Long Term Follow-Up of Single Lead VDD Pacing - Evaluation of Occurrence of Atrial Complications in Chronic Treatment in 299 Patients

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Summary

VDD pacing is the electrotherapy of choice in patients (pts) with advanced symptomatic AV block and without alterations of sinus function. Single AV Lead approach limits vascular burdening, simplifies implant procedures and avoids physical contact of atrial electrodes to myocardium. Full performances and reliability of this pacing method are well proved since last decade. Aim of the study was the evaluation of incidences of atrial fibrillation (AF) and loss of atrial sensing (ASL), both causing a permanent device (PG) reprogramming in VVI mode, in a large and homogeneous population. Since 1987 in the hospital of Viterbo 299 pts, mean age 75.4 ± 8.7 years, were implanted with 338 devices. All patients were affected by symptomatic AV block (various degrees) and the absence of sinus node (SN) dysfunction was assessed by negative anamnesis of atrial pathologies and simple ambulatory tests. The implanted devices were: 272 (39 replacements) Medico mod. PHYMOS (7 different models) and 66 Biotronik (29 mod. DROMOS SL and 37 mod. EIKOS SLD). The mean follow-up time was 3.3 ± 2.5 y/pt (range 11ys - 6 m). Three pts (1%) developed occasional episodes of paroxysmal AF. In these pts the PG was temporarily programmed in VVI mode to allow maneuvers to restore sinus rhythm; then PG was reprogrammed in VDD. Chronic AF occurred in 12/299 pts equivalent to a ratio of 1.2% AF/y. ASL requiring permanent PG programming in VVI mode occurred in 5/299 pts equivalent to a ratio of 0.5% ASL/y. Atrial synchronization >98% was found in 225/299 pts (75.3%) while in remaining 74 pts it was always >95%. The long term follow-up shows that Single Lead VDD pacing has a very low occurrence of AF, both paroxysmal and chronic, and of permanent ASL as well. Single Lead VDD approach should be the treatment of choice for pts with symptomatic AV block, in which the absence of SN disease can simply be assessed by negative anamnesis of atrial pathologies followed by simple ambulatory tests.

Key Words

Single lead VDD pacing, atrial fibrillation, loss of atrial sensing

Introduction

PAF (%)		CAF (%)		ASL (%)		SAC > 98%	SAC > 95%
Whole	Yearly rate	Whole	Yearly rate	Whole	Yearly rate	Whole	Whole
1.0	0.3	4.0	1.2	1.74	0.53	75.3%	24.7%

Table I: Occurrence of atrial complications.
Notes. PAF: paroxysmal AF; CAF: chronic AF; ASL: loss of atrial sensing; SAC: stability of atrial synchronization.

Methods

An efficient alternative to conventional DDD pacing is the VDD stimulation using a single AV lead, that makes a ventricular pacing synchronous to atrial systole and physiologically rate-modulation by the healthy sinus node possible. This approach is feasible using leads with a pair of atrial electrodes that can sense the intrinsic P-waves even when floating in the atrial blood stream. Twenty years of evolution and progressive diffusion demonstrate that this pacing system is easy to perform and reliable during time. [1]
Aim of this study was to review the results of a long term follow-up in a large and homogeneous population of patients implanted with single lead VDD pacing systems in the Viterbo hospital (Italy). The effectiveness of persistence of a suitable VDD function and the occurrence of sinus node dysfunctions during chronic evolution of the implant were evaluated in patients affected by symptomatic AV block (various degrees) and no evidence of atrial diseases at implant time.
The parameters evaluated were: atrial fibrillation (AF) and loss of atrial sensing, both causing a permanent reprogramming of the device in VVI mode.
In the Cardiology Department of Viterbo hospital the implants of Single Lead VDD systems started in November 1987. From that date 299 patients, 180 males and 119 females, mean age 75.4 ± 8.7 years, were implanted with 338 devices.
The absence of sinus node dysfunction was assessed by atropine test (0.02 mg/kg), negative anamnesis of atrial pathologies, 24 h Holter ECG monitoring and, when allowed by patient conditions, by ergometric test. All patients reporting previous episodes of paroxysmal AF during pre-implant evaluation were treated with conventional DDD or VVI pacing systems.
Implanted devices were:

- 272 (39 replacements) Medico mod. Phymos (7 different models);
- 66 Biotronik mod. Dromos SL (29) and mod. Eikos SLD (37).

All devices were connected to a single AV lead supplied by the device manufacturer. The main difference between Medico's and Biotronik's leads is the interelectrode spacing of the atrial dipole, which is 30 mm and 10 mm respectively.
Implants were performed through succlavian or cephalic (right) access depending on contingency and not by lead type. The atrial dipole was positioned in mid-high or mid portion of right atrium in according to the best and more stable P-wave signal, and where minimum amplitude always higher than 0.6 mV was detectable. The amplitude stability of the atrial signal was assessed during deep breathing and coughing.
Follow-up procedures were assessed before discharge, at 1 month and every 6 months after implant by clinical test, full pacing check and 24 h ECG Holter monitoring. Particular care was done to detect anamnesic and clinical markers of atrial arrhythmias.

Results

The mean time of follow-up was 3.3 ± 2.5 year/patient (range 11 years - 6 months). During follow-up 76 patients deceased for device unrelated cause.
Data collected during this follow-up review are summarized in Table 1. Data was treated using simple descriptive statistical methods.
Three patients (1%) developed occasional episodes of paroxysmal AF. In these patients the PG was temporarily programmed in VVI mode to allow cardioversion and restore sinus rhythm; then the PG was reprogrammed in VDD mode. Chronic AF occurred in 12/299 patients (4%) and a permanent reprogramming of the PG in VVI mode was necessary. Permanent loss of atrial sensing, requiring permanent programming in VVI mode, occurred in 5 of the remaining 287 patients (1.74%). During all follow-ups an atrial synchronization higher than 98% was found in 225/299 patients (78.4%), while in the remaining 74 patients it was always higher than 95%.
No myopotential inhibitions were detected during whole follow-up.
These results are in accordance with other studies

reported in literature [2,3] and confirm the low incidence of both, acute and chronic AF in patients implanted with single lead VDD pacing systems. They become more significant when the long term follow-up of 3.3 ± 2.5 years per patient is considered, some patients have now more than ten years of follow-up, and the high mean age (75.4 ± 8.7 years) of observed population. This is probably the reason of the found chronic AF incidence (4%), higher than those reported in literature (range between 0.4% [2] and 2.7% [3]). A similar chronic AF incidence was reported in follow-ups of patients with complete and symptomatic A-V block and without sinus node dysfunction implanted with DDD pacing system [4].

The reason of the low AF incidence, either paroxysmal and chronic, can be explained as follow:

1. Reliable and constant A-V synchronization reachable by single lead VDD systems.
2. Absence of contacting atrial electrodes that could mechanically induce arrhythmias.
3. Careful selection of the patients, avoiding admission of those that could be affected by sinus node dysfunction. This is an indirect proof of selected diagnostic criteria.

Data concerning the stability of atrial synchronization and sensing are similar to those reported in literature [2-6] and confirm the reliability of this pacing system in a large number of patients and for a long term of follow-up.

Conclusion

Single lead VDD pacing demonstrates to be the treatment of choice for patients with symptomatic AV block, in which the absence of sinus node disease can simply be assessed by negative anamnesis of atrial pathologies followed by an atropine test and a 24 h ECG Holter monitoring.

A greater diffusion of this pacing system can help a higher number of patients to take benefit from "physiologic pacing" also in those hospitals in which the conventional DDD pacing is not performed due to cost problems and/or low number of implants.

References

[1] Antonioli GE. Single-Lead for P-synchronous Ventricular Pacing. A Dream Come True. PACE. 1994; 17: 1531-1547.

[2] Curzio G and the Multicenter Study Group. A multicenter evaluation of a single-pass lead VDD pacing system. PACE. 1991; 14: 1134.

[3] Rey JL, et al. Single lead VDD pacing: long-term experience with four different systems. Am Heart J. 1998; 135: 1036.

[4] Chamberlain-Weber R, et al. Reasons for reprogramming dual chamber pacemakers to VVI mode: a retrospective review using a computer database. PACE, 1994; 17: 1730.

[5] Levander-Lindgren M, et al. Occurrence and significance of arrhythmias associated with atrial-triggered ventricular pacing. PACE. 1984; 7: 628.

[6] Pitts-Crick JC. European Multicenter Prospective Follow-up Study of 1,002 Implants of a Single Lead VDD Pacing System. PACE. 1991; 14: 1742.