



Yale SCHOOL OF MEDICINE

Non-Invasive Assessment of Myocardial Ischemia and Chest Pain Syndrome Using CardioMap (EKG Dispersion Mapping) In Office Based Patient

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Introduction

12 lead electrocardiogram (EKG) is being used for detection of Coronary Artery Disease (CAD) and Myocardial ischemia during routine and emergency setting, however, its sensitivity is low and varies.

In order to increase sensitivity, a stress test is used. The sensitivity can be increased by the modality of the stress test and also the pretest probability.

Coronary Angiogram remains the gold standard, however, it carries a risk and it cannot be done on routine bases. It will be desirable to use a non-invasive method with higher sensitivity than a 12 lead EKG for the detection of Asymptomatic CAD and Myocardial ischemia.

The CardioMap is a computerized analysis based on dispersion analysis of low amplitude EKG signal during cardiac systolic intervals. Dispersion mapping are effective indicators of pathological changes of myocardium, which are not totally expressed on the conventional EKG.

This analysis is performed during 30-60 sec of continuous EKG. I have performed a prospective observational study to analyze patients with Asymptomatic CAD, normal coronary arteries by coronary angiogram and CP syndrome using EKG dispersion mapping (CardioMap).

Methods

Single observational study that includes:

- GROUP A:** Patient with chest pain syndrome (CP syndrome)
- GROUP B:** Patient with normal coronaries by coronary angiogram
- GROUP C:** Patient with coronary risk factors
- GROUP D:** Patient with documented coronary artery disease and stent placement
- GROUP E:** Patient with previous Myocardial Infarction
- GROUP F:** Patient with previous Coronary Artery Bypass (CABG)

CardioMap provides information of Heart stress index and color mapping.

Heart Stress Index is considered normal when it is <15%

Low Stress Index is considered normal when it is between 15-20%

High Stress Index is considered normal when it is >20%

Mapping is considered normal when the color is green, and a moderately diseased and severely diseased heart when the color is not green. This is called abnormal color mapping.

Results

GROUP A – Chest Pain Syndrome

Total patients in this group were 6 patients

All of them were found to have a normal (<15%) Heart Stress Index by color mapping, a green color, which is considered a normal color.

These groups of patients subsequently underwent a non-invasive study which showed no evidence of Myocardial Ischemia.

This correlation is important and it can be applicable in the evaluation of patients presenting with chest pain in the office or Emergency Department.

GROUP B – Patients with normal coronaries by Coronary Angiogram

Total patients in this group were 6 patients. CardioMap was performed on all 6 patients. CardioMap showed normal (<15%) Heart Stress Index and normal (green) color mapping. This finding can reassure that chest pains were not cardiac in origin.

GROUP C – Patients with Cardiovascular Risk Factors

The total patients included were 16 patients. This group included patients with single risk factor or multiple risk factors. Patients with single risk factor were found to have a normal (<15%) or low (15-20%) Heart Stress Index, however, an abnormal color mapping (not green color). While patients with multiple risk factors were found to have a high (>20%) Heart Stress Index and an abnormal color mapping. Cardiovascular risk factor produces abnormal color mapping despite normal (<15%) or Low Normal (15-20%) Heart Stress Index.

GROUP D – Patients with documented coronary artery disease and stent placement

9 patients were included. All of them were found to have a normal (<15%) Heart Stress Index, with an abnormal color mapping, mainly moderately diseased heart.

GROUP E – Patients with documented Myocardial Infarction and Stent Placement

There were 4 patients included. All of them were found to have a higher (>20%) Heart Stress Index and abnormal color mapping, consistent with severely diseased heart.

GROUP F – Patients with previous Coronary Artery Bypass Graft (CABG)

There were 3 patients studies with variation in the Heart Stress Index and color mapping.

Discussion

CardioMap can be used as a diagnostic tool for the evaluation of patients with chest pain.

There was an excellent correlation of normal CardioMap indicated by normal (<15%) Heart Stress Index and a normal color mapping (green) in patients with chest pain and normal non-invasive

study, and in patients with normal Coronary Angiogram. This indicates that CardioMap is able to exclude the presence of Myocardial Ischemia.

Abnormal color mapping was seen in all patients with coronary risk factors, documented patient with coronary artery disease, previous MI and stent placement.

CardioMap should be considered as a risk stratification device.

Limitation

This is not a randomized study. This is observational information, however, a valid way to evaluate new technology.

Conclusion

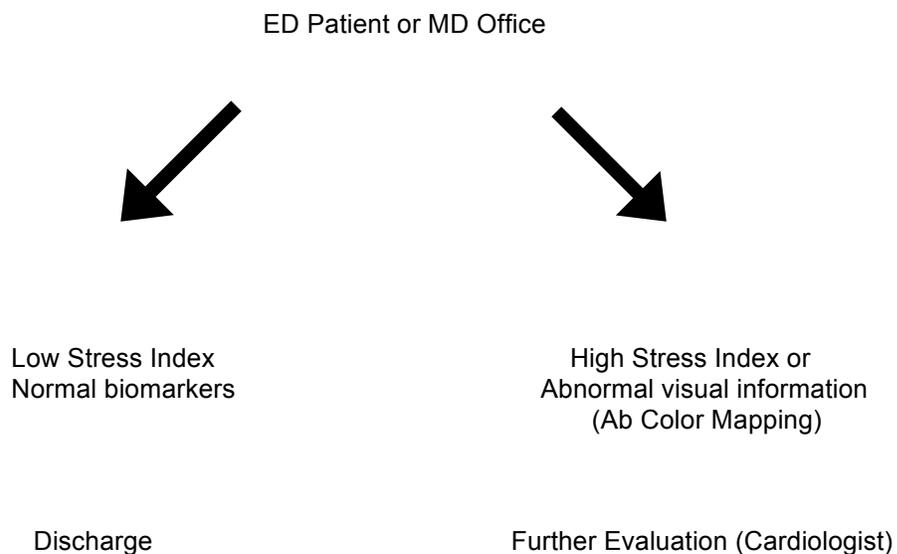
The early dispersion mapping used by CardioMap has a significant clinical application for the detection of normal heart muscle, detection of subclinical disease, Myocardial Ischemia and risk stratification for patients with coronary risk factor.

The information obtained by CardioMap is provided by a variety of ways:

1. Visual information (color mapping)
2. EKG information
3. Heart Stress Index
4. Location of changes

It is a very simple method which can be used for screening purposes. An algorithm can be implemented in patients present with CP symptoms in the Emergency Department, doctor's office and further risk stratification.

Chest Pain Syndrome



Stratification color mapping can be used for risk stratification

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