troublesome and fibrillation may afford an additional layer of protection and allow more effective deairing in some cases. Additional benefits from fibrillating the heart during pump exchange are reduced blood loss from the apical inflow site during pump exchange and decreased risk of blood contact contamination of the operating team from an ejecting left ventricle. Because most patients with an LVAD also have an AICD in situ, we suggest that the method described here is a simple means to induce, maintain, and reverse fibrillation. Although dissecting out the base of the right ventricle to attach a fibrillator lead is also possible, this adds another layer of complexity to the surgery with increased risk of bleeding and injury to the heart, and risks unanticipated cardiac ejection if wires are displaced and the heart beats spontaneously. By using the AICD to fibrillate, we were able to keep the procedure almost entirely within the LVAD pocket, making it truly minimally invasive. Furthermore, as seen in our case, defibrillation by external pads may be difficult.

The potential applications of this approach are not limited to LVAD device exchange, but could be extended to other minimal access cardiac surgical procedures in patients who have AICDs. The approach may be useful in such procedures, particularly where access to the heart is limited, or where there is a desire to avoid aortic clamping, such as mitral valve repair via thoracotomy in a patient with previous coronary bypass grafts and depressed ventricular function.

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Cardiac hemangioma at the apex of the right ventricle: A case report and literature review

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Primary tumors and cysts of the heart and pericardium are rare, and only 2.8% of these tumors are cardiac hemangiomas.¹ Ventricular hemangiomas are extremely uncommon. We report one of these unusual cases and discuss others in the literature.

CLINICAL SUMMARY

A 49-year-old man without symptoms was admitted to our hospital. A mass between the right ventricle (RV) and the pericardium was demonstrated on his chest computed tomography (Figure 1, A). Transthoracic echocardiography showed the mass to be located at the apex of the RV, and there was no hemodynamic abnormality or RV outflow tract obstruction.

The mass adjacent to the RV had a clear border with the normal myocardium (Figure 1, B). It was totally excised under cardiopulmonary bypass. A patch of autologous pericardium covered with Dacron polyester fabric was used for the reconstruction of the RV (Figure 1, C). This patient recovered uneventfully, with no evidence of recurrence after 6 months of follow-up. The size of the mass was $6.8 \times 5.0 \times 2.6$ cm (Figure 1, D). Histologic diagnosis was hemangioma (Figure 1, E).

DISCUSSION

Primary tumors and cysts of the heart and pericardium are rare, and only 2.8% of these tumors are cardiac hemangiomas.¹ Hemangiomas of the heart affect all ages and may occur anywhere within the heart,² but ventricular hemangiomas are extremely uncommon. In 45 reviewed cases of cardiac hemangioma, only 11 were located in the RV.³ Cardiac hemangiomas are vascular tumors composed of capillaries or cavernous vascular channels, and most are benign.⁴ Surgery is the first choice of therapy in all patients with cardiac tumors.⁵

To date, 30 cases of hemangiomas located in the RV (including that reported here) have been reported in the literature. Table 1 shows the summary of preoperative data and lists the surgical procedures in these cases. The

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FIGURE 1. A, Computed tomographic view shows a tumor mass (M) in the right ventricle (RV). B, After sternotomy, the tumor can be seen in the apex of the right ventricle. C, Operative photograph shows the reconstruction of the right ventricle after the resection of the tumor with a graft patch (P). D, Photograph shows a macroscopic view of the tumor, which was $6.8 \times 5.0 \times 2.6$ cm. E, Photomicrograph shows a microscopic view of the tumor (original magnification $\times 200$). F, Fiber trabecular; S, sinusoids.

most common sites were the anterior wall of the RV in 20 patients (66.7%), including the apex of the RV in 2 patients and the RV outflow tract in 10 others (33.3%). Sotoda and colleagues⁶ reported the first cardiac hemangioma at the apex of the RV in 2008, and our case is the second ever reported.

All 30 patients described in the literature underwent operation. Cardiopulmonary bypass was used in 76.7% of the cases. Total resection of the tumor was done in 83.3% of cases, 88% with cardiopulmonary bypass. Surgical outcome and follow-up information were available for 23 patients, who were followed up for periods ranging between 6 months and 2 years; all were alive and well at follow-up. Especially for the cardiac hemangiomas located in the anterior wall of the RV, the reconstruction of cardiac ventricle after the resection of the tumor, which is the same as the procedure after the resection of ventricular aneurysmectomy, is important, because heart failure can result from low cardiac output.⁵ Because of the reconstruction of the RV, postoperatively cardiac function in our case was satisfactory.

Considering all the points discussed here, we may safely conclude that most cardiac hemangiomas in the RV are located in the anterior wall, and these patients should undergo reconstruction of the ventricle after resection of the tumor under CPB. Long-term outcome seems satisfactory, and little recurrence has been reported.

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TABLE 1. Summary of preoperative data and details of surgical procedures in 30 cases of right ventricular hemangioma reported in the literature

Case	First author and year	Age (y)	Sex	Clinical presentation	Surgical access	Tumor site	CPB	Surgical procedure	Outcome	Pathology
1	Hochberg 1950	8	F	Dyspnea	Thoracotomy	RV anterior wall, pericardial pleura	N	Total excision	NA	Cardiac hemangioma
2	Nicks 1964	20	F	Dyspnea, murmur	Sternotomy	RV anterior wall, RA anterior wall	Y	Total excision	NA	Vascular hemangioma
3	Warembourg 1971	44	F	Dyspnea, murmur	Thoracotomy	RV anterior wall	N	Total excision	NA	Cardiac hemangioma
4	Delaye 1972	23	M	Dyspnea	Sternotomy	RVOT	Y	Total excision	NA	Hemangioendothelioma
5	Contamin 1973	20	F	RH failure	Sternotomy	RV-LV-RA	N	No resection, biopsy	NA	Cardiac hemangioma
6	Thompson 1977	10	F	RH failure, murmur	Sternotomy	RV-LV-PA	N	No resection, biopsy	NA	Cardiac hemangioma
7	Larrieu 1982	27	F	Dyspnea, murmur	Sternotomy	RV anterior wall, RA	N	Total excision	Alive and well	Cardiac hemangioma
8	Novitzky 1984	59	F	Pseudoangina	Sternotomy	RVOT	Y	Total excision	Alive and well	Cardiac hemangioma
9	Palmer 1986	43	M	Arrhythmias	Thoracotomy	RV anterior wall, Ao-PA	N	No resection, biopsy	Alive and well, 2 y	Cardiac hemangioma
10	Soberman 1988	3	M	Murmur	Sternotomy	RVOT, septum	Y	Partial excision	Alive and well, 1 y	Cardiac hemangioma
11	Matsutani T 1989	62	M	RH failure	Sternotomy	RV anterior wall	Y	Total excision	Alive and well	Cardiac hemangioma
12	Golosovskaia 1990	17	M	Dyspnea, murmur	Sternotomy	RV ant wall, septum	Y	Total excision	Alive and well	Cardiac hemangioma
13	Liao WH 1990	57	M	Dull chest pain	Sternotomy	RVOT	Y	Total excision	Alive and well, 7 mo	Cardiac hemangioma
14	Reiss N 1991	28	F	Dyspnea, murmur	Sternotomy	RVOT	Y	Total excision	Alive and well	Cardiac hemangioma
15	Cunningham 1993	17	M	Dyspnea, murmur	Sternotomy	RV anterior wall	Y	Total excision	Alive and well	Cardiac hemangioma
16	Ando M 1993	52	M	NA	Sternotomy	RV anterior wall, septum	Y	Total excision	Alive and well	Cardiac hemangioma
17	Brizard 1993	24	M	Dyspnea, hepatalgia	Sternotomy	RVOT, septum	Y	Total excision	Alive and well, 1 y	Cardiac hemangioma
18	Gaires 1997	36	M	NA	Sternotomy	RV anterior wall	Y	Total excision	Alive and well	Cardiac hemangioma
19	Harada 1998	74	M	Dyspnea, murmur	Sternotomy	RV anterior wall, septum	Y	Total excision	Alive and well	Cardiac hemangioma
20	Kipfer 2000	74	M	NA	Sternotomy	RV anterior wall	Y	Total excision	Alive and well, 12 mo	Cardiac hemangioma
21	Ikeda 2001	56	M	NA	Sternotomy	RV anterior wall	Y	Total excision	Alive and well	Cardiac hemangioma
22	Colli 2003	69	M	NA	Sternotomy	RVOT	Y	Total excision	Alive and well, 6 mo	Relapsed hemangioma
23	Arjomand 2004	61	F	RH failure, dyspnea	Sternotomy	RV anterior wall	Y	Total excision	Alive and well	Cardiac hemangioma
24	Iba 2005	46	F	Dizziness	Sternotomy	RVOT	Y	Total excision	Alive and well	Cardiac hemangioma
25	Turkoz 2005	61	F	Palpitation and tightness of chest	Sternotomy	RV anterior wall, RA	Y	Total excision	Alive and well, 14 mo	Cardiac hemangioma
26	Sotoda 2008	74	M	NA	Sternotomy	Apex of RV	Y	Total excision	Alive and well, 24 mo	Cardiac hemangioma
27	Botha 2010	65	F	RH failure, murmur	Sternotomy	RV anterior wall	N	No resection, biopsy	NA	Cardiac hemangioma
28	Chen 2012	42	F	Chest pain, edema	Sternotomy	RVOT	Y	Total excision	Alive and well	Cardiac hemangioma

(Continued)

TABLE 1. Continued

Case	First author and year	Age (y)	Sex	Clinical presentation	Surgical access	Tumor site	CPB	Surgical procedure	Outcome	Pathology
29	Sogawa 2012	73	M	NA	Sternotomy	RVOT	Y	Total excision	Alive and well, 24 mo	Cardiac hemangioma
30	Jiang 2013	49	M	NA	Sternotomy	Apex of RV	Y	Total excision	Alive and well, 6 mo	Cardiac hemangioma

CPB, Cardiopulmonary bypass; F, female; RV, right ventricle; NA, not available; RA, right atrium; M, male; RVOT, right ventricular outflow tract; RH, right heart; LV, left ventricle; PA, pulmonary artery; Ao, aorta.

Functioning Cooley-Cutter aortic valve prosthesis 40 years after implantation

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Video clip is available online.

The development of artificial heart valves has revolutionized cardiac surgery. During the past 60 years, heart valve prostheses have evolved considerably, with each new model designed with the hope of better hemodynamics and outcomes for patients. The Cooley-Cutter heart valve was designed in the 1960s by Denton A. Cooley, MD, in collaboration with Cutter Laboratories and introduced for clinical use in 1971.¹ The device used 2 sets of titanium struts to contain a biconic occluder composed of pyrolytic carbon. Cooley-Cutter heart valves were used frequently in the 1970s,² with Dr Cooley alone having implanted the device in a total of 3275 patients (1786 in the aortic position and 1475 in the mitral) over a 10-year period, with very good clinical results.³ Since that time, newer mechanical valves have replaced the Cooley-Cutter valve.

CLINICAL SUMMARY

An 85-year-old man with a medical history significant for diabetes, coronary artery disease, previous stent placement

in the left anterior descending coronary artery, and previous mechanical aortic valve replacement was seen for dyspnea on exertion and minor weight loss. The patient's surgical history was significant for aortic valve replacement with a Cooley-Cutter prosthesis, implanted by Dr Cooley at the Texas Heart Institute on October 4, 1973. Results of physical examination were unremarkable; cardiac examination revealed regular rate and rhythm with S1 and S2, no S3 or S4, and no appreciable murmurs, rubs, or gallops.

Transthoracic echocardiography (Figure 1) showed an intact aortic valve replacement. The valve was properly seated with normal occluder motion. The peak transvalvular velocity was 3.4 m/s, with a mean gradient of 24 mm Hg. The left ventricular ejection fraction was calculated to be 60%.

DISCUSSION

A recent single-center retrospective review of the results of the use of the St Jude mechanical valve⁴ demonstrated a 25-year survival of 17% ± 4%. In the context of these results, it is high unusual to document such excellent functional results as those of this 40-year-old Cooley-Cutter prosthesis. Another mechanical aortic valve prosthesis that has been shown to be remarkably durable in certain cases is the Starr-Edwards prosthesis.⁵ Our patient's symptoms were ultimately found to be unrelated to his cardiac history, and he currently remains well controlled on warfarin. Overall, the prosthetic valve remains in excellent condition with no need for replacement.

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