CLINICAL ARRHYTHMIA
Case Report

https://doi.org/10.24207/jca.v37i1.3492

Parahisian Stimulation Through Unusual Vascular Access - Case Report

Paulo Albino[1], Carlos Robério Mendes[1,*]

ORCID ID

Albino P https://orcid.org/0009-0007-3560-9341 Mendes CR https://orcid.org/0009-0003-9126-5644

ABSTRACT

Introduction: To report the case of a patient with a total atrioventricular block with significant ventricular dysfunction whose pacemaker implantation and physiological stimulation occurred through the iliac vein due to tortuosities in other vessels that prevented the procedure. **Method:** Information was obtained by reviewing the medical records, interviewing the patient, photographing the diagnostic methods to which the patient was submitted, and reviewing the literature. **Conclusion:** The reported case and published publications bring to light the discussion of pacemaker implantation sites and physiological stimulation in a complex situation that, although it occurs in a minority of cases, when well it is capable of obtaining satisfactory results.

KEYWORDS: Physiological cardiac stimulation; His-bundle ventricular stimulation; Ventricular dysfunction.

INTRODUCTION

As society ages, there is an increase in cardiovascular morbidity, mainly due to the deterioration of cardiac conduction tissue, resulting in increased rates of advanced and total atrioventricular blocks.

Currently, implanting pacemakers in elderly patients with multiple comorbidities can be technically challenging despite technological advances. Therefore, searching for new surgical techniques is essential to overcome these challenges in cardiac stimulation practice[1-3].

The purpose of this study is to present a case of a patient diagnosed with paroxysmal atrioventricular block who required a permanent pacemaker implantation. Due to ventricular dysfunction, physiological stimulation was recommended. However, the patient's subclavian/axillary venous access sites, typically used for this procedure, were highly irregular.

METHOD

The information included in this publication was obtained through a review of the medical records, photographic images of complementary exams performed, and available literature related to the topic.

1. Hospital Assim Niterói – São Lucas–RJ, Brazil.
***Correspondence author:** carlosroberio@gmail.com
Received: May 24, 2023 | **Accepted:** Nov. 07, 2023

Anamnesis

Patient A. M., male, 84 years old, sought the emergency department of a private hospital due to syncope. He had a history of several episodes of loss of consciousness in the last year without investigation.

Ten (10) years before, he underwent myocardial revascularization surgery.

Hypertensive for 32 years on regular treatment with losartan, acetylsalicylic acid and carvedilol, maintaining well-controlled blood pressure. He denied elitism and smoking.

Physical exam

Regular general condition, drowsy, with a blood pressure of 100 x 60 mmHg. Heart rate of 32 bpm with decreased distal capillary refill. In-room air, a respiratory rate of 22 rpm was noted, auscultation without rales and peripheral O2 saturation of 92%.

Diagnostic hypothesis

The diagnostic hypothesis of syncope was made due to cardiovascular pathology.

Conduct

In the emergency department, cardiac monitoring and an electrocardiogram were performed, which showed a complete atrioventricular block. The patient was then admitted to the Intensive Care Unit (ICU) due to the risk of hemodynamic instability.

Initially, a coronary study was performed which observed a patent breast bridge and occlusion of the venous grafts. During monitoring in the ICU, periods of 1:1 atrioventricular conduction were observed, interspersed with total atrioventricular block (AVB). A transthoracic echocardiographic study was then performed, which demonstrated significant left ventricular systolic dysfunction with a left ventricular ejection fraction of 34%.

Therefore, the patient was referred for implantation of a definitive atrioventricular pacemaker with a plan to perform physiological stimulation by placing the ventricular electrode in the region of the conduction system[4-6].

Surgical conduct

During the surgery, the attempt to dissect the cephalic vein failed because it was not visualized, and two punctures of the left subclavian vein were performed with the insertion of two independent introducers. However, there was difficulty in passing the electrodes, and venography was chosen, which demonstrated marked tortuosity of the venous system (Fig. 1), making it impossible to progress the electrodes safely.

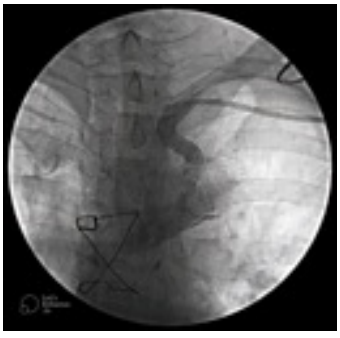

Figure 1. Tortuosity of the left thoracic venous system demonstrated by subclavian venography.
Source: Prepared by the authors.

Using an ultrasonographic method, a new puncture of the left subclavian-innominate vein was performed without complications. Local venography demonstrated significant stenosis at the junction between the innominate and superior cava veins, which prevented the passage of the electrode (Fig. 2).

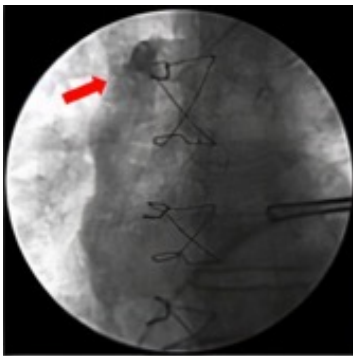

Figure 2. An unsuccessful attempt to introduce the electrode through the innominate vein due to significant stenosis at the junction with the superior vena cava.
Source: Prepared by the authors.

Right flexography was chosen, which revealed occlusion of the subclavicular venous system on the right (Fig. 3).

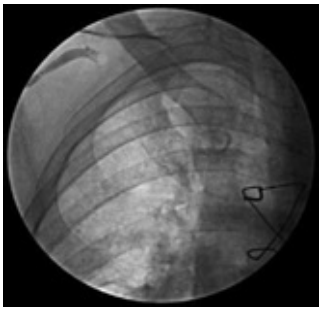

Figure 3. Chronic occlusion of the right subclavian system by ipsilateral peripheral venography.
Source: Prepared by the authors.

Given the adversities in venous access, the procedure was suspended. Due to the patient's advanced age and previous surgical revascularization with a single patent graft, pacemaker implantation via thoracotomy was considered a high surgical risk. Therefore, we opted for a new attempt at endovascular implantation in an unusual region[7-11].

Before surgery, a 12-lead electrocardiogram was performed (Figs 4 and 5) which demonstrated a regular rhythm with the absence of a P wave associated with a 160 ms QRS and the presence of ventricular extrasystole.

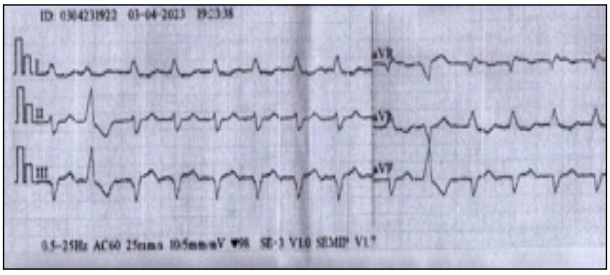

Figure 4. Electrocardiogram from D1 to VF performed before pacemaker implantation.
Source: Prepared by the authors

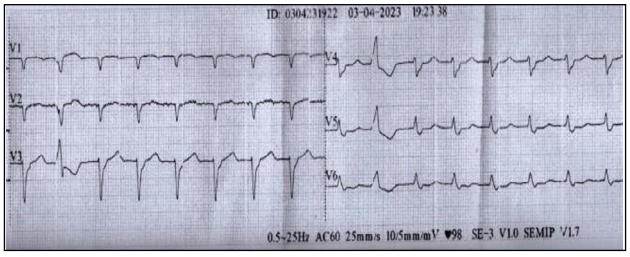

Figure 5. Electrocardiogram from V1 to V6 performed before pacemaker implantation.
Source: Prepared by the authors

The surgery began with the preparation of the pacemaker-generating source pocket in the left inguinal region (Fig. 6), as the right one had a massive inguinal hernia.

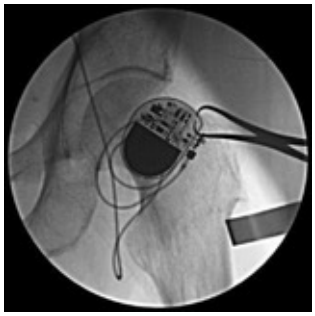

Figure 6. Generating source implant location.
Source: Prepared by the authors

Using ultrasound assistance, a puncture was performed in the left iliac vein with direct insertion of a 7F vascular sheath. The Capsurefix 5076-85cm Medtronic® electrode was introduced, under fluoroscopic visualization, into the right atrium. The electrode guide was replaced with a manually formatted guide (Fig. 7), and then the right ventricular mapping was performed with the aid of the electrophysiology polygraph connected to the distal pole of the electrode to fix in the His potential region. In the region with the best His potential, stimulation thresholds were high with loss of capture. Thus, it was established in the Parahissian region. The Pacemaker is programmed in unipolar VVI 70 bpm stimulation mode. The procedure went without any complications.

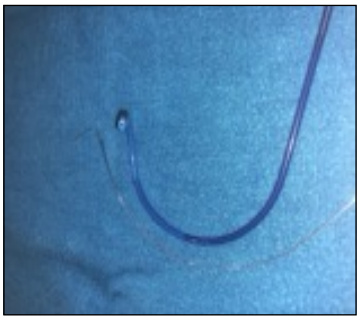

Figure 7. A manually molded guide for mapping the His beam.
Source: Prepared by the authors

Intraoperatively, shortening of the QRS was evident (Figs. 8 and 9) in relation to the myocardial stimulus of the right ventricle. Measurements of the duration of the QRS complex at the end demonstrated 154 ms.

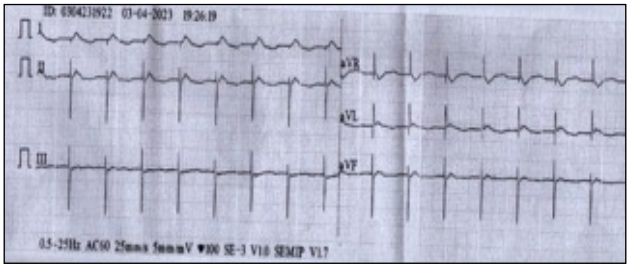

Figure 8. Electrocardiogram from D1 to VF after pacemaker implantation.
Source: Prepared by the authors

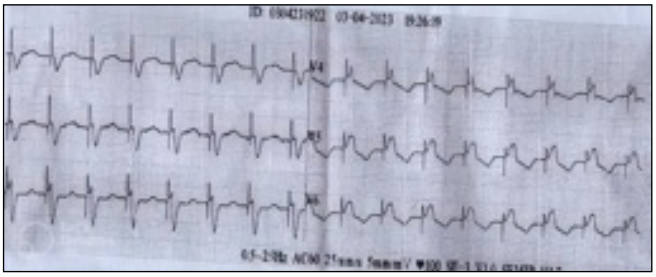

Figure 9. Electrocardiogram from V1 to V6 performed after pacemaker implantation. The LVAT (left ventricular activation time) in V6 is 118ms.
Source: Prepared by the authors

The ventricular electrode was fixed in the parahisian region, an area of the His bundle with an amplitude of 1.8 V and a 1.0 ms pulse width. R wave felt was 2.2 mv. Implantation and fixation did not require an electrophysiology sheath or catheter (Fig. 10).

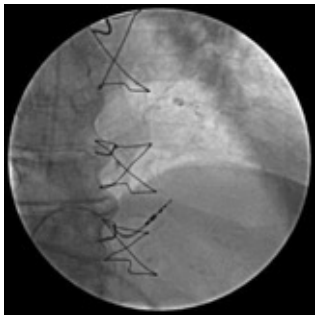

Figure 10. Electrode fixation region in right anterior oblique projection.
Source: Prepared by the authors

Postoperative evolution

In the immediate postoperative period, the patient's improvement and stabilization were observed. A reduction in the duration of the QRS complex by 26ms was observed on the ECG.

In addition to the improvement in the patient's functional class (NYHA 2) with no limitation in walking due to the positioning of the generating source in the left inguinal region. No complications in the inguinal surgical site were observed. There were no infectious complications postoperatively.

After 14 days, we observed a surgical scar in good condition, and there was no longer any report of fatigue on exertion. During this period, an echocardiogram was performed, demonstrating a slight improvement in the ejection fraction to 38%. In the evaluation of the pacemaker, an R wave of 2.8mv was observed with a threshold of 1.2 V.1.0ms.

DISCUSSION

According to the DAVID[12] study, deterioration of left ventricular function may occur if there is excessive stimulation. In this case, the use of physiological stimulation was planned to solve the conduction problem and ventricular dyssynchrony, as suggested by Michael Glikson[13].

However, the difficulty of establishing traditional venous access in the case described resulted in a major challenge. It is known that traditional stimulation can be performed in other venous sites that are little used. But the stimulation for hissiana brought a new paradigm shift since there are no case reports in the literature.

LEADLESS stimulation was considered, however, ventricular stimulation of the right ventricle at its tip would not be the best option and an attempt at physiological stimulation was chosen.

FINAL CONSIDERATIONS

The case report and publications in the literature have sparked a discussion about new locations for pacemaker implantation and physiological stimulation in complex situations where multiple vessels are occluded and tortuous. Such procedures can often be performed satisfactorily without additional instruments like electrophysiology sheaths and catheters.

DATA AVAILABILITY STATEMENT

Data will be available upon request.

AUTHOR'S CONTRIBUTIONS

Data will be available upon request.

FUNDING

Not applicable.

ACKNOWLEDGMENT

Not applicable.

REFERENCES

1. Mateos JCP, Mateos JCP, Vargas RNA, Mateos EIP, Cosac K, Lopes HB, et al. Comparação de parâmetros eletrofisiológicos das estimulações cardíacas endocárdicas septal e apical. Braz J Cardiovasc Surg [Internet]. 2012;27(2):195–202. https://doi.org/10.5935/1678-9741.20120055

2. Coello RCA, Piedra DPS. Electrocardiographic Comparison Between Artificial Cardiac Stimulation of Apex, Septum and Right Ventricular Outflow Tract. Journal of Cardiac Arrhythmias. 2020;32(3), 174–177. .https://doi.org/10.24207/jca.v32n3.010_PT

3. Karpawich PP, Rabah R, Haas JE. Altered cardiac histology following apical right ventricular pacing in patients with congenital atrioventricular block. Pacing Clin Electrophysiol. 1999;22(9):1372-7. https://doi.org/10.1111/j.1540-8159.1999.tb00631.x

4. Su Y, Pan W, Gong X, Cui J, Shu X, Ge J. Relationships between paced QRS duration and left cardiac structures and function. Acta Cardiol. 2009;64(2):231-8. https://doi.org/10.2143/ AC.64.2.2036143

5. Deshmukh PM, Romanyshyn M. Direct his-bundle pacing: present and future. Pacing Clin Electrophysiol. 2004;27(6 pt 2):862-70. https://doi.org/10.1111/j.1540-8159.2004.00548.x

6. Grines CL, Bashore TM, Boudoulas H, Olson S, Shafer P, Wooley CF. Functional abnormalities in isolated left bundle ranch block. The Effect of Interventricular Asynchrony. Circulation. 1989;79(4):845-53. https://doi.org/10.1161/01.cir.79.4.845.

7. Yousef Z, Paul V, Leyva F. Cardiac resynchronization via the femoral vein: a novel method in cases with contraindications to the pectoral approach. Europace. 2006;8(2):144-6. https://doi.org/10.1093/europace/euj025

8. Joudier L, Swinburn J, Roberts D, Clague J. Implantation of a biventricular implantable cardioverter defibrillator via the femoral vein. Pacing Clin Electrophysiol.2007;30(4):571-2. http://doi.org/10.1111/j.1540-8159.2007.00711.x

9. MC, Paul DL, Meierbachtol CJ. Active-Can implantable cardioverter defibrillator placement from a femoral approach. Pacing Clin Electrophysiol. 2003;26(5):1297-8. https://doi.org/10.1046/j.1460-9592.2003.t01-1-00185.x

10. Ellestad MH, French J. Iliac vein approach to permanent pacemaker implantation. Pacing Clin Electrophysiol.1989;12(7 Pt 1):1030-3. https://doi.org/10.1111/j.1540-8159.1989.tb01921.

11. Agosti S, Brunelli C, Bertero G. Biventricular pacemaker implantation via the femoral vein. J Clin Med Res. 2012;4(4):289-91. https://doi.org/10.4021%2Fjocmr920

12. Wilkoff BL, Cook JR, Epstein AE, Greene HL, Hallstrom AP, Hsia H, et al. Dual-chamber pacing or ventricular backup pacing in patients with an implantable defibrillator: the dual chamber and VVI implantable defibrillator (DAVID) trial. Dual chamber and VVI implantable defibrillator trial investigators. JAMA. 2000;288(24):3115-23. https://doi.org/10.1001/jama.288.24.3115

13. Mathur G, Stables RH, Heaven D, Ingram A, Sutton R. Permanent pacemaker implantation via the femoral vein: an alternative in cases with contraindications to the pectoral approach. Europacehttps://doi.org/10.1053/eupc.2000.0135 Glikson M, Nielsen JC, Kronborg MB, Michowitz Y, Auricchio A, Barbash IM, et al. 2021 ESC Guidelines on cardiac pacing and cardiac resynchronization therapy. Eur HeartJ.2021;42(35):3427-3520. https://doi.org/10.1093/eurheartj/ehab364