Right Ventricular Myocardial Perforation by Pacemaker Lead

Perforation myocardique du ventricule droit par une sonde de pacemaker

Syrine Dardour. [1] ; Souha Friha.[1];I Ganzoui[2], Hedi Ben Slima [1]

1. *Cardiology Department, Menzel Bourguiba Hospital*
2. *Radiology Department, Habib Bougatfa Hospital*

Summary

Introduction : Cardiac perforation by pacemaker leads is an uncommon complication, Its management remains controversial.

Case Report: We report the case of a 67-year-old female who underwent dual-chamber pacemaker implantation. One month later, she presented with abdominal pain. Chest radiography revealed abnormal lead positioning.Computed Tomography scan confirmed right ventricular myocardial perforation, with the lead tip displaced into the epicardial fat. Given the patient's hemodynamic stability, a conservative strategy was adopted. Transvenous lead extraction and percutaneous repositioning were successfully performed.

Conclusion: This case emphasizes the importance of imaging and supports the safety of a percutaneous approach in stable patients without complications

Keywords

Pacemake, perforation, delayed complication, CT scan

Résumé

Introduction : La perforation myocardique par sonde de pacemaker est une complication rare dont la prise en charge reste controversée.

Observation : Nous rapportons le cas d'une patiente de 67ans ayant bénéficié de l'implantation d'un pacemaker double chambre. Un mois plus tard, elle a consulté pour douleurs abdominales. La radiographie thoracique a montré une position anormale de la sonde. Le scanner a confirmé une perforation du ventricule droit. L'extraction transveineuse et la reposition percutanée ont été réalisées avec succès.

Conclusion : Ce cas souligne l'importance de l'imagerie et la sécurité d'une approche percutanée chez les patients stables sans complications.

Mots-clés

Pacemaker, perforation, complication tardive, scanner

Correspondance

Syrine Dardour

Email: sirine.dardour@yahoo.fr

INTRODUCTION

Migration of atrial or ventricular pacing leads and myocardial perforation during pacemaker implantation are uncommon complications, occurring in approximately 0.1–1% of cases(1), but they may be potentially life-threatening due to the absence of clearly standardized management strategies. Diagnosis relies on a combination of clinical assessment, electrocardiography, and device interrogation parameters. When perforation or lead displacement is suspected, imaging plays a central role: chest radiography provides an initial evaluation, while computed tomography (CT) is considered the most accurate imaging modality for confirming myocardial perforation and determining the exact position of the lead tip (2) .

CASE PRESENTATION

We report the case of a 67-year-old woman diagnosed in April 2024 with complete atrioventricular (AV) block, for which she underwent implantation of a dual-chamber pacemaker. Immediate post-implantation chest radiography confirmed appropriate positioning of the pacing leads. (figure 1)

Figure 1. Chest radiography post implantation: pacing leads in place without a visualized perforation

One month later, the patient presented to our cardiology department with abdominal pain. Her blood pressure was 110/80 mmHg and her heart rate 60 bpm, with no signs of shock or right-sided heart failure. The electrocardiogram (EKG) showed loss of capture and inappropriate stimulation, with pacemaker spikes occurring within the QRS complexes (Figure 2).

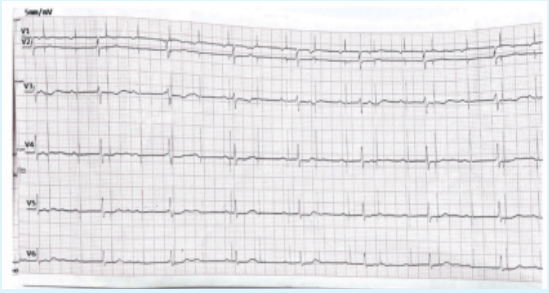

Figure 2. EKG Loss of capture and inappropriate stimulation.

A chest radiograph revealed downward displacement of the ventricular pacing lead, projecting below the left diaphragmatic shadow. Lead migration was suspected.(Figure 3).

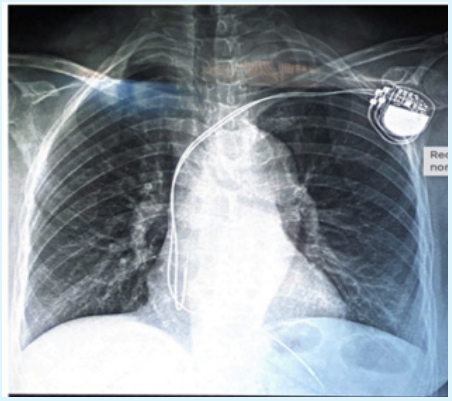

Figure 3. Chest radiograph Revels displacement of the ventricular pacing lead

A subsequent CT scan confirmed right ventricular perforation by the pacing lead. The lead tip was found outside the myocardium, in contact with the parietal pericardium and embedded in the epicardial fat layer. No pleural or pericardial effusion was detected (Figure 4).

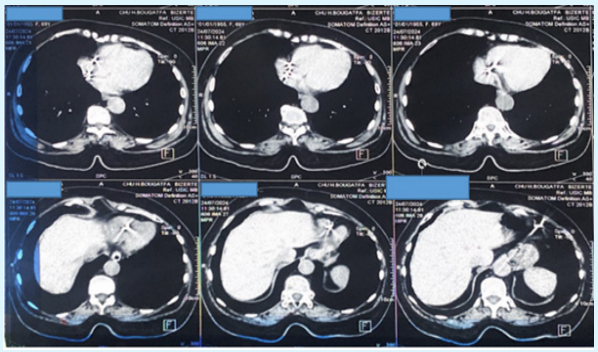

Figure 4. CT scan with right ventricular perforation by the pacing lead

Given the patient's hemodynamic stability, a conservative management strategy was adopted. The ventricular lead was removed by transvenous extraction under fluoroscopic guidance in the catheterization laboratory using simple traction, and was then repositioned in the appropriate right ventricular location. This was achieved without resorting to cardiac surgery, which was kept as a bailout option, and with the cardiac surgery team informed and ready to intervene in case of complications. The postoperative course was uneventful, and the patient was discharged three days later

DISCUSSION

Myocardial perforation caused by pacing leads has an incidence of less than 1% (3). A chronological classification divides iatrogenic myocardial perforation into three major categories: acute (occurring within the first 24 hours after implantation), subacute (between 1 and 30 days), and delayed (more than one month after implantation)(4)

Diagnosis is based on clinical findings, electrocardiography, and device interrogation (abnormal electrical parameters). Imaging plays a central role, primarily computed tomography, although fluoroscopy may also be helpful in selected cases.

The most frequently reported symptoms include chest pain (72%), abdominal pain, and dyspnea secondary to pneumothorax, hemopneumothorax, hemothorax, or pericardial effusion. Muscle stimulation, such as hiccups in cases of diaphragmatic irritation (5), may also occur. Some patients experience nonspecific symptoms such as fatigue, chest discomfort, or asthenia, while others remain completely asymptomatic.

Risk factors include patient-related, operator-related, material-related, and technical factors. Myocardial perforation is most commonly observed in female patients over 65 years, those receiving anticoagulation or corticosteroid therapy, patients with BMI < 20 Kg/m^2, or those with a scarred myocardium (dilated cardiomyopathy, ischemic scars.).(6)

From a technical standpoint, perforation is more frequent with active-fixation leads, atrial lead placement (since atrial wall thickness is approximately 2 mm), and apical positioning compared with septal placement. Some studies also identify lead length and lead stiffness as risk factors: longer and stiffer leads are associated with a higher risk compared with shorter and more flexible leads. The only protective factor described is pulmonary hypertension (> 35 mmHg), due to the associated right ventricular hypertrophy which increases wall thickness.(7)

In our case, age, sex, and apical positioning were present as contributing factors, although the patient did not have pulmonary hypertension.

Management of myocardial perforation depends primarily on hemodynamic status, the presence and severity of pericardial effusion, the timing of the perforation, and the affected cardiac chamber.

- In acute perforation with hemodynamic instability, immediate lead removal is required.
- If perforation results in pericardial effusion without hemodynamic compromise, urgent pericardial drainage is indicated, followed by discussion of transvenous lead extraction.
- In hemodynamically stable patients, management depends on additional factors such as the time interval between implantation and diagnosis, the site of perforation, and the extent of lead displacement.

Two therapeutic strategies may be considered:(8)

1. Conservative management, which may range from simple clinical observation to transvenous lead extraction (9).This approach is less invasive than surgery but may still carry risks such as cardiac tamponade or hemorrhagic shock. Most cardiac perforations can be managed safely and effectively using transvenous extraction techniques, which include. Simple traction,Mechanical sheath extraction,Laser sheath extraction,Electrosurgical sheaths using radiofrequency energy and Rotating threaded-tip sheaths.
2. Surgical management, consisting of radical lead extraction, which may be performed via median sternotomy or left mini-thoracotomy(5) and may be combined with transvenous assistance.

In our case, we opted for a conservative approach, performed in a center with immediate access to cardiac surgery. Fortunately, the procedure was uneventful and the outcome was favorable.

CONCLUSION

Our case highlights the fact that delayed myocardial perforation by pacemaker leads, although uncommon,

should be considered in patients with prior device implantation who present with atypical or non-specific symptoms accompanied by abnormal EKG findings. Computed tomography plays a pivotal role in confirming the diagnosis and assessing the extent of lead displacement. Management should be guided by hemodynamic stability and by early recognition of predictive risk factors in order to determine the most appropriate approach—whether conservative transvenous extraction or surgical intervention. Early identification and timely, individualized management are essential to prevent potentially life-threatening complications.

REFERENCES

1. Ellenbogen KA, Wood MA, Shepard RK. Delayed complications following pacemaker implantation. Pacing Clin Electrophysiol. août 2002;25(8):1155-8.
2. Henrikson CA, Leng CT, Yuh DD, Brinker JA. Computed tomography to assess possible cardiac lead perforation. Pacing Clin Electrophysiol. mai 2006;29(5):509-11.
3. Waddingham PH, Elliott J, Bates A, Bilham J, Muthumala A, Honarbakhsh S, et al. Iatrogenic cardiac perforation due to pacemaker and defibrillator leads: a contemporary multicentre experience. Europace. 22 nov 2022;24(11):1824-33.
4. Sterliński M, Przybylski A, Maciag A, Syska P, Pytkowski M, Lewandowski M, et al. Subacute cardiac perforations associated with active fixation leads. Europace. févr 2009;11(2):206-12.
5. Uemura H, Yajima S, Sekiya N, Yamazaki S, Satoh A, Tanaka H, et al. Repair of pacemaker lead-induced right ventricular perforation via a left mini-thoracotomy. J Cardiol Cases. déc 2021;24(6):307-9.
6. Chniti G, Ouali S, Kacem S, Halima MB, Jebbari Z, Mourali MS, et al. La Perforation cardiaque après mise en place de sondes endo-cavitaires. A propos de 10 cas et revue de la littérature Cardiac perforation by pacemaker and implantable cardio- verter defibrillator leads. 2016;
7. Hirschl DA, Jain VR, Spindola-Franco H, Gross JN, Haramati LB. Prevalence and characterization of asymptomatic pacemaker and ICD lead perforation on CT. Pacing Clin Electrophysiol. janv 2007;30(1):28-32.
8. Khan MN, Joseph G, Khaykin Y, Ziada KM, Wilkoff BL. Delayed lead perforation: a disturbing trend. Pacing Clin Electrophysiol. mars 2005;28(3):251-3.
9. Wilkoff BL, Love CJ, Byrd CL, Bongiorni MG, Carrillo RG, Crossley GH, et al. Transvenous lead extraction: Heart Rhythm Society expert consensus on facilities, training, indications, and patient management: this document was endorsed by the American Heart Association (AHA). Heart Rhythm. juill 2009;6(7):1085-104.