Operative repair of iatrogenic innominate artery to left innominate vein arteriovenous fistula after pacemaker laser lead extraction

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Percutaneous extraction methods of pacemaker and defibrillator leads have decreased morbidity in comparison with open chest surgery, but carry the risk for potential iatrogenic cardiovascular injury. We report a rare case of multiple iatrogenic arteriovenous fistulae (AVF) after laser lead extraction with resulting right-sided heart failure and tricuspid regurgitation (TR) requiring percutaneous and surgical closure of the fistulae, and placement of a tricuspid annuloplasty ring.

CLINICAL SUMMARY

A 37-year-old woman with congenital atrioventricular heart block underwent a pulse generator exchange with laser lead extraction of a dislodged right atrial lead. The original pacemaker was placed 20 years prior, and the patient had undergone multiple prior revisions. Access was obtained through the left axillary vein, and using a locking stylet with 14F and 16F sheaths, laser extraction of the right atrial lead was attempted, but was unsuccessful due to significant calcification and bleeding at the entry site. The patient was

Iatrogenic fistula between the innominate artery and left innominate vein.

Central Message

Iatrogenic arteriovenous fistula after laser lead extraction is a potentially serious complication that requires prompt diagnosis and intervention.

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discharged home; however, she returned with worsening dyspnea and a new, continuous murmur on physical exam. Echocardiography findings were consistent with right ventricular volume overload and arteriography demonstrated a left internal thoracic artery to left subclavian vein fistula. The patient underwent successful left internal thoracic artery stenting. Several weeks later, the patient returned with recurrent symptoms and findings on echocardiography demonstrating persistent right heart enlargement with new

FIGURE 1. A, Angiography demonstrating saccular outpouching of ascending aorta or proximal innominate artery (red arrow). B, Echocardiography image demonstrating abnormal communication between the distal ascending aorta and left innominate vein.

FIGURE 2. A, Intraoperative photograph showing 1-cm innominate artery fistula opening. B, Intraoperative photograph showing venotomy on the anterior surface of the left innominate vein exposing a 1-cm posterior fistula opening.

moderate-severe TR and concern for a flail anterior leaflet due to chordal rupture (Figure 1, B). Systolic pulmonary artery pressures increased from 25 to 55 mm Hg. Computed tomography angiogram and repeat arteriography demonstrated continuous flow in the innominate artery and distal ascending aorta concerning for pseudoaneurysm and AVF (Figure 1, A). The patient was taken to the operating room for AVF ligation and tricuspid valve (TV) repair.

SURGICAL TECHNIQUE

A median sternotomy was performed, the femoral vessels were cannulated, and cardiopulmonary bypass was

initiated. The left innominate vein was dissected free from dense scar tissue. A pseudoaneurysm of approximately 1 cm was identified between the anterior surface of the proximal innominate artery and the posterior surface of the left innominate vein (Figure 2). The fistulous openings in the artery and vein measured approximately 1 cm in diameter. Vascular control of both artery and vein was obtained, and the fistula was opened. Cerebral near-infrared spectroscopy was monitored during snaring of the innominate artery with no change from baseline values. The opening on the anterior innominate artery was closed primarily with prolene sutures. We incised the anterior surface of

TABLE 1. Literature review of iatrogenic arteriovenous fistula after laser lead extraction

Author	Year	No. of cases	Type	Timing of diagnosis	Procedure	Outcome
Bracke and colleagues ²	1999	1	LITA-LSCV	0 d	Coil embolization	Discharge
Kumins and colleagues	2000	2	BCA-LBCV	0 d	No intervention	Mortality
			LCCA-LBCV	0 d	Sternotomy, aorta-LCCA bypass, fistula, and LCCA ligation	Discharge
Milla and colleagues	2006	1	LCCA-LBCV	14 d	Sternotomy, aorta-LCCA bypass, fistula, and LCCA ligation	Discharge
Lawton and colleagues	2006	2	LCCA-LSCV	5 d	No intervention	Mortality
			LSCA-LSCV	0 d	Stent	Discharge
Alayadhi and colleagues	2009	1	LCCA-LSCV	Unknown	Stent	Discharge
O'Connor and colleagues ⁵	2010	2	LSCA-LSCV	30 d	Stent	Discharge
			LCCA-LBCV		Stent	
Strickman and colleagues	2012	1	RITA-SVC	30 d	Stent	Discharge
Anastacio and colleagues ⁴	2012	1	LITA-LSCV	0 d	Coil embolization	Discharge
Yamada and colleagues	2013	1	LITA-LBCV	0 d	Stent	Discharge
Hanninen and colleagues	2013	1	LITA-LBCV	3 d	Stent	Discharge
Cronin and colleagues ³	2014	8 total				
		3	LITA-LSCV	3-586 d	Stent (2), attempted coiling (1)	Discharge (1), mortality (2 at 98 and 656 d)
		1	LSCA-LSCV	13 d	Glue embolization	Discharge
		3	BCA-LBCV	0 d	Stent (2), spontaneous closure (1)	Mortality (1 at 216 d), discharge (2)
		1	Aorta-LBCV	0 d	No intervention	Mortality

LITA, Left internal thoracic artery; LSCV, left subclavian vein; BCA, brachiocephalic artery; LBCV, left brachiocephalic vein; LCCA, left common carotid artery; LSCA, left subclavian artery; RITA, right internal thoracic artery; SVC, superior vena cava.

the left innominate vein, providing access to the fistulous tract, which we primarily closed with prolene sutures. The calcified right atrial lead was removed and the left innominate vein was closed with a patch. The TV annulus was severely dilated and 1 pacemaker lead had torn through the anterior leaflet of the TV, explaining the preoperative echocardiogram findings. All chordae were intact. This injury appeared chronic because the lead was scarred into the leaflet and did not appear to affect valve function, and therefore no intervention took place. A 31-mm tricuspid annuloplasty ring was placed. Postoperative echocardiogram demonstrated successful fistula ligation and no TR.

DISCUSSION

Percutaneous extraction of pacemaker and defibrillator leads provides a safe method with decreased morbidity compared with open chest surgery.¹ Although complications from laser lead extraction can be catastrophic, occasionally these complications are insidious with symptomatic presentation, including chest pain, progressive dyspnea, extremity edema, new murmur or thrill on physical exam, and radiographic abnormalities (eg, widened mediastinum). We identified 11 articles reporting the complication of iatrogenic AVF development after laser lead extraction since the first reported case in 1999 (Table 1).² The largest series reported is by Cronin and colleagues,³ who identify 8 patients in their experience with an incidence of 0.3%. The majority underwent successful endovascular stenting (52%). Other interventions included operative intervention, coil embolization, or expectant management with spontaneous closure.⁴ There were 3 perioperative mortalities (14%) in patients who died before intervention.

Our patient presented with delayed symptoms of right heart failure due to her left-to-right shunting. Initially, only 1 fistula was identified, allowing progression of her right heart failure and TR. We believed the safest option, with potential involvement of the aorta, was to surgically identify and repair her AVF during the period of cardiopulmonary bypass. Furthermore, repair of her TV was performed due to the severity of regurgitation at the time of fistula ligation.

CONCLUSIONS

Iatrogenic AVF after laser lead extraction is a potentially serious complication that requires prompt diagnosis and intervention. Angiography may be warranted in technically challenging lead extraction procedures with excessive blood loss to assess for iatrogenic AVF. Findings of a new, continuous murmur and right heart failure symptoms should prompt further investigation into this potentially lethal complication.

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