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Effects of Cardiac Drugs on Pacemaker Therapy: A Review Article

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ABSTRACT

A pacemaker patient who takes cardiac medication must be informed of the possible drug interaction. Medication effect on pacemaker function could lead to increase or decrease threshold. The pacemaker output should be programmed to allow an adequate pacing margin of safety. The objective of this review article was to discuss the effects of cardiac medications on pacemaker threshold.

Keyword

Pacemaker, Cardiac drugs, Effects of cardiac drugs.

Introduction

Drug effect on pacemaker function could lead to increase or decrease threshold. Some cardiac drugs have been shown to cause alteration in pacemaker activities [1-3].

This alteration could present in decrease or increase threshold. Some of these drugs that persistently result in pace maker alterations are classified as (1) medications that increase pacemaker threshold (2) medications that lower the pacemaker threshold.

Medications That Increase Pacemaker Threshold

Class I anti-arrhythmic drugs

Class IA drugs eg quinidine and procainamide may increase pacing thresholds [1-3]. Procainamide may lead to failure in capturing at toxic level [4]. It increases in threshold of pace maker in humans. Quinidine may increase threshold of pacer activity.

Class IB drugs (lidocaine and mexilitence) are not thought to have a clinically significant effect on pacing thresholds [1-3]. Individual studies describing an effect of each of these agents in humans and/or animals, the use of these drugs in paced patients is safe.

Class 1C drugs eg flecainide, encainide, and propafenone increase pacing threshold. These drugs should be avoided in patients with pacemaker-dependent [5-8].

Class IC drugs must be used cautiously in pacemaker patients, especially in those who are pacemaker-dependent. The possibility of a rise in threshold should always be considered in pacemaker-dependent patients. Pacemaker output should be programmed to allow an adequate pacing margin of safety.

Class II medications

Beta blockers: Sympathetic stimulation lowers pacing threshold. So beta-blockers would raise pacing threshold. But studies have been inconsistent. In clinical practice, these class of drugs do not show a significant rise in pacemaker threshold [1-3].

Calcium channel blockers have not been reported to have any significant effect on chronic pacing thresholds in humans [1-3].

Class III medications

Amiodarone has been shown to affect defibrillation thresholds, but there is no convincing evidence that it significantly affects pacing thresholds.

Medications That Lower the Pacemaker Threshold

Corticosteroids lower pacemaker threshold. Steroid-eluting lead prevents the usual rise in pacing threshold after pacemaker implantation [9]. Sympathomimetic agents, such as epinephrine, ephedrine, and isoproterenol, also have been reported to decrease pacing threshold [10].

Sensing thresholds are much less commonly recognized to

be affected by cardioactive drugs. Significant clinical sensing problems have not been found with any of the drugs discussed in relation to pacing threshold.

Vaughan Williams Classification	Anti-arrhythmic Drugs	Effect for pacing threshold
1A	Quinidine	↑
	procainamide	↑↑
	ajimaline	↑
	disopyramide	↑
	cibenzoline	↑↑
	pirmeno	↑
1B	Aprindine	↑
	lidocaine	→
	phenytoin	→
	mexiletine	↑
IC	Propafenone	↑↑↑
	pilsicainide	↑↑↑
	flecainide	↑↑↑
II	Propranolol	→
III	Amiodarone	→
	sotalol	→
IV	Verapamil	→
	Digoxin	→ or ↑

Table 1: Effects of anti-arrhythmic drugs for pacing threshold.
Key: ↓: decrease, :→ no change, ↑: increase.

Antihypertensive in pacemaker patients

Data on the effect of many drugs (calcium channel blockers, ACE inhibitors, angiotensin II receptor antagonists, and others.) used for the treatment of patients with cardiovascular disease with implanted pacemaker are scars. In the medical support of patients with hypertension and an implanted pacemaker is used angiotensinconverting enzyme (ACE) inhibitors, angiotensin II receptor antagonists (ARA, sartans), beta-blockers (BAB), diuretics, calcium channel blockers. For the treatment of comorbid cardiovascular diseases is used ivabradine, digoxin, statins, warfarin, dabigatran, rivaroxaban, apixaban, aspirin, amiodarone, which may influence the course of hypertension [11,12].

Angiotensin Converting Enzyme (ACE) inhibitors

ACE inhibitors are among the common drugs used in the treatment of hypertension, left ventricular hypertrophy and heart failure. They have protective effects on target organs [13,14]. They provide cardio-vascular and renoprotective effect and the reduction in the incidence of cardiovascular complications and increases life expectancy of patients with their long-term use [13,15].

ACEIs have demonstrated it ability to cause LVH regression [16]. Several randomized studies CONSENSUS and SOLVD have shown, that treatment with ACE inhibitors led to reduction in mortality (relative risk reduction (RR) of 27% in CONSENSUS and 16% in SOLVD).

The PROGRESS study involved 1923 patients. It showed that perindopril significantly (by 28%) reduced the risk of a recurrent stroke in patients with cerebrovascular diseases on the background of AH.it also significantly reduced the risk of cardiovascular disease (26%) and the risk of myocardial infarction (38%) [3,16] The HOPE trial also showed that ramipril compared with placebo significantly caused regression of LVH [17].

ACE inhibitors in patients with pacemaker have been noted to cause lengthening of QTc intervals in 31% of patients with cardiac pacer [18,19]. The use of ACE inhibitors in patients with a pacemaker and cardiac resyndronization therapy may lead to increase in left ventricular ejection fraction [20]. There are no data on the effect of ACE inhibitors in patients with AH and pacemaker.

Angiotensin II Receptor Antagonists (ARA)

They are used in the treatment of hypertension and heart failure. They differ from ACEIs in that they do not produce dry cough and angioneurotic edema [21]. ARB could reduce systolic and diastolic BP by 50–70% within 24 hours [22-24]. LIFE trial showed a 13% reduction in major cardiovascular events and greater regression of LVH in the losartan group [25-27].

ARB have shown to lengthen QTc interval by 8-13% in patients with pacemaker [19]. There are no trials on the effect of ARB in patients with arterial hypertension and a pacemaker.

Non-Dihydropyridine Derivatives (Diltiazem and Verapamil)

They are used for treatment of ischemic disease and hypertension [28,29]. There is no clinical trials on the effects of diltiazem on ischemic heart disease, pacemaker and hypertension.

The effect of verapamil in patients with cardiac pacing has been shown to increase percentage of stimulation [28]. Cardiac pacing had no effect on the frequency and dosage of the prescription of calcium channel blockers [19]. However, there are no data on the effect of calcium channel blockers in patients with AH and pacemaker.

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References

1. Hayes DL, Furman S, Hayes DL, et al. Electromagnetic interference, drug-device interactions, and other practical considerations. Eds. A Practice of Cardiac Pacing. 3rd ed. New York Futura. 1993; 665-684.
2. Reiffel JA, Coromolas J, Zimmerman JM, et al. Drug-device interactions clinical considerations. PACE. 1985; 8: 369-373.
3. Hayes DL. Effects of drugs and devices on permanent pacemakers Cardiology. 1991; 1: 70-75.
4. Gay RJ, Brown DF. Pacemaker failure due to procainamide toxicity. Am J Cardiol. 1974; 34: 728-732.
5. Hellestrand KJ, Burnett PJ, Milne JR. Effect of the antiarrhythmic agent flecainide acetate on acute and chronic

pacing thresholds. PACE. 1983; 6: 892-899.
6. Salel AF, Seagren SC, Pool PE. Effects of encainide on the function of implanted pacemakers. PACE. 1989; 12: 1439-1444.
7. Montefochi N, Boccadamo R. Propafenone induced acute variation of chronic atrial pacing threshold a case report. PACE. 1990; 13: 480-483.
8. Bianconi L, Boccadamo R, Toscano S, et al. Effects of oral propafenone therapy on chronic myocardial pacing threshold. PACE. 1992; 15: 148-154.
9. Kruse IM. Long-term performance of endocardial leads with steroid-eluting electrodes. PACE. 1986; 9: 1217-1219.
10. LeVick CE, Mizgala HF, Kerr CR. Failure to pace following high dose antiarrhythmic therapy-reversal with isoproterenol. PACE. 1984; 7: 252-256.
11. Manunta P, Ferrandi M, Cusi D, et al. Personalized Therapy of Hypertension the Past and the Future. Curr Hypertens Rep. 2016; 18: 1-5.
12. Shin J, Park J, Kim K, et al. 2013 Korean Society of Hypertension guidelines for the management of hypertension part III hypertension in special situations. Clin Hypertens. 2015; 15: 20-175.
13. Opie LH. Angiotensin converting enzyme inhibitors. The advance continues. 3rd edition. sNew-York Authors' Publishing House. 1999; 276.
14. Guo W, Li L. Angiotensin converting enzyme inhibitors for heart failure with reduced ejection fraction or left ventricular dysfunction A complementary network meta-analyses. Int J Cardiol. 2016; 1: 2-10.
15. Gueyffier F, Wright J. Are we using blood pressure-lowering drugs appropriately Perhaps now is the time for a change. J Hum Hypertens. 2014; 28: 68-70.
16. Sun W, Zhang H, Guo J, et al. Comparison of the Efficacy and Safety of Different ACE Inhibitors in Patients with Chronic Heart Failure A PRISMA-Compliant Network Meta-Analysis. Medicine Baltimore. 2016; 95: 1-8.
17. Dolzhenko MN, Dolzhenko MN, Volgina IN. ACE inhibitors in treatment and prevention of cardiovascular Pathology potential ramiprila. Consilium medicum Ukraine. 2009; 2: 12-15.
18. Shanina IV. Volkov DE. Frequency of detached cardiac drugs prescribing in patients of different classes QRS complex duration on the permanent pacing background. The Journal of V.N. Karazin Kharkiv National University. Series Medicine. 2014; 27: 33-37.
19. Shanin IV. The duration of the QRS complex and the effectiveness of drug therapy for patients with implanted pacemakers: avtoref. dis. for the sciences. the degree of PhD special. 14. 01.11 cardiology. Kharkiv. 2015; 25.
20. Penn JI. Goldenberg S, McNitt, et al. Changes in Drug Utilization and Outcome With Cardiac Resynchronization Therapy A MADIT-CRT Substudy. J Card Fail. 2015; 21: 7-541.
21. Ah Y, Lee J, Choi Y, et al. Influence of initial angiotensin receptor blockers on treatment persistence in uncomplicated hypertension A nation-wide population-based study. Clin Exp Hypertens. 2016; 30: 1-6.
22. Hsiao F, Tung Y, Chou S, et al. Fixed-Dose Combinations of Renin-Angiotensin System Inhibitors and Calcium Channel Blockers in the Treatment of Hypertension A Comparison of Angiotensin Receptor Blockers and AngiotensinConverting Enzyme Inhibitors. Medicine Baltimore. 2015; 94: 9-80.
23. Makkink J, Greeff O. Angiotensin converting enzyme inhibitors v angiotensin receptor blockers in the management of hypertension: a funder's perspective. S Afr Med J. 2014; 104: 4-292.
24. Sabbah Z, Mansoor A, Kaul A. Angiotensin receptor blockers - advantages of the new sartans. J Assoc Physicians India. 2013; 61: 70-464.
25. Kikuchi K, Tancharoen S, Ito T, et al. Potential of the angiotensin receptor blockers ARBs telmisartan, irbesartan, and candesartan for inhibiting the HMGB1/RAGE axis in prevention and acute treatment of stroke. Int J Mol Sci. 2013; 14: 924-1889.
26. Greve A, Olsen M, Bella J, et al. Contrasting hemodynamic mechanisms of losartan- vs. atenolol-based antihypertensive treatment a LIFE study. Am J Hypertens. 2012; 25L 23-1017.
27. Ruwald A, Westergaard B, Sehestedt T, et al. Losartan versus atenolol-based antihypertensive treatment reduces cardiovascular events especially well in elderly patients the Losartan Intervention for Endpoint reduction in hypertension LIFE study. J Hypertens. 2012; 30: 9-252.
28. Barrios V. Diltiazem in the treatment of hypertension and ischemic heart disease. Expert Rev Cardiovasc Ther. 2011; 9: 82-1375.
29. Agbor-Etang B, Setaro JF. Management of Hypertension in Patients with Ischemic Heart Disease. Curr Cardiol Rep. 2015; 17: 119.

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