

PACE-ECG IN PREVIOUS MYOCARDIAL INFARCTION: AN UNFINISHED STORY

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Aim. The diagnosis of previous myocardial infarction (MI) is difficult in patients with pacemaker and usually further tests must be done to confirm the diagnosis. To overcome this difficulty five major ECG criteria have been proposed by authors: 1. Notching 0.04 second in the ascending limb of the S wave of leads V3,4 or 5 (Cabrera's sign), 2. Notching of the upstroke of the R wave in leads I, aVL or V6 (Chapman's sign), 3. Q wave >0.03 second in leads I, aVL or V6, 4. Notching of the first 0.04 second of the QRS complex in leads II, III, aVF, 5. Q wave >0.03 second in leads II, III, aVF. The aim of this study is to find the predictive value of the five major proposed criteria for MI in pacing ECG of patients with previous MI.

Material and methods. Twenty- three pacemaker patients with known MI (anterior 15, inferior 8) and 24 healthy pacemaker control patients; 17 female, 30 males, aged between 17-92 years with mean age of 59.5 ± 20 years, total 47 patients were studied. Documentation and localization of MI was based on history and confirmed by angiography and or scintigraphy.

Results. Sensitivity was lower in all parameters for prediction of any MI whereas specificity was higher and ODA was moderate. Cabrera's and Chapman's sign had moderate sensitivity (60%-60%) whereas high specificity (90%-90%) and ODA (81%-81%) for anterior MI. Sensitivity of Q wave in I, aVL or V6 was lower (47%) for anterior MI but specificity and ODA was higher 84% and 92% respectively.

Conclusion. In conclusion Cabrera's and Chapman's sign have a moderate sensitivity and higher specificity for recognising previous anterior MI in pacing patients.

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Key words: pacemaker, electrocardiography, previous MI, Cabrera, Chapman.

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О ПЕЙС-ЭКГ ПЕРЕНЕСЕННОМ ИНФАРКТЕ МИОКАРДА: НЕЗАКОНЧЕННАЯ ИСТОРИЯ

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Цель. Диагностика перенесенного инфаркта миокарда (ИМ) является трудной у пациентов с кардиостимулятором и, как правило, дальнейшие исследования должны быть проведены, чтобы подтвердить диагноз. Чтобы преодолеть эту трудность, авторами предложены пять основных ЭКГ-параметров: 1. Зубец 0.04 второй восходящей ветви волны S в отведениях V 3, 4 или 5 (признак Cabrera), 2. Зубец восходящей R-волны в отведениях I, aVL или V6 (признак Chapman), 3. Волна зубца Q >0.03 секунды в отведениях I, aVL или V6, 4. Зубец в первые 0.04 секунды комплекса QRS в отведениях II, III, aVF, 5. Волна зубца Q >0.03 секунды в отведениях II, III, aVF. Целью данного исследования является поиск прогностической ценности из пяти основных предложенных критериев для ИМ при пейс-ЭКГ у пациентов с перенесенным ИМ.

Материал и методы. Двадцать три пациента с кардиостимуляторами с известным ИМ в анамнезе (передне-стеночный 15, задне-стеночный 8) и 24 здоровых пациента с кардиостимуляторами контрольной группы; 17 женщин, 30 мужчин в возрасте от 17–92 лет, средний возраст 59,5 лет, всего 47 больных были изучены. Документация и локализация ИМ были основаны на истории

болезни и подтверждены ангиографией или скintiграфией.

Результаты. Чувствительность была ниже во всех параметрах для прогнозирования ИМ любой локализации, принимая во внимание, что специфичность была выше и общая диагностическая точность (ОДТ) была умеренной. Признаки Cabrera и Чарпман имели умеренную чувствительность (60%-60%), при высокой специфичности (90%-90%) и ОДТ (81%-81%) на переднем ИМ. Чувствительность зубца Q отведениях I, aVL или V6 была ниже (47%) для переднего ИМ, но специфичность и ОДТ были выше 84% и 92%, соответственно.

Заключение. Признаки Cabrera и Чарпман обладают умеренной чувствительностью и высокой специфичностью для определения перенесенного передне-стеночного ИМ у пациентов с кардиостимуляторами.

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Ключевые слова: кардиостимулятор, электрокардиография, перенесенный инфаркт миокарда, Cabrera, Chapman.

Introduction

Ventricular pacing changes ventricular depolarization and repolarisation process causing left bundle branch block (LBBB). Thus the diagnosis of previous myocardial infarction (MI) is difficult in patients with pacemaker and usually further tests must be done to confirm the diagnosis. To overcome this difficulty five major ECG criteria have been proposed by authors: 1. Notching 0.04 second in the ascending limb of the S wave of leads V3,4 or 5 (Cabrera's sign), [1] 2. Notching of the upstroke of the R wave in leads I, aVL or V6 (Chapman's sign) [2], 3. Q wave >0.03 second in leads I, aVL or V6 [3], 4. Notching of the first 0.04 second of the QRS complex in leads II, III, aVF [4], 5. Q wave > 0.03 second in leads II, III, aVF [5]. Limited number of studies evaluated these criteria and revealed low

sensitivity but high specificity for the diagnosis of previous MI but these studies are performed in a small number of patients and methods for confirming previous MI are different [6, 7]. The aim of this study is to find the predictive value of the five major proposed criteria for MI in pacing ECG of patients with previous MI.

Material and methods

624 patients with implanted permanent pacemaker in our clinic were evaluated retrospectively. Twenty- three pacemaker patients with known MI (anterior 15, inferior 8) and 24 healthy pacemaker control patients; 17 female, 30 males, aged between 17–92 years with mean age of 59.5 ± 20 years, total 47 patients were studied. Documentation and localization of MI was based on history and con-

Table 1

Sensitivity (%), Specificity (%) and Overall Diagnostic Accuracy (%) of five ECG criteria for all myocardial infarctions

ECG Sign	Anterior Myocardial Infarction			Inferior Myocardial Infarction		
	Sensitivity	Specificity	ODA	Sensitivity	Specificity	ODA
Cabrera's	60 %	90 %	81 %	25 %	74 %	66 %
Chapman's	60 %	90 %	81 %	25 %	74 %	66 %
Q I, aVL, V6	47 %	84 %	72 %	25 %	74 %	66 %
N II, III, aVF	27 %	90 %	70 %	37 %	90 %	81 %
Q II, III, aVF	27%	81 %	64 %	50 %	85 %	79 %

Abbreviation: ODA - overall diagnostic accuracy.

firmed by angiography and or scintigraphy. Control group was constituted of patients without history of MI and with normal myocardial scintigraphy.

Pace lead was in right ventricular apical position in all patients. Pace mode was DDD-R in 16 (69.5%) of 23 patients in MI group and 17 (70.8%) of 24 patients in control group and VVI-R in 7 (31.5%) in MI group and 7 (29.2%) in control group. Complete ventricular capture was confirmed in all patients.

A surface 12-lead ECG was recorded in all patients and patients with full ventricular capture were included study. Two different experts, who were blinded to group status of the patients, manually analyzed all ECGs. Differences in interpretation were resolved by consensus. According to the literature five major ECG criteria were assessed in our study.

1. Notching 0.04 second in the ascending limb of the S wave of leads V3,4 or 5 (Cabrera's sign),
2. Notching of the upstroke of the R wave in leads I, aVL or V6 (Chapman's sign),
3. Q wave >0.03 second in leads I, aVL or V6,
4. Notching of the first 0.04 second of the QRS complex in leads II, III, aVF,
5. Q wave >0.03 second in leads II, III, aVF.

First three criteria were used to determine previous anterior MI whereas number 4, and 5 were used to find out old inferior MI.

Specificity, sensitivity and overall diagnostic accuracy of these criteria to find out previous MI were calculated as follows:

Sensitivity = True positive / (true positive+false negative)

Specificity = True negative / (true negative+false positive)

Overall diagnostic accuracy = (true positive+ true negative) / total study population

Results

Of the 23 patients with MI, a positive Cabrera's sign was found in 11 (47.8%) patients (9/15 with anterior MI, 2/8 with inferior MI), Positive Chapman's sign was seen in 6 (26.0%) patients (4/15 anterior MI, 2/8 inferior MI), Q wave in I, aVL or V6 was found in 9 (39.1%) patients (7/15 anterior MI, 2/8 inferior MI), Notching of QRS complex in leads II, III, aVF in 7 (30.0%) patients (4/15 anterior MI, 3/8 inferior MI), Q wave in leads II, III, aVF in 8 (34.7%) patients (4/15 anterior MI, 4/8 inferior MI).

Table 2

Sensitivity (%), Specificity (%) and Overall Diagnostic Accuracy (%) of five ECG criteria for anterior and inferior myocardial infarctions

ECG Sign	Sensitivity	Specificity	ODA
Cabrera's	48%	96%	72%
Chapman's	48%	96%	72%
Q I, aVL, V6	39%	88%	64%
N II, III, aVF	30%	100%	66%
Q II, III, aVF	35%	91%	64%

Abbreviation: ODA — overall diagnostic accuracy.

Of the 24 control patients; there was a positive Cabrera's sign in 2 (8.3%) patients, a positive Chapman's sign in 2 (8.3%) patients, Q wave in I, aVL or V6 in 3 (12.5%), notching of the QRS complex in leads II, III, aVF in 1 (4.1%) patient and Q wave in leads II, III, aVF in 2 (8.3%) patients.

The sensitivity, specificity and overall diagnostic accuracy of all parameters for detecting previous MI are given in Table 1 and 2. Sensitivity was lower in all parameters for prediction of any MI whereas specificity was higher and ODA was moderate. Cabrera's and Chapman's sign had moderate sensitivity (60%-60%) whereas high specificity (90%-90%) and ODA (81%-81%) for anterior MI. Sensitivity of Q wave in I, aVL or V6 was lower (47%) for anterior MI but specificity and ODA was higher 84% and 92% respectively.

For previous inferior MI both notching in II, III, aVF and Q wave >0.03 second in II, III, aVF had lower sensitivity (37%-50%), but specificity (90% — 85%) and ODA (81%-79%) were higher.

Discussion

This study was aimed to find the predictive value of the five major proposed criteria for MI in pacing ECG of patients with previous MI. The diagnosis of previous MI in the presence of LBBB, fascicular block, Wolf-Parkinson-White syndrome or right ventricular pacing is challenging and despite several criteria have been proposed, the real diagnostic value of these criteria remains controversial [8–11]. From these criteria five of them have been studied commonly but results of these studies are controversial and most of them are rather old [6–11]. Kochiadakis et al [6] evaluated five criteria for determining previous

MI in paced patients and reported that Cabrera's and Chapman's signs and their combination was useful for recognising previous MI whereas determining the location of the infarct was impossible with any of these criteria. There are many limitations of this study; first temporary pacing used to produce a pacing ECG in patients with previous MI so these findings cannot be generalized to real life permanent pacemaker patients, secondly authors excluded patients with multiple previous necrosis and patients with atrial fibrillation and patients with ejection fraction less than 40%. Recently Theraulaz et al [7] investigated these criteria in permanent pacemaker patients with previous MI. They reported that the sensitivity of Cabrera's sign was moderate for detecting previous MI but poor for all other ECG criteria ranging from 9.1% to 40.9%. In their study specificity was relatively high for all ECG criteria ranging from 81.6% to 100%. None of the five criteria was useful to assess the site of previous MI. In means of specificity and sensitivity for determining all MI, our findings were similar but in our study sensitivity, specificity and ODA of Cabrera's and Chapman's sign in previous anterior MI was higher compared to their study. Usefulness of Cabrera's and Chapman's sign for determining the location of MI was also confirmed by Barold et al [8] and Kindwall et al [9].

The ECG criteria for the presence of previous inferior MI (notching of the QRS and qR in II, III, aVF) was lower

sensitivity but a higher specificity in our study and these findings are consistent with previous studies [7–8].

The present study has important findings; first the specificity of all signs has higher than their sensitivity for anterior, inferior and all of MI. Second; Cabrera's and Chapman's signs have higher sensitivity, specificity and ODA for anterior MI and ODA for all MI. Third; Notching in II, III, aVF and Q wave >0.03 second in II, III, aVF have lower sensitivity but high specificity and ODA for inferior MI.

Limitations of study

First of all, this study is a single centre study with a small number of patients that may lead to patient selection bias, secondly our study group was consisted of right ventricular apical pacing patients so these results cannot be applicable to patients with different lead position in right ventricle of biventricular pacing, third; intraobserver variability may be seen in interpretation and analysis of the various ECG criteria.

Conclusion

In conclusion Cabrera's and Chapman's sign have a moderate sensitivity and higher specificity for recognising previous anterior MI in pacing patients. Although sensitivity was lower for other criteria for determining MI specificity were higher and their presence on a pace ECG should alert physician for previous MI.

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