

Pacemaker-Mediated Tachycardia 3례의 임상적 고찰

이계원 · 조정휘 · 김우식 · 강홍선 · 김권삼 · 송정상 · 배종화

Three Cases of Pacemaker-Mediated Tachycardia

Kae Won Lee, MD, Chung Whee Choue, MD, Woo Sik Kim, MD, Heung Sun Kang, MD,
Kwon Sam Kim, MD, Jung Sang Song, MD and Jong Hoa Bae, MDDivision of Cardiology, Department of Internal Medicine, College of medicine, Kyung Hee University,
Seoul, Korea

ABSTRACT

Pacemaker-mediated tachycardia (PMT) is a well-known complication of dual-chamber pacemaker with atrioventricular sensing and pacing (DDD) or atrial synchronous, ventricular demand pacemaker (VDD). PMT usually starts with sensing a retrograde P waves linked to ventricular extrasystole with retrograde ventriculoatrial conduction and forms reentrant or circus movement tachycardia with the pacemaker itself as an antegrade limb and the conducting tissue of the heart as a retrograde limb. Recently, a number of pacemaker manufactures have incorporated in their devices a variety of relatively complex algorithms to prevent PMT. Despite these measures, PMT may still occur because of inappropriate programming or unpredictable variations of ventriculoatrial conduction. We report two cases of PMT in 78 year-old man and 60 year-old man who received DDD type pacemakers due to sick sinus syndrome, and a case of PMT in 69 year-old man who had suffered complete heart block and received a VDD type pacemaker. In these cases, we investigate symptoms, mechanism of PMT, programed parameters of pacemaker and treatments of PMT. (Korean Circulation J 2000;30(3):334-338)

KEY WORD : Pacemaker-mediated tachycardia.

서 론

1)2) , 가
3)4) ,
5) ,
6)7) ,
pacemaker - mediated tachycardia
(PMT) (dual chamber pacemaker)
가 ,
(rate adaptive pacemaker)

long QT syndrome

: 1999 10 25
: 2000 2 17
: , 130 - 702 1

: (02) 958 - 8166 · : (02) 958 - 8160
E - mail : cwchoue@khmc.or.kr

가 PMT , 2 1 , 3 4

PMT 가 PMT Biotronik , PMT postventricular atrial refractory period(PVARP) dynamic AV delay atrial refractory period , Medtronics

PMT 7)8) DDD PMT upper rate limit 9 ventricular event PVARP cycle atrial tracking PMT DDD 1 2 가

대 상

PMT가 3 3 2 3 , 1 (atrioventricular delay ; AVD) 225 ms PVARP 1 24 200 ms, 2 175 ms 가 가

PMT가 (Figs. 1 and 2). VDD , 24 , 3 (AVD) 120 ms, PVARP 270 ms, upper rate limit 150 bpm (Table 2, Fig. 3).

결 과

3 1 2 24 가 (ventriculoatrial conduction time) upper rate limit VDD (Thera VDD 8968i, Medtronic, Inc.) (Table 1). 3 PMT upper rate limit 1 5 PMT , 1 2

Table 1. Characteristics of study patients

Pt.	Age/sex	Diagnosis	Pacemaker	Mode
1	78/M	SND	BIOTRONIK PHYSIOS TC 01	DDD
2	60/M	SND	BIOTRONIK PHYSIOS TC 01	DDD
3	69/M	CHB	MEDTRONIC THERA 8968i	VDD

SND : sinus node dysfunction, CHB : complete heart block

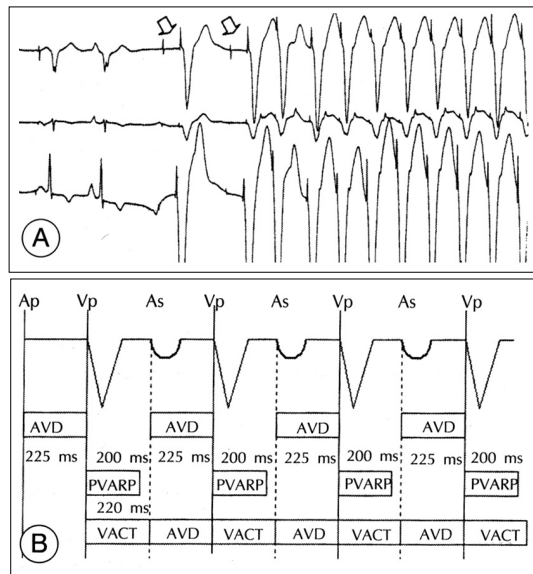


Fig. 1. PMT of case 1. 24 hour Holter monitoring (A) and its schematic diagram (B) show atrial capture failure (arrow) and initiation of PMT. BIOTRONIK PHYSIONS TC 01, DDD, URL : 140 bpm, LRL : 60 bpm, AVD : 225 msec, PVARP : 200 msec, PMT rate : 136 bpm, PMT intervention : On, AVD : atrioventricular delay, LRL : lower rate limit, URL : upper rate limit, PVARP : post-ventricular atrial refractory period, As : atrial sensed, Ap : atrial paced, Vp : ventricular paced, VACT : ventriculoatrial conduction time.

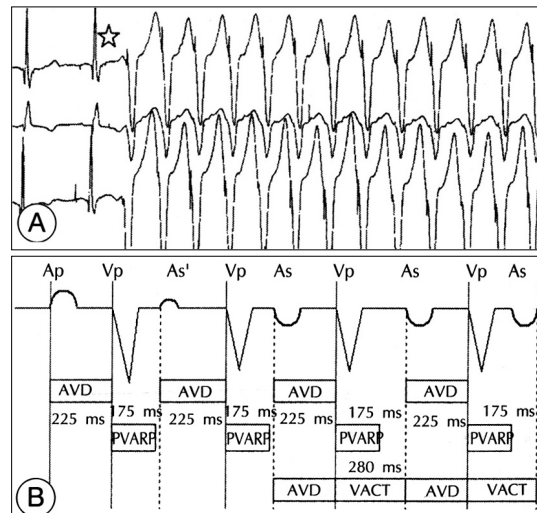


Fig. 2. PMT of case 2. 24 hour Holter monitoring (A) and its schematic diagram (B) show atrial oversensing (star) and initiation of PMT. BIOTRONIK PHYSIONS TC 01, DDD, URL : 130 bpm, LRL : 60 bpm, AVD : 225 msec, PVARP : 175 msec, PMT rate : 120 bpm, PMT intervention : Off, AVD : atrioventricular delay, LRL : lower rate limit, URL : upper rate limit, PVARP : postventricular atrial refractory period, As : atrial sensed, Ap : atrial paced, Vp : ventricular paced, VACT : ventriculoatrial conduction time, As' : atrial oversensing.

가
가
, PVARP가
1
, 2 PMT가
(Figs. 1 and 2) 3
P
PMT가 (Fig. 3).
PMT
1, PMT 가 upper rate limit
PMT termination mode가
, 2 3 PMT
termination mode가
PMT 가 upper rate
limit
upper rate limit
magnet PMT
PMT PVARP
PMT protection algorithm

고 안
Pacemaker - mediated tachycardia(PMT)
(6)(8-11) PMT 가
endless loop tachycardia
(ELT)
가
3-6)(9)(11-13)(15)
가 ELT가
PMT ELT

Table 2. Pacemaker settings and PMT data

pt.	AVD (ms)	PVARP (ms)	VACT (ms)	URL		PMT	
				CL (ms)	Rate (bpm)	CL (ms)	Rate (bpm)
1	225	200	220	428	140	440	136
2	225	175	280	461	130	500	120
3	120	270	340	400	150	460	130

AVD : atrioventricular delay, CL : cycle length, PMT : pacemaker-mediated tachycardia, PVARP : postventricular atrial refractory period, URL : upper rate limit, VACT : ventriculoatrial conduction time

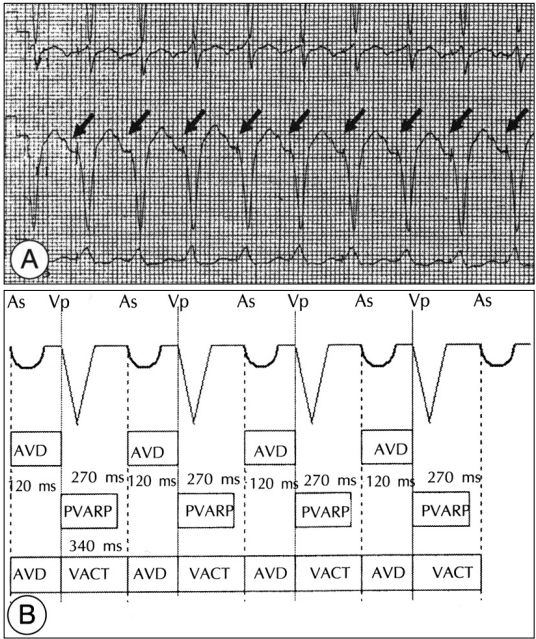


Fig. 3. PMT of case 3. ECG during PMT attack (A) and its schematic diagram (B) show endless-loop tachycardia which was initiated by retrograde conduction (arrow) to atria. MEDTRONIC THERA 8968i VDD, URL : 150 bpm, LRL : 60 bpm, AVD : 120 msec, PVARP : 270 msec, Atrial sensing : 0.5 mV, PMT rate : 130 bpm, AVD : atrioventricular delay, LRL : lower rate limit, URL : upper rate limit, PVARP : postventricular atrial refractory period, As : atrial sensed, Ap : atrial paced, Vp : ventricular paced, VACT : ventriculoatrial conduction time.

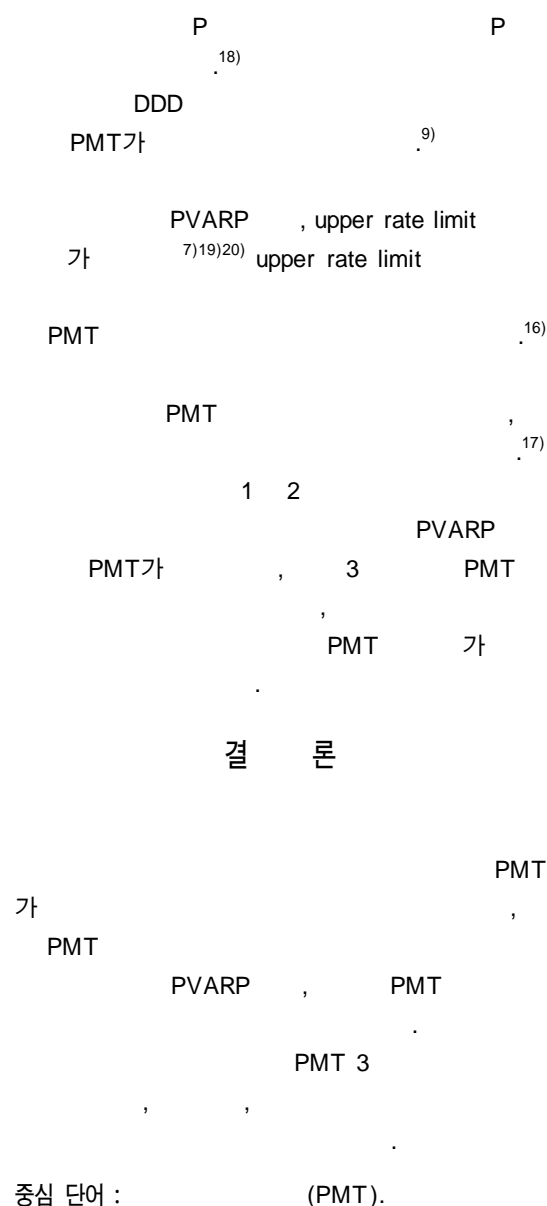
pseudoendless loop tachycardia¹⁶⁾

(rate adaptive
pacing) (sensor feedback tachycardia)

(¹⁴⁾¹⁵⁾¹⁷⁾ (voltage dip)

PMT

가
(1)
(2) (ventricular escape
beat), (3)
, (4) magnet¹⁶⁾
DOO
PMT가 가
P
가 , P
PMT
가
PMT 24
6)
PMT 가
magnet
non tracking mode¹⁵⁾¹⁸⁾
PMT
(AV delay)
PVARP 가
(differential AV de-
lay) , (adaptive AV delay),



REFERENCES

- 1) Barold SS, Zipes DP. Cardiac pacemakers and antiarrhythmic devices. In: Brounwald E, editor. Heart disease; A textbook of cardiovascular medicine. 5th ed. Philadelphia: WB Saunders Company;1997. p.705-31.
- 2) Raul DM, Robert JM, Agustin C. Cardiac pacemakers. In; R Wayne A, Robert CS, Valentin F, editor. Hurst's the Heart. 9th ed. New York: Mc Graw Hill;1998. p.1023-55.
- 3) Barold SS. Pacemaker induced repetitive nonreentrant ventriculo-atrial synchrony: Initiation and termination by ventricular extrasystole. PACE 1997;20:989-92.
- 4) Nitsche R, Gueunoun M, Lamaison D, Lascault G, Pioger G, Richard M, et al. Endless-loop tachycardias: Description and first clinical results of a new fully automatic protection algorithm. PACE 1990;13:1711-8.
- 5) Mechelen RV, Ruiter J, Vanderkerckhove Y, Boer HD, Hagemeyer F. Prevalence of retrograde conduction in heart block after DDD pacemaker implantation. Am J Cardiol 1986;57:797-801.
- 6) Buckingham TA, Janosick DL, Pearson AC. Pacemaker hemodynamics: Clinical implications. Progress in Cardiovascular Diseases 1992;34:347-66.
- 7) Lau CP, Tai YT, Fong PC, John PSL, Chung FLW, Song S. The use of implantable sensors for the control of pacemaker mediated tachycardias: A comparative evaluation of between minute ventilation sensing and acceleration sensing dual chamber rate adaptive pacemakers. PACE 1992;15:34-44.
- 8) Gross JN, Moser S, Bened ZM, Firman S. DDD pacing mode survival in patients with a dual-chamber pacemaker. J Am Coll Cardiol 1992;19:1536-41.
- 9) Littleford PO, Curry RC Jr, Schwartz KM, Pepine CJ. Pacemaker-mediated tachycardias. A rapid bedside technique for induction and observation. Am J Cardiol 1983;52:287-91.
- 10) Ibrahim B, Sanderson JE, Wright B, Palmer B. Dual chamber pacing: How many patients remain in DDD mode over the long term? Br Heart J 1995;74:76-9.
- 11) Limousin M, Bonnet JL, Investigators of the Multicenter Study. A New algorithm to solve endless loop tachycardia in DDD pacing: A Multi-center study of 91 patients. PACE 1990;13:867-74.
- 12) Sermasi S, Marconi M. VDD single pass lead pacing. Sustained pacemaker mediated tachycardias unrelated to retrograde atrial activation. PACE 1992;15:1903-15.
- 13) Lamas GA, Pashos CL, McNeil B. Permanent pacemaker selection and subsequent survival in elderly medicare pacemaker recipients. Circulation 1995;91: 1063-9.
- 14) Lau CP, Tai YT, Fong PC, Cheng CH, Chung FLW. Pacemaker mediated tachycardias in single chamber rate responsive pacing. PACE 1990;13:1575-9.
- 15) Lau CP. Sensor and pacemaker mediate tachycardias. PACE 1991;14:495-8.
- 16) Castellanos A, Fernandez PR, Interian Jr A, Myerberg RJ. Pacemaker-induced arrhythmias. In; William JM editor. Cardiac Arrhythmias. 3rd ed: Philadelphia Lippincott company;1995. p.1075-93.
- 17) Stroobandt B, Vandenbulcke F, Falleyn H, Sunnaeve A. Voltage dip in pacemaker battery supply: A new cause of pacemaker mediate tachycardia. PACE 1993;16: 806-11.
- 18) Conti JB, Curtis AB, Hill JA, Raymenants ER. Termination of pacemaker-mediated tachycardia by adenosine. Clin Cardiol 1994;17:47-8.
- 19) Lau CP, Tai YT, Fong PC, Lu JPS, Chung FLW. Atrial arrhythmia management with sensor controlled atrial refractory period and automatic mode switching in patients with minute ventilation sensing dual chamber rate adaptive pacemakers. PACE 1992;15:1504-14.
- 20) Leung SK, Lau CP, Leung WH, Tai YT, Chow FCYH. Apparent extension of the atrioventricular interval due to sensor-based algorithm against supraventricular tachyarrhythmias. PACE 1994;17:321-30.
- 21) Ausubel K, Gabry MD, Klementowicz PT, Furman S. Pacemaker-mediated endless loop tachycardia at rate below the upper rate limit. Am J Cardiol 1988;61:465-7.