Novel Technique of Transfemoral Venous Pacing in a Rare Case of Inferior Vena Cava Stenosis

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Abstract

Temporary transvenous pacing is a simple and routinely performed invasive procedure for treatment of life threatening bradyarrhythmias. We present a novel technique for transfemoral venous pacing in a patient with rare co-occurrence of inferior vena cava stenosis, rheumatic mitral stenosis, left ventricular dysfunction and digitoxicity.

Introduction

Cardiac bradyarrhythmias represent a heterogeneous group of rhythm disorders of impulse generation and conduction. Temporary cardiac pacing may be required to bridge patients through hemodynamic instability and recovery or to permanent pacemaker implantation. Transvenous cardiac pacing is a life saving and routinely performed invasive procedure for treatment of bradyarrhythmias.[1] Inferior vena cava (IVC) stenosis is a rare disorder that may be asymptomatic and detected incidentally during temporary transvenous pacing. We present a novel technique for transfemoral pacing in a patient with IVC stenosis and rheumatic mitral stenosis (MS).

Case Presentation

A 68-year old lady with a diagnosis of rheumatic valvular heart disease (RHD) with severe MS, moderate mitral regurgitation (MR), left ventricular (LV) dysfunction and atrial flutter had presented with complaints of syncopal episodes and worsening dyspnea for 7 days. On examination she was found to have bradycardia (heart rate of 30 / min) and hypotension (systolic blood pressure of 60 mm Hg). Her initial ECG showed junctional bradycardia and frequent ventricular premature complexes. Chest radiograph revealed cardiomegaly, left atrial enlargement and pulmonary edema. Transthoracic two-dimensional echocardiography confirmed severe MS with transvalvular mean gradient of 12 mmHg, a mitral valve area of 1.0 cm^2, moderate MR and LV dysfunction. Digoxin levels were found to be 3.4 ng/ml confirming digoxin toxicity as the cause for bradycardia. Emergency temporary transvenous pacing was planned for symptomatic bradycardia.

Right ventricular pacing was initially attempted through transfemoral route under fluoroscopic guidance using 6 French (F) lead but it was noted that there was difficulty advancing the pacing lead beyond the L3 vertebral level. Subsequently 5F pacing lead was used but it could be passed till D8 level only (drainage site of IVC into right atrium). Repeated manipulations were attempted but neither the pacing lead nor a diagnostic 0.032 inch wire could pass into the right atrium (RA). Stenosis of the IVC at the D8 level was confirmed by a contrast venogram. A Terumo wire (0.035 inch and 150 cm) was advanced into the IVC and then negotiated past the stenosis through gentle manipulation and passed into the RA (Figure 1). A 6F armoured sheath (24 cm length) was advanced over the Terumo wire into the RA and then after removal of the wire, a 6F pacing lead with its proximal end shaped into a more curved manner was inserted through the armoured sheath and advanced into the RA. The armoured sheath was then pulled back into the IVC and the lead was positioned into right ventricle (RV) apex (Figure 2). Adequate pacing and sensing thresholds were obtained and lack of diaphragmatic stimulation at high output was noted. Armoured sheath and pacing lead were anchored to the thigh with sutures. Procedure was successful and uneventful and pacing lead and sheaths were removed after 4 days when rhythm had reverted to sinus rhythm. Patient was given heparin till the time the temporary pacing lead was in situ. Abdominal ultrasonography revealed no evidence of extrinsic compression on IVC suggesting a membranous or a web like obstruction at drainage site into RA. Patient was advised further workup and treatment for mitral stenosis and IVC stenosis but she declined for the same. Patient was discharged on 7th post procedure day in a stable condition.

Discussion

Intracardiac temporary pacing by placement of electrode catheter into RV for management of bradyarrhythmias was first described by Furman and Robinson in 1958. It can be attempted through femoral, jugular, subclavian or brachial vein. IVC obstruction occurs in 3% of congenital heart diseases, especially heterotaxy. Isolated obstruction of caval veins is rare, usually iatrogenic and may be detected during right heart catheterization, percutaneous balloon mitral valvotomy (PBMV) or temporary pacing through femoral vein as in our case. Congenital membranous obstruction of the IVC at junction with RA or a restrictive eustachian valve has been described.[2] In Asian countries, the most common cause of acquired IVC obstruction is Budd-Chiari syndrome which presents as membrane occlusion or stricture of IVC.[3] In the west, thrombotic and proliferative disorders, post hepatic transplantation and post IVC filter placement are the predominant causes of acquired IVC obstruction. External compression by a tumor, aneurysmal dilation of aorta, pseudoaneurysm of a venous coronary graft,[4] goiter, mediastinal fibrosis, constrictive pericarditis, bile bladder distention,

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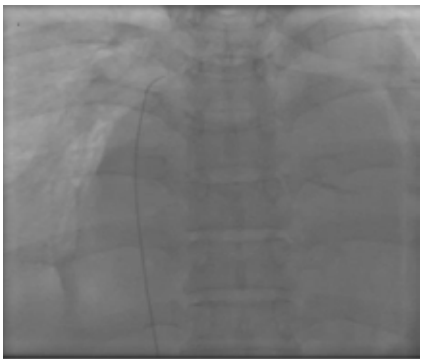

Fig. 1: Plane AP view showing terumo wire (0.035 inch and 150 cm) that negotiated past the IVC stenosis and passed into the RA

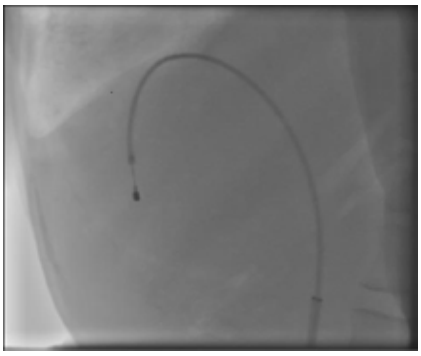

Fig. 2: Lateral view showing the 6F armoured sheath (distal end) in IVC with 6F pacing lead distal electrode at RV apex

polycystic kidneys, hydatid cyst, and hematoma after blunt liver trauma have been reported. Vasculitis such as Behcet's disease may lead to shrinkage and obstruction of caval veins. Our patient denied history of any surgical intervention or blunt trauma to the abdomen in past.

In presence of IVC obstruction, the conventional transfemoral approach may not be feasible. In such situations, options are to use a transjugular or subclavian approach. But these approaches can be time consuming and requires considerable instrumentation and surgical skills. Moreover, manipulation of pacing lead from this site into right atrium is not always easy, especially in older people and use of subclavian route compromises later plans for permanent pacemaker implantation.

A transfemoral approach has several advantages: it can be accomplished quickly in 3-13 minutes and is particularly valuable in management of patients with cardiogenic shock where expediency is of paramount importance.[5] With the use of fluoroscope, placement of the pacing lead is precise, and the repositioning or replacement of lead can be done quickly. It does not compromise later plans for permanent pacemaker implantation. It is a simple and safe technique and has a short learning curve. A long armoured sheath is helpful in not only these situations but also in procedures attempted through femoral arterial route where the aorta might be tortuous.

Conclusion

Cost efficacy is a concern in developing countries. This novel technique of using an armoured sheath over a terumo wire to cross the IVC stenosis is a safe alternative and could be of help to interventionist to provide successful outcome when faced with similar difficult situation without significant increase in the procedural cost.

References

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