PACE-ECG IN PREVIOUS MYOCARDIAL INFARCTION: AN UNFINISHED STORY

Cuneyt Kocas, Okay Abaci, Baris Okcun, Alev Arat Ozkan, Yusuf Atayev, Tefvik Gurmen, Cengiz Celiker, Murat Ersanli

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 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 recognizing previous anterior MI in pacing patients.

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

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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 1, 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).

### 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

### Table 1

<table>
<thead>
<tr>
<th>ECG Sign</th>
<th>Anterior Myocardial Infarction</th>
<th>Inferior Myocardial Infarction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cabrera’s</td>
<td>Sensitivity 60 %</td>
<td>specificity 90 %</td>
</tr>
<tr>
<td>Chapman’s</td>
<td>Sensitivity 60 %</td>
<td>specificity 90 %</td>
</tr>
<tr>
<td>Q II, III, aVF</td>
<td>sensitivity 47 %</td>
<td>specificity 84 %</td>
</tr>
<tr>
<td>N II, III, aVF</td>
<td>sensitivity 27 %</td>
<td>specificity 90 %</td>
</tr>
<tr>
<td>Q II, III, aVF</td>
<td>sensitivity 27 %</td>
<td>specificity 81 %</td>
</tr>
</tbody>
</table>

Abbreviation: ODA — overall diagnostic accuracy.

### Table 2

<table>
<thead>
<tr>
<th>ECG Sign</th>
<th>Sensitivity (%)</th>
<th>Specificity (%)</th>
<th>Overall Diagnostic Accuracy (%)</th>
<th>Anterior Myocardial Infarction</th>
<th>Inferior Myocardial Infarction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cabrera’s</td>
<td>48%</td>
<td>96%</td>
<td>72%</td>
<td>Sensitivity 48%</td>
<td>Specificity 96%</td>
</tr>
<tr>
<td>Chapman’s</td>
<td>48%</td>
<td>96%</td>
<td>72%</td>
<td>Sensitivity 48%</td>
<td>Specificity 96%</td>
</tr>
<tr>
<td>Q II, III, aVF</td>
<td>39%</td>
<td>88%</td>
<td>64%</td>
<td>Sensitivity 39%</td>
<td>Specificity 88%</td>
</tr>
<tr>
<td>N II, III, aVF</td>
<td>30%</td>
<td>100%</td>
<td>66%</td>
<td>Sensitivity 30%</td>
<td>Specificity 100%</td>
</tr>
<tr>
<td>Q II, III, aVF</td>
<td>35%</td>
<td>91%</td>
<td>64%</td>
<td>Sensitivity 35%</td>
<td>Specificity 91%</td>
</tr>
</tbody>
</table>

Abbreviation: ODA — overall diagnostic accuracy.
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 Théraulaz 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 specificity, sensitivity 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.

References