Right bundle branch block pattern after uncomplicated right ventricular outflow tract pacing in a patient with a left sided superior vena cava and corrected tetralogy of Fallot

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ABSTRACT

Usually an electrocardiogram after right ventricular (RV) pacing should yield left bundle branch block (LBBB) pattern. However, the presence of right bundle branch block (RBBB) pattern after pacemaker implantation should alert the physician to a malposition of lead. We report a case of 18-year-old female who underwent dual chamber pacemaker implantation and had RBBB pattern post implantation. Detailed evaluation revealed an uncomplicated right ventricular outflow tract pacing. The possible causes of this abnormal pattern after an uncomplicated RV pacing are also reviewed.

1. Introduction

Right bundle branch block (RBBB) pattern in ECG after pacemaker implantation usually suggests left ventricular pacing due to malposition of the lead. We are hereby, reporting a case of RBBB pattern after uncomplicated right ventricular outflow tract pacing in a patient with surgically corrected tetralogy of Fallot (TOF).

1.1. Case

A two-year-old female child underwent intracardiac repair of TOF through right atrial atrial approach with infundibular resection and GORE-TEX patch ventricular septal defect (VSD) closure. Postoperatively, she developed complete heart block requiring single chamber (VVIR) permanent pacemaker implantation. Her pacemaker was implanted via right axillary route with right ventricular (RV) lead at the apical septum. Electrocardiogram after pacemaker implantation showed an left bundle branch block (LBBB) pattern consistent with RV apical pacing (Fig. 1). Her subsequent follow up remained uneventful and she underwent elective pulse generator replacement at the age of ten years. However, at the eighteen years of age, she presented with history of recurrent presyncope. On evaluation, these presyncopal episodes were attributed to high lead impedance and high pacing threshold, necessitating a pacemaker revision. A dual chamber pacemaker (DDDR) from left axillary access was planned, keeping in mind the presence of persistent left sided superior vena cava. The right ventricular lead was implanted in the right ventricular outflow tract septum after some manipulation and position was confirmed fluoroscopically, in anteroposterior, left anterior oblique and right anterior oblique projections. Post implantation electrocardiogram revealed inferior axis and RBBB pattern with predominant R waves from lead V1 to V6 (Fig. 2). The post procedural chest X ray confirmed the lead in right ventricular outflow tract (Fig. 3). The echocardiography also confirmed the lead in RVOT septal position (Fig. 4 and Online supplementary Video 1).

Supplementary video related to this article can be found at https://doi.org/10.1016/j.jipej.2017.11.005.

2. Discussion

Right ventricular pacing leads to LBBB pattern on
electrocardiogram. Presence of RBBB pattern after pacing should alert the physician with a possibility of left ventricular pacing. However, RBBB pacing can be seen in around 8% of patients with uncomplicated RV pacing [1]. Possible causes of RBBB pattern pacing post pacemaker implantation are lead placement in the middle cardiac or posterior LV branch of the coronary sinus, lead placement via subclavian artery into the left ventricle, lead placement via patent foramen ovale or atrial septal defect or ventricular septal defect and lead perforation of the RV apex or interventricular septum [2].

Rarely RV apical pacing may lead to RBBB pattern in lead V1 and V2, however lead I shows LBBB pattern which was described as pseudo RBBB pattern. However, in that scenario recording the precordial leads one intercostal space below the usual space eliminates the RBBB pattern in V1-V2 (Klein Maneuver) [3]. Right ventricular pacing can be identified correctly in patients, who present with RBBB pattern on pacing, by presence of left superior axis deviation, RS or QR morphology in lead V1, and precordial transition at lead V3, with high sensitivity and specificity [1].

Yung-Nien Yang et al. reported a case of RBBB pattern ECG after apical RV pacing in an elderly male, who was having baseline RBBB [4]. Their possible explanation of RBBB pattern was early penetration of the electrical impulse to the left ventricle and RV activation delay due to baseline disease of the RV conduction system. This hypothesis has also been postulated by Barold et al. [5].

RBBB is commonly seen after surgical repair of TOF and various mechanisms for RBBB have been proposed. In patients undergoing ventriculotomy, RBBB has been attributed to either by transection of the proximal right bundle branch during closure of VSD and/or interruption of terminal ramification of right bundle branch by ventricular incision. This latter mechanism is most frequently responsible for RBBB during transventricular repair of TOF [6–8]. RBBB is also seen in patients undergoing transatrial repair, and is produced by infundibular resection as seen in our case [8].

Infundibular resection is more likely to remove peripheral Purkinje fibers and causes RBBB pattern due to peripheral delay rather than in the conduction delay in the main right bundle [8]. The conduction in the proximal right bundle is usually intact. In our patient removal of Purkinje fibers due to infundibular resection resulted in delayed penetration of the right bundle on RVOT pacing resulting in RBBB pattern. However, during earlier RV apical pacing, the penetration to right bundle was not affected as pacing was distal to site of block resulting in LBBB pattern. Presence of baseline RBBB pattern does not increase the likelihood of RBBB pattern on RV pacing [9]. RVOT pacing leading to RBBB pattern as seen in this case, differs from RV apical or mid septal pacing leading to RBBB pattern. In RVOT pacing there is no transition seen in precordial leads. However, in RV apical and mid septal pacing precordial transition is seen at lead V3 in most of the cases [1].
This is a rare case of uncomplicated RVOT septal pacing resulting in RBBB pattern. Understanding of underlying conduction abnormality and a focused echocardiogram are valuable tools in ameliorating unnecessary apprehension of a possible lead malposition.

Conflicts of interest

None.

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