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# Appropriateness of anteroseptal myocardial infarction nomenclature evaluated by late gadolinium enhancement cardiovascular magnetic resonance imaging ☆

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**Abstract**

**Background:** In traditional literature, it appears that "anteroseptal" MIs with Q waves in V1-V3 involve basal anteroseptal segments although studies have questioned this belief.

**Methods:** We studied patients with first acute anterior Q-wave (>30 ms) MI. All underwent late gadolinium enhancement (LGE) cardiac magnetic resonance imaging (MRI).

**Results:** Those with Q waves in V1-V2 (n = 7) evidenced LGE >50% in 0%, 43%, 43%, 57%, and 29% of the basal anteroseptal, mid anteroseptal, apical anterior, apical septal segments, and apex, respectively. Patients with Q waves in V1-V3 (n = 14), evidenced involvement was 14%, 43%, 43%, 50%, and 7% of the same respective segments. In those with extensive anterior Q waves (n = 7), involvement was 0%, 71%, 57%, 86%, and 86%.

**Conclusions:** Q-wave MI in V1-V2/V3 primarily involves mid- and apical anterior and anteroseptal segments rather than basal segments. Data do not support existence of isolated basal anteroseptal or septal infarction. "Anteroapical infarction" is a more appropriate term than "anteroseptal infarction."



*Keywords:* Electrocardiography; Myocardial infarction; Magnetic resonance imaging; Q waves; Anterior wall myocardial infarction; Anteroseptal myocardial infarction

## Introduction

Isolated Q waves in leads V1-V3 of the electrocardiogram (ECG), with or without extension to V4, have traditionally denoted "anteroseptal" myocardial infarction (MI), while isolated Q waves found in leads V1-V2 have been termed "septal" MI. The origin of these definitions stems from histopathological studies carried out several decades ago [1,2]. Given the selection bias inherent in such works, the external validity of these findings has reasonably been brought into question.

More recent studies have attempted to address the controversy through correlations of the ECGs with

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angiography or advanced cardiac imaging modalities. Shalev et al. concluded that the traditional definition of isolated anteroseptal MI is not supported by angiographic and echocardiographic data and that the actual infarcted area is in fact more anteroapical with minimal septal involvement [3]. Bogaty et al. reported somewhat similar findings, suggesting that the area of infarct is apical but still involves the septum in a majority of patients [4]. Unfortunately, both studies were limited by the inability of echocardiography to distinguish between stunned and infarcted myocardium.

In the context of MI, late gadolinium enhancement cardiovascular magnetic resonance imaging (LGE MRI) is especially useful for noninvasive assessment of infarct tissue volume and extent of transmural involvement with high spatial resolution [5–7]. In a set of 19 patients with acute MI and new Q waves in leads V1 to V2-V4, Selvanayagam et al. used LGE MRI to suggest predominantly apical infarction with some involvement of the mid-ventricular anteroseptum [6]. However, this study was marked by nebulous inclusion criteria, as patients with more extensive anterior Q waves were grouped together with those with limited "anteroseptal" Q waves in the analysis.

We aimed to assess the extent and location of pre-discharge LGE in patients with traditional "anteroseptal" MI (Q waves in V1-V3) and to compare this to the pattern seen in patients with more extensive distribution of Q waves in the precordial leads. We hypothesize that the ECG diagnosis traditionally termed "anteroseptal" MI, actually denotes an area of apical infarction, rather than basal anteroseptal MI, as is often thought and taught.

## Methods

We conducted a multicenter retrospective cohort analysis of patients undergoing LGE cardiac MRI at sites in the United States and Europe. We incorporated data from the MITOCARE study, patients from the Houston Methodist Hospital (Houston, Texas, USA) and the Texas Heart Institute, Baylor St. Luke's Medical Center (Houston, Texas, USA). Details of the MITOCARE study have been previously released [8,9].

Inclusion criteria were admission to the hospital with a first acute anterior MI and pre-discharge ECG demonstrating Q or QS waves (>30 ms) in leads V1 up to V6. ECGs were reviewed by the ECG laboratory, which was blinded to the results of LGE cardiac MRI.

Eligible patients had undergone LGE cardiac MRI after this index cardiac event on whole-body magnetic resonance scanners with cardiac applications used for standard clinical cardiac magnetic resonance (CMR) [8,10].

The following parameters were collected by a separate observer, examining CMR short-axis images during end-diastole and end-systole: left ventricular mass (g), stroke volume (in mL), left ventricular ejection fraction (LVEF) (graded by percentage), and the transmural extent of LGE (graded by percentage). In order to uniformly describe the distribution of LGE, we have used the American Heart Association (AHA) 17-segment model for description of myocardial segments [11]. LGE was quantified using planimetry.

To compare categorical variables, the $\chi^2$ test or Fisher's exact test were carried out. One-way analysis of variance (ANOVA) was used to compare continuous variables. A $p$-value $< 0.05$ was considered statistically significant for the purposes of this study.

Values herein are described as median or mean ± standard deviation (SD) as appropriate. Frequencies and percentages have been used to describe categorical variables. The study was approved by the institutional review board at Baylor College of Medicine in Houston, Texas.

## Results

A total of 28 patients qualified for inclusion in the study. Thirteen patients were recruited from the MITOCARE study, ten from the cardiac MRI database of the Houston Methodist Hospital and five from the cardiac MRI database of the Texas Heart Institute at Baylor St. Luke's Medical Center. The mean age of the patients was 61 ± 18 years. Twenty-six patients (93%) were male. Eight (28%) had diabetes mellitus, 15 (54%) had hyperlipidemia, and 13 (46%) had hypertension. Nineteen patients (68%) were current or former users of

Table 1
A description of myocardial segments affected left ventricular ejection fraction (LVEF), and myocardial mass for the different Q wave distributions.

| ECG Q- wave distribution | V1-V2 | V1-V3 | >V3 | *P* value | All groups |
|---|---|---|---|---|---|
| Number of patients | 7 | 14 | 7 | – | 28 |
| Age (years) | 61.4 ± 14.0 | 67.4 ± 13.4 | 61.2 ± 13.6 | 0.517 | 60.8 ± 17.7 |
| Male (%) | 86 | 93 | 100 | 0.74 | 93 |
| Caucasian (%) | 57 | 93 | 100 | 0.07 | 86 |
| Diabetes (%) | 57 | 21 | 14 | 0.23 | 29 |
| Hyperlipidemia (%) | 71 | 64 | 14 | 0.07 | 54 |
| Hypertension (%) | 71 | 57 | 14 | 0.06 | 46 |
| Tobacco use (%) | 86 | 57 | 71 | 0.39 | 68 |
| Myocardial segments with LGE | 4.7 ± 3.6 | 8.6 ± 4.0 | 11.1 ± 2.1 | 0.006 | 7.9 ± 4.0 |
| Myocardial scar (g) | 10.4 ± 11.3 | 33.1 ± 23.2 | 44.4 ± 18.8 | 0.029 | – |
| Myocardial mass (g) | 139.4 ± 22.5 | 160.1 ± 42.7 | 144.8 ± 24.4 | 0.455 | – |
| LVEF (%) | 43.7 ± 28.1 | 44.2 ± 16.8 | 42.8 ± 8.8 | 0.99 | 42.7 ± 16.8 |

Values are reported as mean ± standard deviation (SD) when applicable. *P* values are the result of ANOVA comparing the sample means among the three groups.