Implication of a Persistent Left Superior Vena Cava in Transvenous Pacemaker Therapy and Cardiac Hemodynamic Monitoring*

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An anomalous persistent left superior vena cava may complicate the insertion of transvenous pacemaker electrode catheters as well as the catheterization of the pulmonary artery. It is important to recognize the anomaly because of the ease of confusing the position of the catheters passing through the coronary sinus into a distal coronary vein rather than the right ventricular apex. If the condition is known and is associated with a patent right superior vena cava, a catheter or electrode should probably be passed from the right side. If this is not possible, our experience indicates that the flow-directed balloon-tipped catheter (Swan-Ganz) can be passed easily without fluoroscopic control through an anomalous left superior vena cava to the pulmonary artery. Using a similar balloon-tipped flow-directed pacemaker electrode may be helpful in its positioning in the apex of the right ventricle. While short-term temporary pacing via the coronary sinus is probably acceptable, placement of a permanent electrode in the coronary sinus is dangerous. If there is congenital absence of the right superior vena cava, an epicardial electrode is likely preferred.

Persistence of a left superior vena cava that drains into the coronary sinus is of little consequence except to the unsuspecting cardiologist in the cardiac catheterization laboratory or the thoracic surgeon approaching the left mediastinum. There have been a few reports concerning permanent and temporary transvenous pacemakers in patients with a persistent left superior vena cava. We have recently had two unusual experiences with this anomaly: the first related to endocardial pacing and the second was associated with passing a catheter for continuous bedside pulmonary artery pressure monitoring.

CASE REPORTS

Our first patient, a 66-year-old man, was admitted on July 26, 1972 because of loss of consciousness lasting five to ten minutes. While being monitored in the emergency room he had an episode of ventricular tachycardia and ventricular fibrillation from which he was resuscitated. There was a two year history of intermittent dizzy spells and six weeks earlier he had been admitted for treatment of congestive heart failure and a possible myocardial infarction. He had recently been treated with quinidine sulfate gr qid, digoxin 0.25 mg daily, chlorothiazide 500 mg daily and a salt restricted diet. Other significant history included recurrent atrial fibrillation and hypertension. On admission to the coronary care unit he was found to have a slow junctional rhythm with a rate of 35, and evidence of congestive heart failure. A temporary transvenous right ventricular endocardial pacemaker electrode was inserted via the right median basilic vein without difficulty. Within 24 hours the rhythm was atrial fibrillation with a very rapid irregular ventricular response. He was given more digoxin. Considering the history of recurrent light-headed episodes, one episode of ventricular fibrillation and junctional rhythm at a rate of 30-40 (not thought to be due to digitalis) a permanent right ventricular transvenous pacemaker was implanted. The incision was made in the left pectoral region and cephalic vein was isolated as it enters the left subclavian vein. A General Electric catheter electrode was inserted under fluoroscopic control. The surgeon felt the catheter traversed through a persistent left superior vena cava and the coronary sinus into the right ventricle. Considering the low pacing threshold and the catheter appearance in the AP view, he felt the catheter was in relatively good position. A chest x-ray picture obtained 18 hours later (PA and lateral) (Fig 1a and 1b) demonstrated the electrode in a left superior vena cava draining into the coronary sinus and the terminal electrode positioned in a posterior coronary vein. Although the initial capture was good, subsequently occasional pacing failure and poor sens-

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P-A chest x-ray film demonstrates a permanent pacemaker powerpack with the electrode coiled in the subcutaneous tissue, transversing the subclavian vein, entering the anomalous left superior vena cava, and coursing to what appears to be the apex of the right ventricle. FIGURE 1B. Lateral view of the same patient as Figure 1A. The electrode can be seen posteriorly entering through the coronary sinus to a posterior coronary vein.

ing were observed. The following day (Fig 2) a temporary transvenous pacemaker was inserted into the right ventricular apex via the right median basilic vein. The permanent pacemaker was reimplemented to the right pectoral region with the electrode passing through the right cephalic vein, right superior vena cava, and to the right ventricular apex. The remainder of the hospital course was uneventful.

Our second patient was a 56-year-old woman admitted on October 5, 1972 who complained of the sudden onset of chest pain and severe dyspnea. There was a long history of allergies which included the triad of asthma, nasal polyps and aspirin hypersensitivity; hypertension; congestive failure; and diabetes. Treatment included digitalis, diuretics, insulin and cortisone. Physical examination on admission revealed a 4 foot 11 inch moderately obese Caucasian woman with Cushingoid facies, who appeared older than 56. The blood pressure was 154/90, pulse 128 and slightly irregular and respirations 38-40. The jugular venous pulse wave form showed increased pressure and prominent A waves at 30 degrees recumbency. The carotid pulses were normal. The lungs had high-pitched breath sounds and rales at each base with expiratory wheezing in both lung fields. The point of maximal cardiac apical impulse was in the sixth intercostal space in the left anterior axillary line. A loud S3 gallop and a grade 2/6 pansystolic murmur were heard at the apex. The abdomen was obese and extremities showed marked muscle wasting.

Following her admission to the coronary care unit, she was maintained on digoxin and given furosemide intravenously. She continued to be dyspneic with wheezing and was relieved somewhat by intravenous aminophyllin. Frequent FVCs were controlled by lidocaine drip. Because of diagnostic differential between dyspnea due to congestive heart failure and bronchial asthma, catheterization of the right heart and pulmonary artery with determination of the pulmonary capillary wedge pressures was considered important. A
A persistent left superior vena cava draining into the coronary sinus is estimated to occur in 0.5 percent of the general population and the diagnosis is usually accidental. A right superior vena cava is usually present but may be absent in a small percentage. Failure of the left anterior cardinal vein to involute results in the left superior vena cava draining into the common cardinal vein or coronary sinus. On occasion, the left superior vena cava may drain into the left atrium, and thus produce a right-to-left shunt and cyanotic heart disease. Since the condition is fairly rare, its occurrence should not negate the routine use of the left-sided approach for entering the right ventricle with a pacemaker electrode or bedside hemodynamic diagnostic catheter, particularly considering the ease of this technique as opposed to the use of the right side.

Our two cases represent potential complications and difficulties related to the anomalous left superior vena cava. Fortunately in both cases the right superior vena cava was also present. In its congenital absence, the placement of the permanent right ventricular pacemaker catheter should most likely be avoided and an epicardial electrode should be used.

Considering the ease with which the Swan-Ganz catheter was passed in our second case, a pacemaker electrode with a balloon tip likely would be easy to use for emergency pacemaker therapy in the case of a persistent left superior vena cava. The flow-directed single lumen balloon catheters have been utilized extensively for monitoring acute medical emergencies as well as doing elective cardiac catheterizations. It has been demonstrated that the flow-directed catheters will enter the pulmonary artery independent of anomalous venous connections as long as the pressure-flow relationships are favorable. Had we been utilizing a nonflow-directed catheter, such as a stiffer 6 or 7 French Courmand catheter or its equivalent under fluoroscopy, we likely would have had considerable difficulty in catheterizing the pulmonary artery and perhaps caused arrhythmias and other complications related to the stiff-walled catheter passing through the coronary sinus.

**REFERENCES**

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