BIOCHEMICAL MARKERS OF MYOCARDIAL INJURY

Current Views

Introduction:

The ideal biochemical marker of myocardial injury complies with the following requirements:

- It is specific for myocardial damage.
- It is sensitive, thus allowing early diagnosis.
- It can assess reperfusion after thrombolytic therapy.
- It detects reinfarction, as well as peri-operative infarction.
- It can determine infarct size.
- It can detect minor myocardial damage and indicate prognosis.

The new generation markers currently available offer superior diagnostic reliability compared to the older traditional markers (e.g. CK, AST, LDH).

A. Detection of acute myocardial infarction (AMI)

Up to 50% of patients have non-diagnostic ECG changes.

Serum Myoglobin (s-Mb)

The haem protein s-Mb is present in myocardial and skeletal muscle, and is cleared partially by the kidneys. It starts increasing within 1 to 2 hours after AMI and reaches peak values of 10 to 15 times the upper reference limit (URL) within 4 to 12 hours. Levels of s-Mb become normal within 16 hours.

An initial increased value must be followed up with a cardio-specific marker after 2 to 3 hours, or by a second s-Mb determination. A rapidly increasing s-Mb value indicates AMI, if confirmed with a cardio-specific marker.

Other non-specific causes of increased s-Mb values include significant skeletal muscle damage and renal failure.

Serum CK MB-mass and Relative Index

CK Mb (CK-2) is the most cardio-specific iso-enzyme of CK (20% of myocardium CK and 2% of skeletal muscle CK). It starts increasing within 3 to 4 hours after AMI, reaches peak values of 20 times the URL at 24 hours, and becomes normal after 2 to 3 days.

A CK Mb relative index greater than 5% (with an increased CK) indicates cardiac damage rather than skeletal muscle damage. Non-specific causes of increased CK Mb values include inter alia severe skeletal muscle damage.

Serum Troponins (T and I)

Components of cardiac muscle myofibril complex and current methods of determination
show a high degree of cardiac specificity.

Both markers start to increase 4 hours after AMI, reach peak values of 20 to 30 times URL at 24 to 48 hours, and become normal again after 7 days – serum troponin I (TnI) to 10 days – serum troponin T (TnT). TnT may show slightly increased values in muscular dystrophy, polymyositis and chronic renal disease. Only TnT is currently available as a rapid semi-quantitative test and the result is directly comparable with the quantitative TnT.

B. Detection of minor myocardial injury

This includes other forms of ischaemic heart disease (stable and unstable angina), peri-operative/post-operative cardiac injury and cardiac contusion.

Serum Troponins (Tand I)

In a patient with unstable angina, an increased troponin level - especially with increasing values within the first 24 hours - indicates an increased risk for AMI within 30 days. Thirty percent of patients with unstable angina have increasing troponin levels, and 30% of this subgroup have an adverse prognosis.

Troponin determinations show superior sensitivity to detect peri/post-operative myocardial injury (MI) and cardiac contusion.

C. Monitoring of reperfusion following thrombolytic therapy

In general, successful reperfusion is characterised by the earlier appearance of and higher peak values of cardiac markers.

Serum Troponins (Tand I)

Since the concentrations of these markers are very low or undetectable in individuals without myocardial damage, these measurements have superior diagnostic reliability for assessing reperfusion. Troponin shows peak values of up to 200 times the URL within 24 hours after successful reperfusion.

Summary

1. Serum Myoglobin
   The only marker currently available for the early detection of AMI (within two hours).

2. Serum CK MB mass
   Still the most used and widely available laboratory test for diagnosing AMI.

3. Serum Troponins (Tand I)
   Highly cardio-specific markers that remain increased for up to 10 days, and also offer superior prognostic and monitoring value.
Suggested flow diagram for the effective use of cardiac markers