cardiology department. Physical examination revealed systolic ejection murmur in the aortic area. Electrocardiogram showed a left bundle branch block with sinus rhythm. Transthoracic echocardiography (TTE) revealed degenerative calcific aortic stenosis, with a mean gradient of 72 mmHg, maximal aortic gradient of 154 mmHg, left ventricular ejection fraction of 55%, aortic valve area of 0.7 cm^2 and aortic root diameter of 2.4 cm with mild aortic and mitral insufficiency. Because of the high logistic EuroSCORE (31%) and Society of Thoracic Surgeons (STS) risk score (11%), TAVR was planned with the heart team. Coronary angiography revealed normal coronary arteries and peripheral angiograms showed some tortuosity of the iliofemoral arteries (Figure 1A).

The procedure was done under general anesthesia. 6 French (F) left femoral approach was used for pigtail injection and temporal pacing. Right femoral artery was used for main site of valve delivery. Two Perclose Proglide devices (Abbott Vascular, Abbott Park, Illinois, USA) were placed to right femoral artery to achieve vascular access site closure and a small incision of 9-10 mm was created in the skin to facilitate insertion. To treat possible vascular complications, a crossover technique was done with the positioning of a 0.018″ guidewire in the superficial femoral artery inserted from the contralateral side. 14 French sheat was placed to right femoral artery to deliver the valve. The patient was anticoagulated with unfractional heparin during the procedure. 26 mm Evolute R (Medtronic Inc. Minneapolis, Minnesota, USA) valve was implanted to aortic position with rapid right ventricular temporary pacing under fluoroscopic and angiographic guidance. Hemodynamic evaluation by simultaneous measurements of left ventricular and aortic pressure was performed before and after valve implantation. After the valve implantation, vascular closure was made by Proglide suture system and final selective angiography of the iliac and femoral artery was obtained (Figure 1A). It was decided to terminate the procedure, however, five minutes later the patient developed deep hypotension and tachycardia.

Firstly, TTE was performed and it showed functional

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aortic bioprosthesis, without any dissection, pericardial effusion or rupture. Peripheral angiography was made through the left femoral artery and it showed rupture and dissection of right renal artery (Figure 1B). Immediately, it was decided to treat it with stent implantation, and renal artery was cannulated with 6F Judkins right guiding catheter and floppy guidewire passed to distal part of artery. 4.5 × 19 mm covered stent was implanted along the perforation side (Figure 2A). Control angiography showed complete disappearance of the dissection and perforation (Figure 2B). The patient was stabilized after stent deployment and was admitted to coronary care unit. She was discharged from hospital later on without any additional problem.

DISCUSSION

This case showed that renal artery perforation, although extremely rare, is a possible complication in patients that undergo transfemoral percutaneous catheterization. The feasibility and efficacy of TAVR is increasing, however, the procedure still has some important vascular complications.[4] The majority of these complications are related with technical aspects and complexity of TAVR procedure.[5] Most of the reports on TAVR-associated vascular complications published over the past few years. Female sex, peripheral vascular disease, significant calcification, sheat diameter, renal failure, experience, were reported as risk factors for complication.[6] Transfemoral TAVR involves transporting valve prosthesis retrograde through the aortic valve over a stiff guidewire positioned in the left ventricle. Large sized sheaths and careful assessment of vasculature (especially iliofemoral access) is required for a successful procedure. Despite these precautions, vascular complications are common and are major determinants of successful outcomes.[7] TAVR requires large arterial access, usually 14-25 French (F) sheats. However, thanks to the increased experience with vascular closure devices, the incidence of access site complications was greatly decreased.[7] Recent studies have shown that these devices are safe when they are used appropriately.[8,9] In a study which was reported by Chen et al. have showed that the incidences of major vascular complication was 3% in 100 consecutive patients, and all of them were caused by left ventricle perforated by the Amplatz Super stiff guidewires[10]

Ileo-femoral rupture is the one of the feared complications of TAVR but its incidence has decreased significantly with the use of smaller and compact delivery systems as compared to initial TAVR procedures when the frequency was roughly 4%.[7] During the procedure when the sheath is in place, pelvic vascular rupture is not evident, however, as soon as the sheath is withdrawn, the pressure is taken off and bleeding can occur with rapid clinical deterioration and might result in death.[11]

To the best of our knowledge, this is a unique case in TAVR as a vascular complication but it could occur in any transfemoral approach. In this case, after a successful TAVR procedure, control aortography has shown no apparent perforation or dissection in the main access site, with small hazy appearance of right renal artery. The hemodynamic compromise occurred immediately after the procedure was completed. Because of the timing of the complication, we thought that the perforation of renal artery developed during the last part of procedure which included a control of peripheral angiography and access site closure. A 0.035-inch J-shaped tip guidewire was always used during catheter exchange and vascular closure. Our patient also had right common iliac

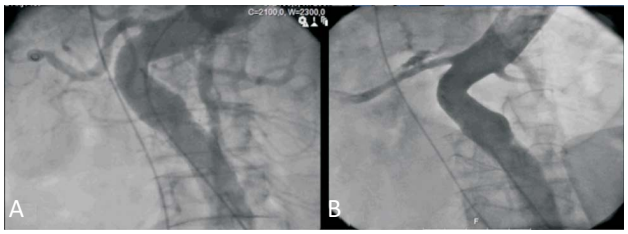

Figure 1. *Aortography immediate after closure of main access site showing no apparent dissection or perforation with only hazy appearance in right renal artery (A). Aortography showing perforation and dissection of right renal artery after the impaired blood pressure of the patient (B).*

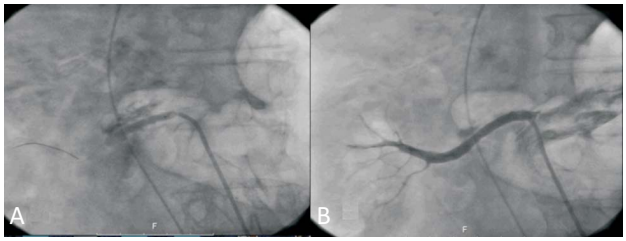

Figure 2. *Selective cannulation and stenting of right renal artery with covered stent (A). Selective angiography showing good flow and disappearance of perforation in the right renal artery (B).*

artery and aorta tortuosity. Abdominal aorta was deviated to right side and the patient's stature was 158 cm. These features might affect the direction and manipulation of guidewire.

In conclusion, vascular complications remain to be the most frequently observed adverse events related to transfemoral TAVR procedures, and renal artery damage could occur in any transfemoral catheterization procedure. Device-related vascular complications were mostly related with access site, however, each step of transfemoral approach requires utmost care and advancing the wires requires fluoroscopy guidance. The patient's clinical status should be monitored especially before the patient is taken out of the catheter laboratory. Sudden hemodynamic decompensation after TAVR might be related with vascular complication.

LEARNING POINTS

- TAVR has become an important treatment modality of patients with severe aortic stenosis.
- Vascular complications remain to be the most frequent adverse events related with transfemoral TAVR procedures.
- Iliofemoral rupture is the one of the fearing complications of TAVR, and renal artery rupture is a possible complication.
- Close monitoring of the patient's hemodynamics is very important during and just after the TAVR procedure for a few minutes.

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None.

CONFLICT OF INTEREST

All the authors declare no conflict of interest.

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