



MAYO CLINIC  
LABORATORIES

MI  
**HEART**  
CERAMIDES



# BE IN THE KNOW. **NOW.**

There is a **better way** to predict which patients are at the greatest risk and need immediate intervention for heart disease.

## WHAT IS MI-HEART CERAMIDES?

MI-HEART CERAMIDES is a blood test that measures the risk of coronary plaque rupture events by quantifying blood plasma levels of ceramides. Ceramides are clinically shown to be novel biomarkers of inflammation and dyslipidemia associated with unstable atherosclerotic plaque.

The MI-HEART CERAMIDES risk score is based on blood plasma levels of four unique ceramides and their ratios on a 12-point scale. The MI-HEART CERAMIDES risk score provides clear results classified as low, moderate, increased, or high risk as validated in several unique patient cohorts.<sup>1,2</sup>

## WHO SHOULD TAKE THE MI-HEART BLOOD TEST?

The MI-HEART CERAMIDES blood test is helpful for assessing a patient's risk of future plaque rupture. Multiple clinical studies have confirmed that MI-HEART CERAMIDES are significantly predictive in a variety of scenarios including:

- Established coronary artery disease<sup>3,4</sup>
- Primary prevention<sup>1,5,6</sup>
- Intermediate or undetermined atherosclerotic cardiovascular risk<sup>2,4</sup>

## THREE REASONS TO ORDER MI-HEART OVER OTHER BIOMARKER TESTS

### 1. Plasma ceramides predict risk of myocardial infarction within one to five years

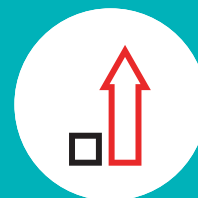
- Most scores predict 10-year of lifetime cardiovascular risk
- One year outcomes among patients with established coronary artery disease<sup>7</sup>
- Three to five years for patients with intermediate risk<sup>2,4</sup>

### 2. Risk conferred by plasma ceramides is independent of other biomarkers, including:

- LDL cholesterol
- HDL cholesterol
- High sensitivity C-reactive protein
- LpPLA2
- Apolipoprotein B

### 3. Plasma ceramides are treatable and modifiable by:

- Statin therapy<sup>7,8</sup>
- PCSK9-inhibitors<sup>9,10</sup>
- Aerobic exercise training<sup>11</sup>
- Mediterranean diets<sup>5</sup>



Ceramide risk scoring outperforms cholesterol testing.



Ceramides are independent from traditional biomarkers.

## BIOMARKER OVERVIEW

Plasma ceramides are lipids carried by plasma lipoproteins. Ceramides are made of a fatty acid and a sphingosine and play a central role in cellular stress response, inflammatory signaling, and apoptosis.

Ceramide synthesis from saturated fats and sphingosine occurs in all tissues. Ceramides accumulate in plasma and tissues during inflammation, metabolic dysfunction, and dyslipidemia. The following ceramides are highly linked to cardiovascular disease inflammation and diabetes: Cer(16:0), Cer(18:0), and Cer(24:1).

## PREDICTING RISK

Plasma ceramides predict adverse cardiovascular events resulting from unstable atherosclerotic plaque. Patients with coronary artery disease (CAD), insulin resistance, and type 2 diabetes mellitus have increased levels of ceramides.

Risk conferred by ceramides is independent of age, sex, smoking status, and family and personal history of CAD. Elevated plasma ceramide concentrations are risk factors for:

- Myocardial infarction<sup>4,7</sup>
- Emergency coronary revascularizations<sup>2</sup>
- Acute coronary syndrome hospitalizations<sup>3</sup>
- Cardiovascular mortality<sup>1</sup>

## A DEEPER DIVE INTO THE RISK SCORE

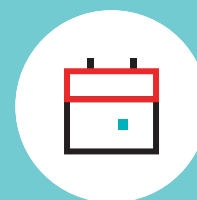
The MI-HEART CERAMIDES risk score is a 12-point scale that predicts the risk of major adverse cardiovascular events from three predictive plasma ceramides and their ratios to a fourth ceramide. The risk score adds one or two points for each result above the median or the third quartile.

The MI-HEART CERAMIDES risk score has been validated in five independent large observational studies. Patients with a score of 10–12 had a four- to six-fold increase in risk of events compared to patients with a score of less than two points.<sup>1,2,4</sup>

MEASURED VALUE	< 50 <sup>th</sup> PERCENTILE	50 <sup>th</sup> –75 <sup>th</sup> PERCENTILE	> 75 <sup>th</sup> PERCENTILE
Cer(16:0)			
Cer(18:0)			
Cer(24:1)	<b>0 Points</b>	<b>+1 Point</b>	<b>+2 Points</b>
Cer(16:0)/Cer(24:0)			
Cer(18:0)/Cer(24:0)			
Cer(24:1)/Cer(24:0)			



MI-HEART CERAMIDES predicts cardiovascular events within one year among patients with established CAD.



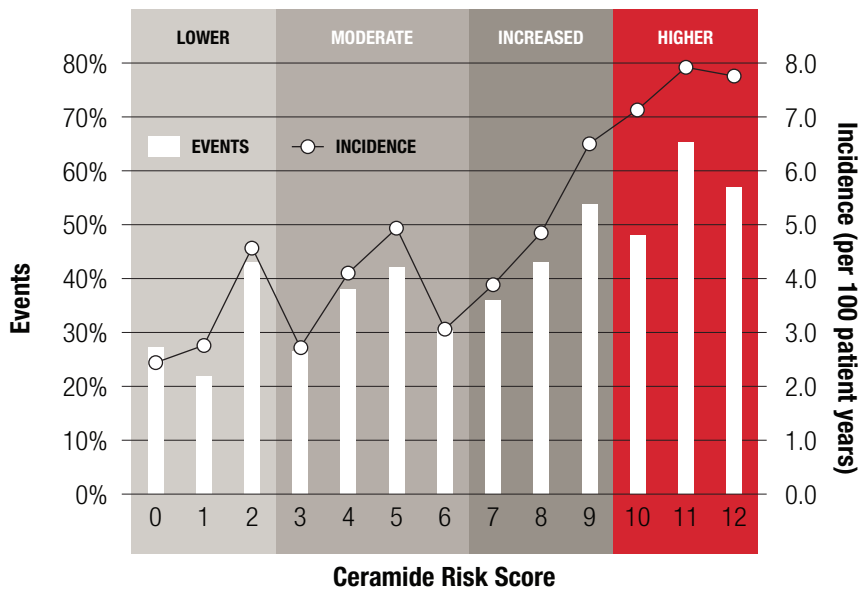
MI-HEART CERAMIDES predicts cardiovascular events within three to five years among patients with suspected CAD.

# RESEARCH DEMONSTRATES THE EFFECTIVENESS OF RISK SCORING

Numerous published clinical studies about the effectiveness of the MI-HEART CERAMIDES risk score demonstrate that:

- Major adverse cardiovascular events increase with the ceramide score.
- Plasma ceramides significantly decrease within three months of aerobic exercise training.<sup>11</sup>
- Patients with elevated ceramide scores benefit from Mediterranean diets.<sup>5</sup>

## EVENTS INCREASE WITH CERAMIDE SCORE



## TAP INTO THE EXPERTISE OF MAYO CLINIC

Focused on acute-care cardiology, risk stratification, and genomics, the Cardiovascular Laboratory Medicine Group within Mayo Clinic works to develop, validate, and use analytics to predict risk for primary and secondary prevention.

### CARDIOLOGISTS



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## FOR MORE INFORMATION ABOUT MI-HEART CERAMIDES

[mayocliniclabs.com/ceramides-miheart](http://mayocliniclabs.com/ceramides-miheart)

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