RapidCardiac Panel Test is an immunochromatography based one step in vitro test. It is designed for qualitative determination of cardiac troponin I (cTnI), CK-MB and Myoglobin in human serum specimens as an aid in the diagnosis of myocardial infarction.

SUMMARY AND EXPLANATION
Cardiac troponin I (cTnI) is a cardiac muscle protein with a molecular weight of 22.5 kilodaltons. Together with troponin T (TnT) and troponin C (TnC), TnI forms a troponin complex in heart to play a fundamental role in the transmission of intracellular calcium signal actin-myosin interaction. The human cTnI has an additional amino acid residues on its N-terminal that are not exist on the skeletal forms thus making cTnI a specific marker for indicating cardiac infarction. cTnI is released rapidly into blood after the onset of acute myocardial infarction (AMI). Its release pattern is similar to CK-MB (4-6 hours after the onset of AMI). However, CK-MB level returns to normal after 36-48 hours, while levels of cTnI remains elevated for up to 6-10 days. The level of cTnI is very low in normal healthy people, and not detected in patients with skeletal muscle injury. Therefore, cTnI is a specific marker for diagnosis of acute myocardial infarction.

Creatine kinase is a dimer occurring in various in three isoenzymic forms, depending on the particular combination of its non-identical subunits.BB (brain type), MM (skeletal type), and MB (hybrid type). Creatine kinase-MB isoenzyme is released into circulation later than myoglobin, reaching abnormal levels within 4 to 6 hours after onset of symptoms. It reaches its highest level with a typical range of 39-185 ng/mL after about 18 to 24 hours, and returns to normal in about 2 to 3 days. CK-MB is widely recognized as the traditional marker for the diagnosis of AMI.

Myoglobin is a low molecular weight, cytoplasmic serum protein. Due to its low molecular weight, myoglobin is released more rapidly when muscle cells are damaged than other markers. Serum concentration of myoglobin increases above the normal range as early as 1 hour after myocardial infarction, and peak in approximately 4 to 8 hours after onset. Therefore, myoglobin is better suited for the early diagnosis of AMI.

RapidCardiac Panel test is a sandwich immunoassay. When serum sample is added to sample pad, it moves through the conjugate pad and mobilizes gold antibody conjugate that is coated on the conjugate pad. The mixture moves along the membrane by capillary action and reacts with anti-cardiac marker antibodies that is coated on the test region. If cardiac markers are present at levels of cut-off level or greater, the result is the formation of a colored band in the test region. If there are no cardiac markers in the sample, the area will remain colorless. The sample is valid.

Below are the cut-off concentrations for each cardiac marker using in the test.

<table>
<thead>
<tr>
<th>Troponin I</th>
<th>1.5 ng/mL  (Abbott AxSYM)*</th>
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</thead>
<tbody>
<tr>
<td>CK-MB</td>
<td>7.0 ng/mL  (Abbott AxSYM)</td>
</tr>
<tr>
<td>Myoglobin</td>
<td>100 ng/mL  (Abbott AxSYM)</td>
</tr>
</tbody>
</table>

*The concentration of Troponin I is not standardized yet. The results from different assay system may vary significantly. Here is the summary of the sensitivity of Rapid Troponin I Test Card on the major assay systems.

<table>
<thead>
<tr>
<th>Assay System</th>
<th>Troponin I Concentration (ng/mL)</th>
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</thead>
<tbody>
<tr>
<td>Bayer ACS:180</td>
<td>0.11</td>
</tr>
<tr>
<td>Abbott AxSYM</td>
<td>1.50</td>
</tr>
<tr>
<td>Bayer ADVIA Centaur</td>
<td>0.18</td>
</tr>
<tr>
<td>Beckmen Access AccuTn</td>
<td>0.14</td>
</tr>
<tr>
<td>Dade Dimension</td>
<td>0.87</td>
</tr>
<tr>
<td>Dade Stratus</td>
<td>0.48</td>
</tr>
</tbody>
</table>

Note: Please deliver sample drop by drop to ensure the best performance.

INTERPRETATION OF RESULTS

Positive:
If two colored bands are visible on any strip of the device within 15 minutes, the test result is positive and valid. The test result can be read as soon as a distinct colored band appears in the test area.

1. If test area has no color band and the control area displays a colored band, the result is negative and valid.
2. If a colored band does not form in the control region of any strip, the test result is invalid. The sample must be re-tested, using a new test device.

Bayer ACS:180 0.11
Beckmen Access AccuTn 0.14
Dade Dimension 0.87
Dade Stratus 0.48

a) MYG-positive/CKMB-positive/TnI-positive
(MYO < 100 ng/mL, CK-MB < 7.0 ng/mL, Tn I ≥ 1.5ng/mL) Myocardial cell necrosis within the past 12 hours.
b) MYG-positive/CKMB-positive/TnI-negative
(MYO < 100 ng/mL, CK-MB < 7.0 ng/mL, Tn I < 1.5ng/mL) Early muscle or cardiac injury. Serial Troponin I testing is suggested in 4 & 8 hrs to rule in acute coronary syndrome.
c) MYG-negative/CKMB-positive/TnI-positive
(MYO < 100 ng/mL, CK-MB < 7.0 ng/mL, Tn I ≥ 1.5ng/mL) Early muscle or cardiac injury. Serial Troponin I testing is suggested in 4 & 8 hrs to rule in acute coronary syndrome.
d) MYG-negative/CKMB-positive/TnI-negative
(MYO < 100 ng/mL, CK-MB < 7.0 ng/mL, Tn I < 1.5ng/mL) Acute myocardial infarction post 12 hours from the onset of early symptoms.
e) MYG-negative/CKMB-negative/TnI-positive
(MYO < 100 ng/mL, CK-MB < 7.5 ng/mL, Tn I ≥ 1.5ng/mL) Acute myocardial infarction post 24-96 hours.
f) MYG-positive/CKMB-negative/TnI-negative
(MYO ≥ 100 ng/mL, CK-MB < 7.5 ng/mL, Tn I < 1.5ng/mL)
Early muscle or cardiac injury. Serial Troponin I testing is suggested in 4 & 8 hrs to rule in acute coronary syndrome. (MYO ≥ 100 ng/mL, CK-MB < 7.5 ng/mL, Tn I < 1.5ng/mL).

g) MYG-positive/CKMB-negative/TnI-positive
(MYO ≤ 100 ng/mL, CK-MB < 7.5 ng/mL, Tn I ≥ 1.5ng/mL)
A very possible myocardial cell necrosis

h) MYG-negative/CKMB-negative/TnI-negative
(MYO < 100 ng/mL, CK-MB < 7.5 ng/mL, Tn I < 1.5 ng/mL)
Acute myocardial infarction may not happen. If the cardiac injury is suspected, retest in 2 - 4 hours.

LIMITATIONS OF THE PROCEDURE
1. The test result should be used in conjunction with other clinical information such as clinical signs and symptoms and other test results to diagnose AMI. A negative result obtained from a patient whose sample was taken at 3-20 hours after the onset of chest pain may help in ruling out AMI. A positive result from a patient suspected of AMI may be used as a rule-in test and requires further confirmation. Serial sampling of patients suspected of AMI is also recommended due to the delay between the onset of symptoms and the release of the cardiac markers in to the bloodstream.

2. A number of conditions, other than myocardiac infarction, including polymyositis, dermatomyositis, systemic lupus erythematosus, shock, severe renal failure, or muscle damage caused by trauma, ischemia and inflammation, can cause elevated levels of myoglobin. These conditions should be considered with appropriate clinical evidence. Recent cardioversion or an anginal episode may increase myoglobin level. Testing 12 hours or later after onset of myocardial infarction can produce misleading results, because serum levels may already have returned to normal range.

3. RapidCardiac Panel test only provides qualitative result. A quantitative assay method must be used to determine the concentrations of each marker.

4. As with all diagnostic tests, a definitive clinical diagnosis should not be based on the result of a single test, but should only be made by the physician after all clinical and laboratory findings have been evaluated.

EXPECTED VALUES
RapidCardiac Panel is designed to yield a positive result for the concentrations of cTnI of cTnI of 0.11 ng/mL at Bayer ACS:180 or 1.5 ng/mL at Abbott AxSYM or greater, CK-MB at 7 ng/mL or greater and myoglobin at 100 ng/mL or greater. The time required for blood cTnI level to reach the upper limit of normal has been found to be 4-6 hours after the onset of symptoms. cTnI level reaches the maximum concentration after 12-24 hours of the onset, and then remains elevated for 6-10 days in some cases. Therefore, a negative result within the first hours of the onset of symptoms does not rule out AMI with certainty. If suspected, repeat the test at appropriate intervals.

The time required for blood CK-MB level to reach the upper limit of normal has been found to be 4-6 hours after the onset of symptoms. CK-MB level reaches the maximum concentration after 18-24 hours of the onset, and then remains elevated for 2-3 days in some cases. Therefore, a negative result within the first 4 hours of the onset of symptoms does not rule out AMI with certainty. If suspected, repeat the test at appropriate intervals.

Normal serum myoglobin levels range from 30 to 90 ng/mL. After 1 hour of the onset of myocardial infarction, serum myoglobin level can elevate to 200 ng/mL or even higher. During the peak hour, myoglobin level can be as high as 900 ng/mL. The level of myoglobin usually returns to normal 12 hours after the onset of the myocardial infarction. Elevated myoglobin level has also been observed in patients with other diseases as mentioned in LIMITATIONS OF THE PROCEDURE.

PERFORMANCE CHARACTERISTICS
Sensitivity:
RapidCardiac Panel test can detect cTnI in serum with concentration of cTnI of 0.11 ng/mL at Bayer ACS:180 or 1.5 ng/mL at Abbott AxSYM or greater, CK-MB at 7.0 ng/mL or greater and myoglobin at 100 ng/mL or greater.

Accuracy:
The accuracy of the RapidCardiac Panel test were evaluated in each component strips.

1. Troponin I

<table>
<thead>
<tr>
<th></th>
<th>Troponin I (Abbott AxSYM)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Negative (0 ng/mL)</td>
</tr>
<tr>
<td>Number of specimen</td>
<td>89</td>
</tr>
<tr>
<td>Negative</td>
<td>88</td>
</tr>
<tr>
<td>Positive</td>
<td>1</td>
</tr>
<tr>
<td>Specificity/Sensitivity</td>
<td>99.9%</td>
</tr>
</tbody>
</table>

REFERENCES