

# Failure of Pacemaker Implantation Due to Occlusion of the Left Brachiocephalic Vein

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Implantation of a permanent pacemaker by the transvenous approach might fail from the left side in a patient with abnormal left brachiocephalic vein, including occlusion, or congenital absence of coexisting collateral veins. We report an 85-year-old woman with occlusion of the left brachiocephalic vein accompanied by a large and repeated up-and-down course of the collateral vein draining into the superior vena cava (SVC) along the anterior margin of the aortic arch. Such an unusual venous anomaly was revealed during the procedure of implanting a permanent pacemaker. The course of the tortuous collateral vein was clearly demonstrated by multi-slice computed tomography. Finally, implantation was successful by using the right-sided venous access.

**Key Words:** Anomaly of left brachiocephalic vein • Permanent pacemaker implantation

Implantation of a permanent pacemaker is mostly performed by puncturing the left subclavian vein and introducing the pacemaker leads through the left brachiocephalic vein, the superior vena cava and then to the right atrium or ventricle. Occasionally, abnormal venous anomaly will make the procedure unsuccessful. Such anomalies include the absence of the left brachiocephalic vein with co-existing alternative collateral pathways or existence of persistent left superior vena cava. It is very rare to implant the pacemaker facing occlusion of the left brachiocephalic vein accompanied by a very tortuous collateral vein. Malposition of the pacemaker leads would result in different complications. Herein, we report a case of the occluded left brachiocephalic vein with an abnormal course of the collateral vein that was incidentally diagnosed during the implantation of a perma-

nent pacemaker.

## CASE REPORT

An 85-year-old woman was hospitalized for chest tightness with shortness of breath and intermittent palpitation, which had occurred in resting state since several weeks before the hospitalization. The patient denied history of chest trauma, surgery, and deep vein thrombosis. There was no physical evidence of deep vein thrombosis in her left upper limb. Physical examination did not demonstrate any abnormality. The electrocardiogram disclosed normal sinus rhythm and otherwise normal findings. Chest x-ray showed normal cardiac silhouette without evidence of pulmonary congestion. The 24-hour electrocardiographic recording disclosed many episodes of paroxysmal atrial fibrillation with rapid ventricular response followed by sinus pause up to 3.5 seconds and junctional escape beats at a rate of 50 beats per minute in the daytime. Transthoracic echocardiograms revealed adequate left ventricular systolic performance and were otherwise non-revealing. Under the diagnosis of tachycardia-bradycardia syndrome, the patient underwent pacemaker implantation. During the procedure, venous

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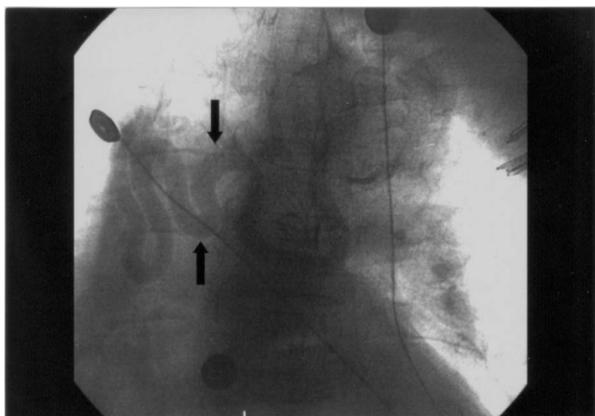
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access was attempted via venous puncture of the left axillary vein. However, the guidewire failed to pass the left brachiocephalic vein (LBCV) after several attempts. The venous angiogram of the left upper extremity vaguely discovered an abnormal course of an unknown tortuous and large-lumen vein connecting with the left subclavian vein (Figure 1). However, we could not clearly identify the final destination of the vessel. The procedure was aborted. The patient underwent 16-slice computed tomography of the venous circulation to show a sharp angle at the cranial part of the LBCV connecting with a large tortuous collateral vein that ran a repeated up-and-down course in the anterior

mediastinum (Figure 2) and drained into the SVC (Figure 3). The venous system of right upper limb was normal. The patient had the procedure of central venous catheterization in the past. Finally, an AAIR pacemaker was implanted successfully at the right subclavicular area.

## DISCUSSION

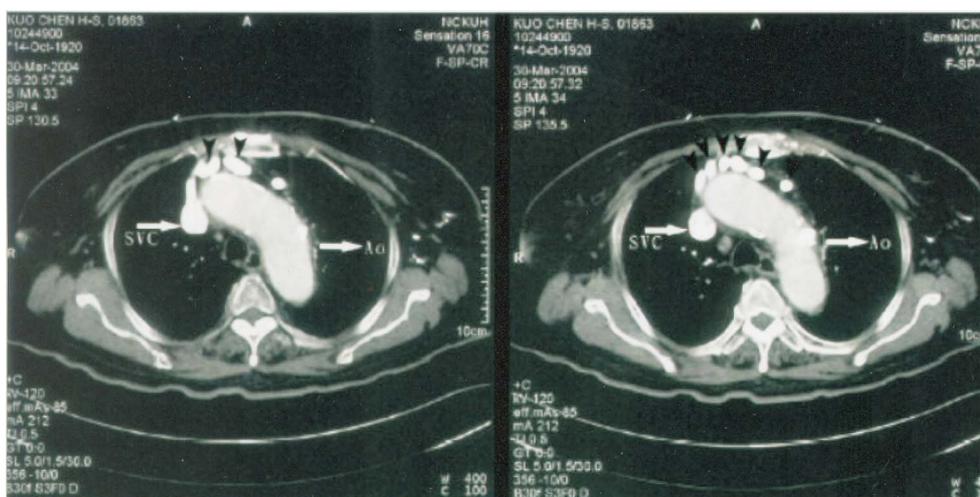
Rare articles presented congenital absence or hypoplasia of the left brachiocephalic vein.<sup>1</sup> When it occurs,



**Figure 1.** The levophase of the venogram in the left upper limb showed a very tortuous and large-lumen vein (arrow) connecting with the left subclavian vein.



**Figure 3.** A three-dimensional reconstruction of the 16-slice computed tomograms disclosed the sharp angle of the left brachiocephalic vein (arrowhead) and a large winding, and repeated up-and-down course of the collateral vein draining into the superior vena cava. SV, left subclavian vein.



**Figure 2.** **Left panel:** The 16-slice computed tomograms demonstrated the large and tortuous collateral vein (arrowhead) draining into superior vena cava (arrow); **Right panel:** The computed tomograms at different level disclosed a long and up-and-down course of the collateral vein (arrowheads). Ao, aorta; SVC, superior vena cava.

there should be alternative collaterals whereby blood from the left upper limb and left internal jugular vein may reach the right atrium. The usual pathways include persistent left superior vena cava (PLSVC),<sup>2</sup> superior intercostal veins,<sup>3</sup> and internal thoracic vein.<sup>4</sup> PLSVC always drains into the coronary sinus or left atrium.<sup>2</sup> The left internal thoracic vein still anteriorly into the SVC via the hemiazygos and azygos systems.<sup>4</sup> Also, the superior intercostal vein runs in the posterior mediastinum and drains into the SVC via the hemiazygos and azygos systems.<sup>3</sup> In our case, multi-slice computed tomograms revealed a very sharp angle of the LBCV, which suggested that obstruction of the LBCV was likely. In addition, a very large tortuous venous system from the sharp angle of the LBCV ran in the anterior mediastinum and drained directly into the SVC, which did not favor the most common collateral vessels like the above mentioned PLSVC, superior intercostal veins, or internal thoracic vein. Based on these facts, this serpentine vessel was defined as a collateral vein due to the obstructed LBCV. Such anomalous venous system has not been reported before.

These anomalies of LBCV usually cause no clinical symptom and show no abnormalities in conventional chest x-ray film. However, Cha and Khoury claimed that the diagnosis of the PLSVC was suggested by the features on plain x-ray, such as widening of the aortic shadow, para-median bulging and a para-median strip or crescent along the left heart border.<sup>5</sup> In our case, we could not identify such characteristics on chest x-ray film. They are usually incidentally encountered when trying to implant a cardiac devices such as pacemaker, implantable cardioverter defibrillator, or to insert central venous catheters through the left-side venous system. Mostly, the procedure fails. When the catheter or lead

succeeds in passing through the long collateral vessels coming from congenital absence of LBCV, it might cause some morbidities, such as pleural, chest wall abscess, pulmonary edema, chest pain, hypotension and cardiac arrest.<sup>6</sup> In our case, if we had tried hard to advance the guidewire through the occluded LBCV, kinking of the guidewire or vessel rupture would have occurred.

In conclusion, when any guidewire or catheter fails to pass through the LBCV, anomaly of the vessel should be suspected. Vigorous manipulation of the catheter or electrode lead in collateral vessels or occluded LBCV should be avoided. If the venograms of the upper limbs do not provide clear anatomy, multi-slice computed tomography could help demonstrate such anomalies.

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## 左臂頭靜脈阻塞導致無法從左側置放心律調整器

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臨床上，心臟科醫師通常從左鎖骨下置放永久性心律調整器。過程中，必須將心律調整器的導線經由左臂頭靜脈及上腔靜脈放至右心房或右心室。但是，如果左臂頭靜脈阻塞或先天性不存在且合併側支循環，盲目的置放心律調整器的導線將會導致不必要之併發症。在此提出一個臨床上極少見的 85 歲女性病例：我們在將導線經由鎖骨下靜脈通過左臂頭靜脈時，遇到阻力而失敗。初步透過左上臂靜脈顯影發現一極彎曲血管，後來透過多切面電腦斷層檢查發現，該病人的左臂頭靜脈全部阻塞並存在一相當彎曲且路徑很長的側枝靜脈而注入右上腔靜脈。最後我們成功的將心律調整器的導線經由右鎖骨下靜脈及右上腔靜脈放至右心房。

**關鍵詞：**左臂頭靜脈阻塞，置放心律調整器。