CASE SERIES: SIGNIFICANCE OF BASIC MODALITIES IN DIAGNOSIS AND MANAGEMENT OF INADVERTENT PLACEMENT OF TEMPORARY PACEMAKER LEADS

Haseeb Raza¹, Madiha Fatima², Zubair Mumtaz¹, Abdul Mueed¹, Faisal Khanzada¹, Faisal Qadir¹, Musa Karim³

1 Department of Electrophysiology, National Institute of Cardiovascular Diseases
2 Adult Cardiology, National Institute of Cardiovascular Diseases
3 Research Department, National Institute of Cardiovascular Diseases

ABSTRACT:
Temporary cardiac pacing via trans-venous approach is a technique of choice in case of life threatening arrhythmias to re-establish the hemodynamics that are acutely compromised by a fast or slow heart rate. Inadvertent lead placement into abnormal locations is an uncommon but serious complication of temporary cardiac pacing in emergency departments. These can easily be detected and managed in time with the help of readily available modalities even in emergencies including 12-lead ECG, chest x-rays as well as transthoracic echocardiography. We are reporting here 2 cases regarding mal-placement of temporary pacing lead and their timely management to highlight the significance of simple yet necessary post procedure investigation techniques.

KEY WORDS: Inadvertent lead placement, septal perforation, electrocardiogram, chest x-ray, fluoroscopy, temporary pacemaker, paced rhythm

INTRODUCTION:
Temporary cardiac pacing, can be a lifesaving process, involves electrical cardiac stimulation to treat bradyarrhythmia or tachyarrhythmia until it resolves or until long term therapy can be initiated. (1) Inadvertent malposition of pacing leads is a recognized complication of the procedure, which can be fatal particularly if lead placement is in the left ventricular cavity because of the risk of thromboembolic events. Malposition leads can be either due to unrecognized congenital heart defects including atrial or ventricular septal defects, Patent foramen ovale or due to iatrogenic perforation of interventricular septum but sometimes it may be due to faulty insertion via trans-arterial instead of trans-venous access.

CASE REPORT 1:
47 year old female had history of syncopal episode one day ago while she was working in her house as well as previous history of pre syncopal episodes which lasted for 2-3 minutes. She had no history of diabetes, hypertension, and stroke/transient ischemic attacks. Her attendants took her to nearby hospital where her electrocardiogram showed complete heart block. On examination, blood
Pressure was 100/70 mmHg, pulse rate was 46 bpm, cardiovascular and respiratory examination was unremarkable. On duty doctor took the consent for temporary pacemaker placement and placed the temporary pacemaker lead via right femoral approach without fluoroscopic guidance. After hemodynamic stabilization she was referred to our electrophysiology center for further management. She landed in our electrophysiology department, when evaluated, she was hemodynamically stable and her electrocardiogram showed pacing spikes with appropriate capture but with R wave in lead V1. (Figure 1)

![12-lead Electrocardiogram (ECG) showing Right Bundle Branch Block (RBBB) Pattern after temporary pacemaker implantation](image)

Figure 1: 12-lead Electrocardiogram (ECG) showing Right Bundle Branch Block (RBBB) Pattern after temporary pacemaker implantation

This led to the suspicion of pacing lead malposition resulting in left ventricular pacing via interventricular septum perforation. There were no post procedure chest x-ray or electrocardiogram records available. So patient was directly taken to the electrophysiology lab, lied down under the fluoroscopy to visualize the lead and the lead was found to be present in the left ventricle but it did not perforated the interventricular septum, in fact the lead entered the left ventricle through aorta i.e. right femoral artery was punctured by the first doctor which led the way to the left ventricular cavity. (Figure 2 - 4)

Right Femoral artery → Abdominal Aorta → thoracic Aorta → Arch of Aorta → Ascending aorta & aortic root → Left ventricular cavity

The condition was explained to the patient and again consent was taken to pass another temporary pacemaker via the right sub-clavian approach followed by removal of the lead present in the left ventricle. This time the electrophysiologist placed the new temporary pacemaker lead to the Right ventricle apex successfully
and removed the lead present in the left ventricle. Patient had no reversible cause for the complete heart block so Dual chamber Permanent Pacemaker was implanted the next day via left subclavian access. She was discharged next day after the procedure and is active in her daily activities now.

Figure 2: Fluoroscopic view in anteroposterior (AP) projection showing two pacing leads. Thick arrow: Temporary pacing lead accessed via right femoral artery, crossing the aorta and entered into the left ventricular cavity after making a loop in the arch. Thin arrow: Second temporary pacing lead accessed via right subclavian vein and entered into the right ventricular cavity
CASE REPORT 2:

A 63 years old male, presented to the cardiac emergency department with the complaints of multiple episodes of pre syncopal attacks and fatigue over the last 3 days. He was ex-smoker and also hypertensive for which he was taking amlodipine 10mg once daily since last 5 years. On examination, his blood pressure was 90/60 mmHg, pulse rate was 30 beats per min, maintaining oxygen saturation on room air. He was comfortably lying on bed. Auscultation of the precordium revealed slow but regular heart rate, with normal first and second heart sounds and no murmurs. Rest of the systemic examination was completely unremarkable.

First electrocardiogram (ECG), showed sinus rhythm with wide QRS escape rhythm and complete AV dissociation rhythm with ventricular rate of 30/minute and atrial rate of 70/minute, suggestive of Complete Heart Block. After taking the informed consent, patient was shifted to pacing lab for the temporary pacemaker placement and it was done by the on duty doctor via the right subclavian vein under fluoroscopic guidance. Post procedure, patient was shifted back from the pacing lab and 12- lead ECG was done which revealed right bundle branch block pattern. This led to the suspicion of inappropriate lead placement. Immediately, chest x-ray was done in both anteroposterior (AP) and lateral views in which posteriorly directed lead raised the suspicion of pacing lead in LV cavity, echocardiography was also done and the lead was seen entering the left ventricle through the interventricular septum from the right ventricle. (Figures 6 & 7) Patient was again shifted to pacing lab for repositioning of pacing lead. Fluoroscopy (LAO view) also supported the findings of chest x-ray and echocardiography i.e. pacing lead was placed in LV cavity via the interventricular septal perforation (Figure 8). Lead repositioning was
done successfully under fluoroscopy and confirmed by post procedure 12-lead ECG, revealed LBBB pattern.

All the reversible causes of complete heart block were ruled out and after 2 days Dual chamber Permanent pacemaker was implanted via the left sub-clavian access and he was discharged the next day after the procedure. Later, he visited in follow up clinic and he was completely alright.

![Figure 6: X-Ray AP View showing tip of the pacing more leftward (Arrow)](image)

![Figure 7: X-Ray chest lateral view showing the tip of the pacing lead posteriorly towards the left ventricle](image)
DISCUSSION:

Temporary cardiac pacing is usually required in life threatening emergencies for appropriate indication and done without fluoroscopy in emergency department, followed by 12-lead surface electrocardiogram showing left bundle branch block (LBBB) to confirm the placement of pacing lead in correct position i.e. right ventricle apex. (2) This left-bundle-branch-like pattern manifest as precardial QRS complex concordance in a negative polarity throughout the precardial leads, whereas in true left bundle branch pattern there is QRS complex transition from negative to positive polarity in the mid precardial leads. (7) Other modalities to confirm the lead malposition includes chest X-Ray, echocardiography, CT scan and definitely fluoroscopy, when available. (3) Without fluoroscopic guidance there are more chances of inadvertent positioning of pacing lead which is not so uncommon and pacing leads may found in several places including left ventricle, atria, coronary sinus etc. either due to underlying congenital heart defects, iatrogenic perforation or arterial access instead of venous access. (4)

In our first case, temporary pacemaker was placed in a tertiary care center of a developing city, without fluoroscopic guidance. Possibly our patient was hemodynamically so comprised at the time of procedure that accidentally arterial access was obtained instead of venous access or maybe it was done by an inexperienced personnel because of lack of specialized services there. As fluoroscopy is not available everywhere, transthoracic echocardiography is a
feasible and safe option other than fluoroscopy in terms of decreasing procedure-related complications and sparing valuable time for unsteady patients. Beside this, post procedure 12-lead electrocardiogram is very helpful in localizing the position of pacing lead as right ventricle pacing demonstrate LBBB on 12-lead electrocardiogram almost always with some exceptional cases in which right bundle branch block (RBBB) pattern is observed instead of correct positioning of pacing lead and it is defined as ‘pseudo RBBB’ pattern which may be due to underlying right bundle branch diseases or early depolarization of left ventricle. (5) This can be corrected sometimes by the placement of leads V1-V2 one interspace lower than standard which results in disappearance of RBBB morphology and appearance of QS or rS pattern in V1-V2. (3) RBBB pattern on electrocardiography can usually be produced by a catheter traversing any intra-cardiac shunt including atrial septal defect or patent foramen ovale, ventricular septal defects or iatrogenic perforation of septum, stimulating the left ventricular endocardium or pacing lead resting in coronary sinus. (6,7) Patient in case 1, had no post procedure 12-lead ECG record with her. Her initial 12-lead ECG that was done at our setup showed RBBB pattern which led to the suspicion of inadvertent placement of pacing lead that has been managed timely. Furthermore, there was no post procedure chest x-ray, if done, it could have helped in diagnosing lead mal-placement. As chest X-ray is also a non-invasive and easily available modality, is not only important to exclude iatrogenic pneumothorax or hemothorax but also valuable in identifying the lead position, especially the lateral view. In anteroposterior chest X-ray view, the tip of pacing lead should be visualized slightly to the left of the thoracic spine, at the anterior-inferior aspect of the cardiac shadow. Lateral view clears the position more, the lead tip should overlies the inferior aspect of the cardiac shadow and points toward the sternum. (8) As in our case 2, where IVS perforation was there, immediate chest x-ray revealed tip of the lead directed upwards in AP view and posteriorly towards the spine in lateral view, suggesting presence of lead in LV apex. It helped in making prompt diagnosis and decision to take patient back to pacing lab for repositioning of pacemaker lead without any delay. Echocardiography and CT-Scan can also help in the same manner depending upon their availability and the clinical status of the patient. (9,10)

CONCLUSION:

We have reported these cases to emphasize the importance of post procedural investigations which are easily available even at primary care centers including 12-lead electrocardiography and chest X-ray. These modalities are very helpful in early detection and management of inadvertent lead placement and may help in avoiding life threatening complications.
REFERENCES:


