CLINICAL VIGNETTE

Venous Stent Embolized to the Right Ventricle

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Case

A 44-year-old male with hypertension and end stage renal disease on hemodialysis presented to the emergency room for several weeks of pain at his upper extremity arteriovenous fistula site used for dialysis access. He had several fistula thrombectomies with chronic pain localized.

Exam included blood pressure of 164/110 mmHg and heart rate of 98. Oxygen saturation was 98% on room air. Vascular exam was notable for a 3/6 holosystolic murmur and a palpable thrill over his fistula site. Labs were notable for a sodium of 131 mmol/L, bicarbonate of 24 mmol/L, potassium of 5.2 mmol/L, BUN of 35 mg/dL and a creatinine of 11 mg/dL. Echocardiogram showed an embolized vascular stent in the right ventricle associated with severe tricuspid regurgitation. A CT angiogram of the chest confirmed the presence of a vascular stent extending from the tricuspid valve into the right ventricle that had likely migrated from the right subclavian vein. The right atrium was dilated with reflux into the inferior vena cava. Interventional radiology and cardiothoracic teams consulted and interventional radiology attempted to retrieve the stent percutaneously. After an unsuccessful attempt he was taken to the operating room and underwent sternotomy and cardiopulmonary bypass for open removal of the vascular stent which was adherent to the sub valvular apparatus. Due to severe tricuspid regurgitation the valve was repaired with a 26 mm Edwards MC3 annuloplasty ring. The patient had a normal postoperative course and was discharged home on postoperative day 4.

Discussion

Both traumatic and iatrogenic intracardiac foreign bodies have been described in a variety of settings. An early report of right ventricular foreign body was described in a Korean War soldier who was injured by an enemy land mine.[1] Fluoroscopy showed a right ventricular foreign body which moved with cardiac activity. This patient underwent surgical removal of the shrapnel, with good outcome without sequelae.

Metal fragments from occupational exposures have been reported to migrate through the venous system to the right ventricle. A metal worker had an arm injury with a metallic foreign body. His physicians were able to track migration with sequential radiographs.[2] The foreign body eventually lodged in the right ventricle. Although surgical removal was recommended, he declined intervention. The object remained in the right ventricle without ill effect one year later.

Venous stent implantation can rarely result in vascular migration. These can involve larger stents (up to 34mm in diameter) in the superior vena cava as in this report, or stents for smaller veins (6mm in diameter).[3] Smaller stents initially placed in the axillary vein, may migrate to the right ventricle and become entangled in the tricuspid valve apparatus. Our patients stent was successfully surgically removed without complication. Others can be complicated by valvular injury, perforation of the right ventricle, or arrhythmia.

Treatment of an embolized vascular stent to the heart has two simultaneous goals. First, the stent must be entirely removed from the body or relocated and stabilized in a benign location. Second, the removal/relocation must avoid further damage to the vascular system, avoiding perforation or damage to the pulmonic or tricuspid valves. Open surgical approach generally allows for both goals to be achieved, it usually requires a sternotomy and cardiopulmonary bypass additional risks. Many successful percutaneous removals of embolized stents have been described. One review reported successful endovascular retrieval in 35 of 52 cases.[4] Various similar techniques, are described in many of the successful reports.[5,6] Large bore access, at least 14F in the internal jugular and/or common femoral veins is necessary to pass multiple pieces of equipment including a large sheath to withdraw the stent. Although it would be impossible to withdraw most expanded stents, stents can be partially deformed to allow withdrawn through a large sheath. In the worst case the stent can be removed en bloc with the sheath. Imaging is an absolute requirement. All procedures are performed with fluoroscopic guidance, use of transesophageal echocardiogram (TEE) is often critical to ensure success. Snares or percutaneous closed-loop devices that can tighten are often employed. They can be used to capture and control ends of the stent and using a catheter with the snare allows pulling and pushing portions of the stent. The goal is to gain control of the stent and withdraw it to the sheath while confirming on imaging that the stent is not caught on cardiac or vascular structures. Multiple snares can be used to pull the stent in opposite directions to deform it to allow easier removal through the sheath.[5] Another technique passes a wire through the central lumen of the stent. This is difficult since the wire will often pass through one of the openings in the struts of the

stent. Using careful fluoroscopy and TEE, it can be achieved, and allows for more control of the stent during removal. For example, a balloon can be inserted and inflated allowing control of the stent from within. The edges of the balloon can help ensure the edges of the stent do not catch on a structure while being withdrawn.[5] This allows the stent to remain coaxial to the sheath during removal. While percutaneous removal was considered in our patient, TEE indicated significant entanglement of the stent within the tricuspid apparatus that made it unlikely to be successful.

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