A case of permanent pacemaker implantation from the left side in persistent left superior vena cava – Technical challenges in a rare presentation

Awadhesh Kumar Sharma[1], Neeraj Prakash[2], Sameer Sarraf[3]

From Assistant Professor, Department of [1]Cardiology and [2]Cardiovascular and Thoracic Surgery, LPS Institute of Cardiology, Kanpur, [3]Assistant Professor, Department of Cardiology, Uttar Pradesh University of Medical Sciences, Etawah, Uttar Pradesh, India

Correspondence to: Awadhesh Kumar Sharma, Department of Cardiology, LPS Institute of Cardiology, Kanpur, Uttar Pradesh - 208 019, India. E-mail: awakush@gmail.com

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ABSTRACT

Abnormalities of the systemic venous system are not uncommon. Two well-known systemic venous anomalies are the persistent left superior vena cava (PLSVC) and interrupted inferior vena cava. PLSVC is usually detected and comes as a surprise for the cardiologist during cardiac permanent pacemaker implantation. We report the case of a 65-year-old male who had a history of recurrent syncope and diagnosed with a complete heart block 8 months back. For which, a single-chamber VVIR pacemaker was implanted through the right subclavian vein at Delhi. The patient was a known case of diabetes mellitus and had poorly controlled blood sugar levels. At present, the patient presented to our center with pacemaker pocket site infection and it was first decided to explain the right-sided permanent pacemaker, insert temporary pacemaker, and implant the new pacemaker on the left side through the left subclavian vein. In this case, during procedure, PLSVC detected accidentally; so, we discuss the challenges we faced during the right ventricular lead placement through PLSVC.

Key words: *Coronary sinus, Pacemaker, Persistent left superior vena cava, Screw lead, Systemic venous anomaly*

Abnormalities of the systemic venous system are not uncommon. Some carry physiological significance in the form of cyanosis while the majority of them are clinically not significant. However, a proper knowledge of the anatomy of the systemic venous drainage is important for the cardiac surgeon, intensivist, and cardiologist for venous catheterization, pacemaker implantation, cardioplegia during surgery, etc. Two well-known systemic venous anomalies are the persistent left superior vena cava (PLSVC) and interrupted inferior vena cava (interrupted IVC).

The most common anomaly is the PLSVC, reported in 0.1–0.6% of the general population [1,2]. In 92% of cases, it drains into the right atria (RA) through the coronary sinus while in 8% of cases, it drains into the left atria causing cyanosis. PLSVC draining into RA is clinically silent except for the dilated coronary sinus during two-dimensional echocardiography. It was first described by Le Cat in 1738. Rarely in a few cases, the right superior vena cava (SVC) is also absent. It is usually detected and comes as a surprise for cardiologist during cardiac permanent pacemaker implantation [3].

CASE REPORT

We report the case of a 65-year-old male who had a history of recurrent syncope and diagnosed with a complete heart block 8 months back. For which, a single-chamber VVIR pacemaker was implanted through the right subclavian vein at Delhi. The patient was a known case of diabetes mellitus and had poorly controlled blood sugar levels. At present, the patient presented to our center with a history of low-grade fever, malaise, and boggy swelling with tenderness at the pulse generator (PG) pocket site.

He was diagnosed as a case of pacemaker pocket site infection and systemic antibiotics were started. The patient blood sugar was also uncontrolled at the time of admission so subcutaneous insulin injection was started. After 5 days of admission and control of blood sugar, it was decided first to explain right-sided permanent pacemaker, insert temporary pacemaker, and after 1 week of systemic antibiotic therapy, to implant the new pacemaker on the left side through the left subclavian vein.

After 7 days, the patient was taken to the cardiac catheterization room for the permanent pacemaker implantation. Inj. Teicoplanin 400 mg was given intravenously 45 min before the procedure as antibiotic prophylaxis. The left subclavian vein was punctuated through the Seldinger technique. After the introduction of the sheath and during the passage of the insertion of guidewire, it was noticed that the course of guidewire is abnormal. In spite of passing toward the right of the spine and mediastinum, it is going toward the left side. On giving contrast through left antecubital vein, it was noticed that the dye is draining into the right atrium (RA) through coronary sinus through the PLSVC (Fig. 1 and Video 1).

Hence, we diagnosed it as a systemic venous anomaly, i.e., persistent left SVC (LSVC) and we changed the plan

accordingly. As per our plan, now over the guidewire, a 58 cm screwing pacemaker lead was advanced with the help of straight stylet up to the RA with proper care and pull-push technique along with gentle rotation as to avoid injury to the coronary sinus. Once the lead was in the RA cavity, we first withdrew the stylet and made a loop in RA along lateral free wall followed by an exchange of straight stylet from curved stylet and pushing gently in such a way as to direct lead tip toward tricuspid valve (TV) orifice; once it was at TV orifice, we pushed the lead with slight withdraw of the stylet.

Once the lead was in the right ventricle (RV), we exchanged curved stylet with straight one and pushed it to RV apex and screwed it (Fig. 2). The lead position was also confirmed in lateral projection. Then, the lead parameters were checked which were found to be satisfactory (threshold 0.5 V, impedance 530 ohms). On fluoroscopy, the lead course looked like roman letter alpha (alpha configuration) which is suggestive of lead course through LSVC to coronary sinus to RA to RV (Fig. 2 and Video 2). After securing the lead, it was connected to a PG and the local site was closed in layers.

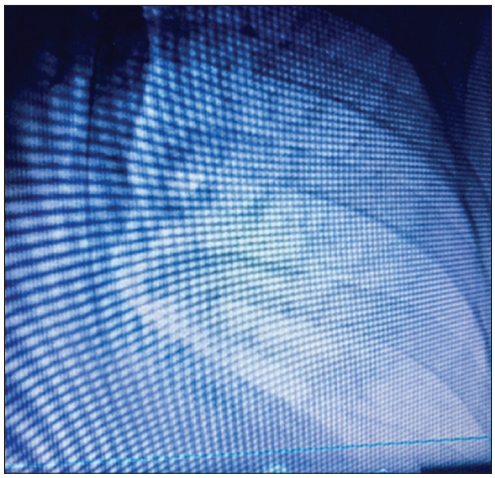

Figure 1: Persistent LSVC draining into coronary sinus Video 1: Guidewire from the left subclavian vein to persistent left superior vena cava to coronary sinus

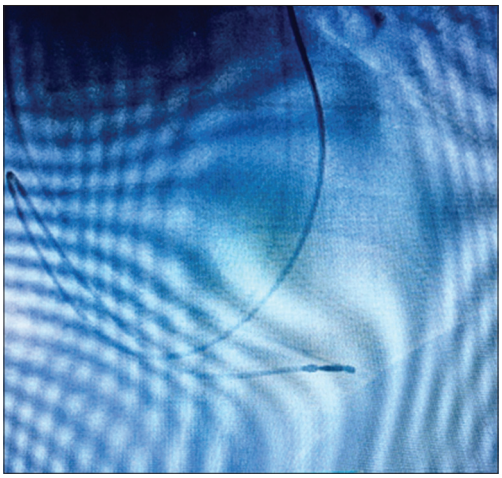

Figure 2: Alpha loop configuration of pacemaker lead Video 2: Alpha configuration of pacemaker lead suggestive of lead course from persistent left superior vena cava to coronary sinus to the right atrium to the right ventricle

The patient was put over systemic antibiotics for 3 days and discharged in a stable position. Later on, after 10 days, stitches were removed. The blood sugar checked and was within the normal range. In 6 months follow-up, the patient is doing well without any complications.

DISCUSSION

During the development of the venous system, the main venous chamber is sinus venosus in which three pairs of veins, namely, cardinal, umbilical, and vitelline drain. The right superior vena cava (RSVC) formed from the right cardinal vein while the left cardinal vein develops into LSVC and the left part of sinus venosus forms coronary sinus [4]. With embryogenesis, the left cardinal vein progressively disappears and only the right cardinal vein, i.e., RSVC persists. The failure to disappear left cardinal vein results in LSVC. Its prevalence ranges from 0.1 to 0.6% in the general population. In subjects with LSVC, RSVC is normally present in 80% of cases. Isolated LSVC is very rare, i.e., 0.07–0.13% in general population.

The presence of the LSVC usually comes as a surprise during pacemaker implantation. Passage of lead into RV from RA through the coronary sinus is not an easy task and needs patience. The presence of LSVC makes the implantation of a cardiac pacing lead into the RV particularly difficult. The explanation for this difficulty is that the ostium of the coronary sinus is not aligned with the TV orifice and that a loop must be made before a lead can pass the TV orifice [5,6].

To overcome this difficulty in many previous case reports, the four steps method was described to solve this problem, i.e., first, advance the lead with a straight guide until it crosses the coronary sinus and enters the RA. In the second step, we have to replace the straight guide with a preformed J-guide which is conventionally used for the RA lead and then position the lead against the lateral or anterolateral wall of the RA as the third step followed by removing the guide, 3–5 cm and then push the probe which forms a loop and passes easily the TV as a final step [7-9].

In another case report by Sonou *et al.* that reported a case of PLSVC with an absence of RSVC, they also noticed that the failing attempt to ascend the stimulation lead into the RSVC starting from the RA suggests the persistence of LSVC with an absence of RSVC and as an implantation technique once the lead was in the RA, it was necessary to make a loop with the lead to reach the TV then remove the curved guide, replace it by a straight guide, pass through the TV, and screw the lead into the RV [10-12]. In another single case report, the author used a 9F sheath through which he guided the lead to the TV orifice and then allow it to be deployed [13].

In our case also, we first advance lead into RA with the help of straight stylet, made a loop in RA, and then exchanged it with a curved stylet, as the lead tip touched TV, we pushed it with gentle force into RV. Once the lead was in RV, took out the straight stylet, and screwed it at RV apex. Other methods which can be applied are implantation through IVC route, epicardial pacing, or leadless pacemaker implantation [14,15].

CONCLUSION

Implantation of the pacemaker in the presence of persistent LSVC is technically demanding and needs patience but can be done successfully with proper techniques.

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