

CYCLIC PSEUDO-FUSION IN A DUAL CHAMBER PACEMAKER

REPETIDOS BATIMENTOS DE PSEUDO-FUSÃO EM MARCAPASSO DE DUPLA CÂMARA

Diego Chemello, Anandaraja Subramanian, Benedict Glover, Sheila Watkins, Douglas Cameron

ABSTRACT

Studies have shown that avoidance of right ventricular pacing results in a decrease in the incidence of atrial fibrillation and congestive heart failure. Newer algorithms which promote intrinsic conduction and decrease the frequency of ventricular pacing have been developed. However some of these new pacing algorithms are complex and can create potential pitfalls for the clinician. Additionally, these features may not be applicable to a reasonable amount of patients. We describe an example of a pacemaker pseudo-malfunction caused by one of these new algorithms.

Keywords: Cardiac pacemaker; pacemaker malfunction; fusion beats

RESUMO

Estudos mostram que reduzir o uso de estimulação ventricular direita em pacientes com marcapasso está relacionado com menor incidência de fibrilação atrial e insuficiência cardíaca congestiva. Diante desse novo paradigma, as empresas fabricantes vêm desenvolvendo novas estratégias de programação com objetivo de minimizar a taxa de estimulação ventricular direita. Entretanto, esses novos modos de programação são muitas vezes complexos, acarretando dúvidas sobre o correto funcionamento desses dispositivos. Além disso, muitos dos novos modos de programação podem não ser aplicáveis a uma parcela significativa dos pacientes. Apresentamos um exemplo de programação de marcapasso visando minimizar a estimulação ventricular direita, cujo resultado prático simula mau funcionamento do dispositivo.

Palavras-chave: Marcapasso cardíaco; disfunção do marcapasso; batimentos de fusão

Rev HCPA 2010;30(2):161-162

Cardiac pacemakers have become the standard of care for patients with symptomatic bradycardia. Although no direct survival benefit has been demonstrated in clinical trials comparing dual-chamber versus ventricular pacing for the treatment of atrioventricular (AV) block, a 20% reduction in atrial fibrillation and stroke was noted (1). Dual chamber pacing also restores AV synchrony and chronotropy and therefore it seems intuitive to implant dual-chamber devices in patients with AV block. However chronic right ventricular (RV) pacing has been shown to increase the risk of heart failure and the overall risk appears to increase directly as the percentage of ventricular pacing increases (2). Hence, device manufactures have introduced new pacing algorithms in order to promote physiologic AV conduction (3). These modern features have resulted in significant reduction in ventricular pacing (VP), but have also introduced new problems for cardiologists and clinicians regarding electrocardiogram interpretation (4).

We report a case when a pseudo-pacemaker malfunction was associated with one of these new features, the Ventricular Intrinsic Preference (VIP™) algorithm.

CASE PRESENTATION

A 80-year-old male with a history of intermittent Mobitz type II AV block (Figure 1) and underlying first degree AV block, with a PR interval of 250

msec underwent implantation of a dual-chamber pacemaker (St. Jude XL DR Model 5826, St. Jude Medical Inc., St. Paul, Minnesota, USA). The device was programmed to DDD mode with a lower rate interval of 60 bpm, paced AV delay of 180ms and sensed AV delay of 150ms. During the first 12 hours post-operatively, telemetry in the cardiac unit revealed intermittent triples of pseudo-fusion beats, despite normal pacemaker function (Figure 2). These triplets were observed cyclically every 30 seconds. The electrophysiology team was consulted for possible pacemaker malfunction.

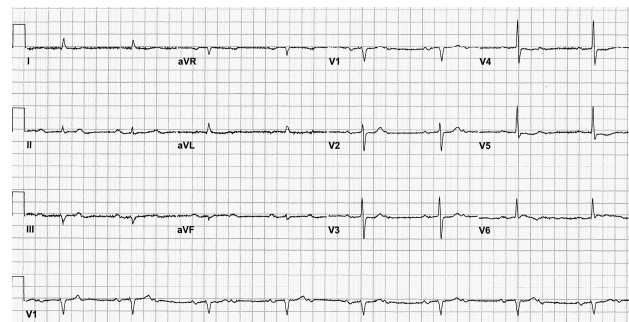


Figure 1 - The 12-lead electrocardiogram before pacemaker implantation. The first beat is a sinus beat with first degree AV block. The following tracing shows baseline second degree AV block with 2:1 conduction.

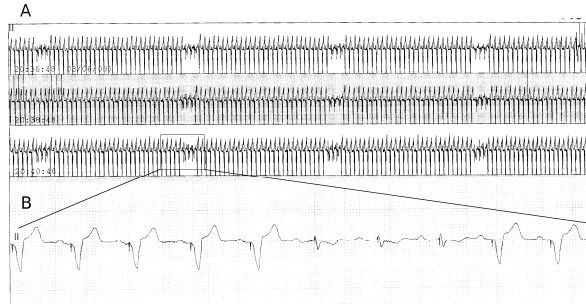


Figure 2 - Telemetry recordings after pacemaker implantation showing regular cycles of three consecutive pseudo-fusion beats. Note that, during the pseudo-fusion complexes, the AV interval is higher than programmed AV pacing interval.

DISCUSSION

Figure 2 demonstrates the periodic occurrence of PR prolongation, followed by pseudo-fusion beats during three consecutive beats. The sensed AV interval is longer than the programmed interval during the pseudo-fusion. A possible diagnosis is intermittent loss of atrial sensing resulting in inappropriate atrial paced beats. If that is the case, then each paced beat should be followed by a ventricular pacing stimulus, which is not evident. Since the pacemaker is functioning normally, it is more likely that there is an intrinsic conduction search algorithm in action. These sequences occur for three consecutive beats every 30 seconds and they are preceded and followed by normal ventricular paced beats. This occurs because the VIP™ mode was turned *on*. The algorithm extends the sensed AV interval (programmable from 100ms to 200ms; nominal 100ms) for 1 to 3 beats at a predetermined interval (from 30 seconds to 30 minutes). In the present case, this feature was programmed to extend AV delay by 100ms for 3 beats every 30 seconds. Due to late sensing R-waves during these extended AV interval periods, a pacing stimulus is delivered, despite a conducted ventricular beat resulting in pseudo-fusion. The extension of the sensed AV interval in VIP™ mode to 150ms decreased the number of pseudo-fusion beats, but increased significantly the AV interval (PR of 330ms). Subsequently, the feature was turned *off*.

It is important to emphasize that the VIP™ mode will work only if the patient persists in first degree AV block with a reasonable AV interval. Additionally, it is equally important to test the amount of late sensing of the R waves, which can contribute for pseudo-fusion. In the present case, one could argue that the use of such feature is at least controversial, since the intrinsic

conduction will be promoted with a very long AV delay. The *paranoia* of intrinsic conduction has sometimes generated aberrant programming and misuse of modern algorithms, paradoxically resulting in non physiological pacing. There are new algorithms developed by different manufacturers, which are very effective in promoting intrinsic AV conduction in patients who have preserved AV conduction (3). The SafeR™ (ELA Medical, France) and the MVP™ (Medtronic Inc., USA) are innovative types of pacing modes, both designed to combine the benefits of AAI and the safety of DDD pacing. Operating primarily in AAI(R) mode, these pacing algorithms are able to switch to DDD(R) in case of significant AV blockage. Additionally, they can automatically converting back to AAI(R) mode when stable AV conduction is detected. Contrary to VIP™, SafeR™ and MVP™ do not promote progressive PR interval prolongation (3).

In conclusion, the present case demonstrates the delicate balance of promoting intrinsic conduction with adequate pacemaker programming. The new pacing algorithms should be used in accordance with patient's characteristics. Nominal settings pre-programmed by the manufacturers should be avoided.

REFERENCES

1. Healey JS, Toff WD, Lamas GA, Andersen HR, Thorpe KE, Ellenbogen KA, et al. Cardiovascular outcomes with atrial-based pacing compared with ventricular pacing: meta-analysis of randomized trials, using individual patient data. *Circulation* 2006;114:11-7.
2. Sweeney MO, Hellkamp AS, Ellenbogen KA, Greenspon AJ, Freedman RA, Lee KL, et al. Adverse effect of ventricular pacing on heart failure and atrial fibrillation among patients with normal baseline QRS duration in a clinical trial of pacemaker therapy for sinus node dysfunction. *Circulation* 2003;107:2932-7.
3. Simantirakis EN, Arkolaki EG, Vardas PE. Novel pacing algorithms: do they represent a beneficial proposition for patients, physicians, and the health care system? *Europace* 2009; 11:1272-804.
4. Sweeney MO, Shea JB, Fox V, Adler S, Nelson L, Mullen TJ, et al. Randomized pilot study of a new atrial-based minimal ventricular pacing mode in dual-chamber implantable cardioverter-defibrillators. *Heart Rhythm* 2004;1:160-7.

Recebido: 18/03/2010

Aceito: 27/05/2010