extending into the atrium in 77 of 1122 patients with renal cancer who underwent radical nephrectomy and complete tumor thrombectomy between 1970 and 2006 at 11 US and European institutions.

On the other hand, cardiac metastasis from a renal cell carcinoma without inferior vena cava extension is rare, and thus surgical treatment for this condition is also rare.

One study of 11,432 autopsies found only 266 (2.33%) cardiac tumors, and almost all of them were metastases originating from the lung, bone marrow, lymph node, and kidneys (3/266, 1.1%).² Another study of 114 autopsies found metastatic cardiac tumors originating from melanoma, germ cell, leukemia, and the kidneys (12/114, 11%).³

Zustovich and colleagues⁴ reviewed 15 patients who were surgically treated for cardiac metastasis from renal cell carcinoma without inferior vena cava involvement. Their review considered the following as pathologic routes of metastatic spread: a venous hematogenous pathway mainly to the right side of the heart and a lymphatic pathway to the lymph nodes, lungs, pericardium, and left side of the heart.⁴ Metastasis to the right side seemed relatively more frequent, especially to the right ventricle. Among the 15 patients in that review, the right ventricle was involved in 10 of 11 with metastasis to the right side.⁴

We found only 1 report of a solitary right atrial metastasis from renal cell carcinoma without inferior vena cava involvement, and this symptomatic patient died shortly after surgery.⁵ Because right atrial tumors generally elicit few

symptoms during the early phase, complete surgical resection is likely to be difficult. However, an asymptomatic right atrial tumor that was incidentally detected in our patient was metastasis that could be resected. This is the first report of a favorable outcome after complete surgical resection of a right atrial metastasis from renal cell carcinoma.

CONCLUSIONS

Progress in diagnostic imaging allows early diagnosis of not only symptomatic but also asymptomatic metastatic cardiac tumors. Surgery should be considered to improve the prognosis of patients in good condition with such malignancies and to prevent the occurrence of concomitant critical events.

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Transapical transcatheter aortic valve implantation and off-pump left internal thoracic artery–left anterior descending anastomosis: Back to the future?

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Coronary artery disease can be identified in up to 50% of patients undergoing transcatheter aortic valve implantation. The management of coronary artery disease in patients

undergoing transcatheter aortic valve implantation is currently a topic of debate. It is currently debated whether the presence of coronary artery disease or non-revascularized myocardium is associated with an increased risk of adverse events in patients undergoing transcatheter aortic valve implantation.

We report a successful case of concomitant transapical aortic valve implantation and off-pump revascularization of the left anterior descending (LAD) artery via a left small thoracotomy. This procedure, which associates an older technique with a new one, can be an important hybrid strategy for the concomitant treatment of aortic stenosis and coronary artery disease.

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CLINICAL SUMMARY

An 81-year-old man with low-flow/low-gradient aortic stenosis presented with New York Heart Association class IV. Transesophageal echocardiogram revealed a calcified aortic valve with an effective orifice area of 0.6 cm^2 , mean transaortic valve gradient of 30 mm Hg, ejection fraction of 20%, and pulmonary artery systolic hypertension (60 mm Hg). The aortic annulus measured 24 mm. Coronary angiography demonstrated a 90% stenosis at the bifurcation of the LAD and first diagonal branch. Furthermore, the patient had a porcelain aorta identified by a multislice computed tomography scan. The patient presented with a history of persistent atrial fibrillation and moderate renal dysfunction. The patient's predicted 30-day mortality for a combined surgical aortic valve replacement and coronary artery bypass procedure was 30% by logistic European System for Cardiac Operative Risk Evaluation and 33% by Society of Thoracic Surgeons' score.

Given the patient's porcelain aorta and low-flow/low-gradient aortic stenosis with severe left ventricular dysfunction (ejection fraction 20%), the possibility of conventional surgery was rejected. Furthermore, percutaneous revascularization of the LAD diagonal bifurcation was considered too high risk by the referring cardiologist. After a multidisciplinary team discussion among the cardiac surgeons, cardiologists, and anesthesiologists, we opted to perform concomitant off-pump revascularization of the LAD with the left internal thoracic artery (LITA) and transapical aortic valve implantation using a 26-mm Edwards SAPIEN XT transcatheter heart valve (Edwards Lifesciences, Irvine, Calif).

The procedure was performed in a hybrid operating room under general anesthesia and double-lumen intubation. A cardiac surgeon and interventional cardiologist assisted with the procedure. Via a 6-cm left anterolateral thoracotomy, the chest was entered in the fifth intercostal space (Figure 1). This allowed a perfect exposition of the apex, but the LAD was too small at this level. Through the same skin incision, the fourth intercostal space was opened. The LAD had a diameter of approximately 2 mm. The LITA was harvested under direct vision using a reusable retractor (Thoralf, Autosuture, US Surgical Corp, Norwalk, Conn). The LAD was stabilized with the Octopus system (Medtronic, Minneapolis, Minn), and the LITA–LAD anastomosis was completed using a running 7-0 Prolene (Ethicon, Inc, Somerville, NJ) suture. A flow of 36 mL/min was measured with a transonic flowmeter.

Transapical aortic valve implantation was subsequently performed through the fifth intercostal space using a 26-mm Edwards SAPIEN XT prosthesis (Figure 2). The technique of transapical transcatheter aortic valve implantation has been described.¹ Postimplantation angiography showed no aortic regurgitation. Graft patency was also

FIGURE 1. Anterolateral thoracotomy for off-pump coronary artery bypass and transapical aortic valve implantation.

confirmed by one selective injection of the LITA graft (Figure 2). No adverse events occurred postoperatively, and the patient was transferred to a rehabilitation facility on postoperative day 14.

DISCUSSION

The present case demonstrates the feasibility of performing minimally invasive off-pump coronary artery bypass concomitant with transcatheter aortic valve implantation through the same left anterolateral thoracotomy site.

FIGURE 2. Coronary angiography showing a patent LITA–LAD bypass graft and Edwards SAPIEN XT valve in situ (Edwards Lifesciences, Irvine, Calif). LITA–LAD, Left internal thoracic artery–left anterior descending.

Because of the patient's porcelain aorta and low-flow/low-gradient severe aortic stenosis (ejection fraction 20%), conventional surgical aortic valve replacement was denied. Furthermore, the referring cardiologist deemed percutaneous coronary intervention of the LAD diagonal bifurcation too high risk. Thus, through the same anterolateral thoracotomy, we opted to perform concomitant off-pump coronary artery bypass of the LAD artery with the LITA and transapical aortic valve implantation using a 26-mm Edwards SAPIEN XT prosthesis. The feasibility of this approach has been described in only 2 other case reports.^{2,3}

It is currently debated whether the presence of coronary artery disease or non-revascularized myocardium is associated with an increased risk of adverse events in patients undergoing transcatheter aortic valve implantation.^{4,5}

The described technique is minimally invasive, without the need of a heart–lung machine and provides the patient with a coronary artery bypass graft that is known to be durable. On the other hand, limited operator experience with off-pump coronary artery bypass surgery and difficulties with locating an adequate thoracotomy site for both bypass and valve implantation procedure can be potential challenges.

Minimally invasive off-pump coronary artery bypass surgery was popular in the 1990s. Although the results were excellent, the rapid growth of 1-vessel percutaneous

coronary interventions contributed to a rapid decline of this technique. Although provocative, it is possible that once transcatheter aortic valve durability is established, a combined procedure as described may become an attractive treatment option for younger patients presenting with LAD coronary artery disease and severe aortic stenosis.

CONCLUSIONS

The fusion of transcatheter-based procedures and minimally invasive cardiothoracic surgery may provide an alternative in those instances when total transcatheter-based treatment is not possible or may even provide patients with a minimally invasive treatment associated with more durable results.

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