The Asia-Pacific Society of Cardiology (APSC) Expert Committee Consensus Recommendations for Assessment of Suspected Acute Coronary Syndrome Using High-Sensitivity Cardiac Troponin T in the Emergency Department

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The Asia-Pacific Society of Cardiology (APSC) high-sensitivity troponin T (hs-TnT) consensus recommendations and rapid algorithm were developed to provide guidance for healthcare professionals in the Asia-Pacific region on assessing patients with suspected acute coronary syndrome (ACS) using a hs-TnT assay. Experts from Asia-Pacific convened in 2 meetings to develop evidence-based consensus recommendations and an algorithm for appropriate use of the hs-TnT assay. The Expert Committee defined a cardiac troponin assay as a high-sensitivity assay if the total imprecision is ≤10% at the 99th percentile of the upper reference limit and measurable concentrations below the 99th percentile are attainable with an assay at a concentration value above the assay's limit of detection for at least 50% of healthy individuals. Recommendations for single-measurement rule-out/rule-in cutoff values, as well as for serial measurements, were also developed. The Expert Committee also adopted similar hs-TnT cutoff values for men and women, recommended serial hs-TnT measurements for special populations, and provided guidance on the use of point-of-care troponin T devices in individuals suspected of ACS. These recommendations should be used in conjunction with all available clinical evidence when making the diagnosis of ACS.

Key Words: Acute coronary syndrome; Asia-Pacific; Consensus recommendations; High-sensitivity troponin T

Acute coronary syndrome (ACS) is a leading cause of death in the Asia-Pacific region, accounting for half of the global burden of ACS. The in-hospital mortality rate of ACS in the region typically exceeds 5%, which is high compared with the West. The high impact of ACS could be attributed to heterogeneity in the management of ACS across the region, together with gaps in patient awareness and adherence to guidelines, low availability and access to advanced medical care, and poor continuity of care and medication adherence.
The Asia-Pacific Society of Cardiology (APSC) hs-TnT consensus recommendations and rapid algorithm were developed to provide guidance for healthcare professionals in the Asia-Pacific in assessing patients with suspected ACS presenting within 6 h of chest pain using hs-TnT assays in the ED setting.

**Consensus Process**

The Expert Committee included cardiologists, pathologists, and ED physicians from Australia, China, Germany, India, Indonesia, Japan, Malaysia, New Zealand, the Philippines, Singapore, South Korea, Taiwan, Thailand, United Arab Emirates, and Vietnam. Two expert consensus meetings were convened, wherein the Expert Committee reviewed the available evidence for hs-TnT assays related to the use of rapid algorithms for evaluating individuals with suspected ACS. Consensus recommendations were formed based on the available clinical evidence and the collective experience of the Expert Committee members. Each recommendation was assigned a strength of recommendation based on a 3-point scale (i.e., strong recommendation, SR; intermediate recommendation, IR; not recommended, NR) and a level of evidence based on an adaptation of the Levels of Evidence by the Oxford Centre for Evidence-based Medicine (Table 2).

### Table 1. Analytical Characteristics of Available Troponin T Assays

<table>
<thead>
<tr>
<th>Test</th>
<th>Level of detection (ng/L)</th>
<th>99th percentile (ng/L)</th>
<th>%CV at 99th percentile</th>
</tr>
</thead>
<tbody>
<tr>
<td>Roche cTnT-hs 18-min*</td>
<td>2.05 (specified value)</td>
<td>14</td>
<td>&lt;10%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4.72 (for the E411)</td>
<td></td>
</tr>
<tr>
<td>Roche cTnT-hs STAT*</td>
<td>2.85 (specified value)</td>
<td>14</td>
<td>&lt;10%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4.88 (for E411)</td>
<td></td>
</tr>
<tr>
<td>Roche TnT Gen 5 STAT*</td>
<td>3 (specified value)</td>
<td>19*</td>
<td>&lt;10%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5 (for E411)</td>
<td></td>
</tr>
<tr>
<td>Radiometer TnT (semi-quantitative)</td>
<td>8</td>
<td>17</td>
<td>15.2%</td>
</tr>
<tr>
<td>Roche POC TnT</td>
<td>40</td>
<td>Not available</td>
<td>Not available</td>
</tr>
</tbody>
</table>

*On Cobas E601, E602, E170, in the US label, based on a healthy reference population from the USA. CV, coefficient of variation; POC, point of care.

### Table 2. Levels of Evidence

<table>
<thead>
<tr>
<th>Strength</th>
<th>Level</th>
<th>Design</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>Level I</td>
<td>Systematic review (with homogeneity) of Level I studies; or a clinical decision rule with Level I studies from different clinical centres</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Validating cohort study with good reference standards; or clinical decision rule tested within one clinical centre</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Diagnostic findings whose specificity is so high that a positive result rules-in the diagnosis; a diagnostic finding whose sensitivity is so high that a negative result rules-out the diagnosis</td>
</tr>
<tr>
<td></td>
<td>Level II</td>
<td>Systematic review (with homogeneity) of Level &gt;II diagnostic studies</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Exploratory cohort study with good reference standards; clinical decision rule after derivation, or validated only on split-sample or databases</td>
</tr>
<tr>
<td></td>
<td>Level III</td>
<td>Systematic review (with homogeneity) of IIIb and better studies</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Non-consecutive study; or without consistently applied reference standards</td>
</tr>
<tr>
<td></td>
<td>Level IV</td>
<td>Case-control study, poor or non-independent reference standard</td>
</tr>
<tr>
<td></td>
<td>Level V</td>
<td>Expert opinion without explicit critical appraisal, or based on physiology, bench research or “first principles”</td>
</tr>
</tbody>
</table>

The problem of prolonged stay and crowding in emergency departments (EDs) has also become pressing in Asia-Pacific countries. Rapid algorithms using high-sensitivity cardiac troponin (hs-cTn) assays to assess patients presenting with chest pain in the ED may aid in alleviating this problem. A global survey of medical centers showed that in the Asia-Pacific (i.e., Australia, China, India, and Japan), around 50% of centers are using hs-cTn assays – not far behind from Europe (60%). Although the adoption rate for high-sensitivity assays is encouraging, access to these assays remains challenging in some resource-limited areas, with point-of-care (POC) assays often being used as alternatives, and thus commonly used.

There are several assays available, but they are not standardized because of the use of different antibodies to recognize different epitopes of TnI. Therefore, different cTnI assays have different reference limits and are not interchangeable. In contrast, the 3 hs-TnT assays are standardized and may be used interchangeably, and 2 POC TnT tests are also available. The analytical characteristics of these 5 tests are shown in Table 1.

Since 2011, the 0–3-h hs-cTn algorithm has generally become the reference standard for rapid disposition worldwide outside of the USA. However, the adoption of algorithms published by international or national professional bodies presents a challenge for many institutions in the Asia-Pacific because of barriers to accessing resources and reimbursement policies, among other limitations. Hence,
Consensus Recommendations

High-Sensitivity Troponin Assays

A cardiac troponin assay may be considered a high-sensitivity assay if the following 2 criteria are met:
• The total imprecision is ≤10% at the 99th percentile of the upper reference limit.
Strength of recommendation: SR; Level of evidence, V
• Measurable concentrations below the 99th percentile should be attainable with an assay at a concentration value above the assay’s LOD for at least 50% of healthy men and women.
Strength of recommendation: SR; Level of evidence, V

In 2012, the IFCC Task Force on Clinical Applications of Cardiac Biomarkers proposed that a high-sensitivity assay must meet 2 basic criteria: the total CV at the 99th percentile value should be ≤10% and that measurable concentrations below the 99th percentile should be attainable with an assay at a concentration value above the assay’s level of detection (LOD) for at least 50% of healthy men and women. These criteria have since been widely accepted. The Expert Committee was also in agreement that this set of criteria be used in the Asia-Pacific region.

Definitions of Patient Dispositions Used in the Algorithm
For the purposes of this consensus, the following terms are defined as follows.
• Rule-in: The individual has very high troponin concentrations, or high elevation together with a relevant rise of concentration, indicating acute myocardial injury and a high probability of acute myocardial infarction (AMI).
• Observe: The individual has moderately elevated troponin concentration, but no relevant concentration change within the short sampling period, suggesting a chronic myocardial injury. Additional investigations including serial troponin measurements are required to determine the individual’s probability of acute myocardial injury and/or AMI.
• Rule-out: The individual has very low troponin concentration, or low troponin concentration together with small concentration change, rendering myocardial injury unlikely. However, the diagnosis of significant coronary artery disease (CAD) cannot be excluded. These terms for patient disposition provide general recommendations to guide patient management and assessment of an individual’s risk of acute myocardial injury. The Fourth Universal Definition of Myocardial Infarction requires a rise and/or fall and concomitant objective evidence of myocardial ischemia. In addition to troponin measurements, the diagnosis of ACS involves assessment of the patient’s history, clinical presentation, and other diagnostic modalities.

Recommendations

Serial troponin measurements in patients with suspected ACS are preferable and recommended in international
guidelines. However, a single measurement for rule-in/rule-out may be used under certain circumstances. This strategy may help reduce unnecessary prolonged hospital stay for patients with low probability of myocardial injury and unnecessary costs to the patient in settings where serial testing is not reimbursed or prohibitively expensive, as in the case in several centers in the Asia-Pacific region. Both strategies were included into the rapid disposition hs-TnT algorithm (Figure).

**Rule-Out Recommendations**

- An initial hs-TnT \(<5\text{ng/L}\) may rule-out acute myocardial injury.

**Strength of recommendation: SR; Level of evidence, I**

- An initial hs-TnT \(<12\text{ng/L}\) at 0 h and an increase of \(<3\text{ng/L}\) after 1–3 h may rule-out acute myocardial injury.

**Strength of recommendation: SR; Level of evidence, I**

- Consider careful clinical assessment and/or the use of a risk score validated in ACS alongside hs-TnT values to inform the decision of whether to discharge an individual and/or follow-up in the outpatient setting.

**Strength of recommendation: SR; Level of evidence, V**

An individual with chest pain or other symptoms of ACS for at least 3 h and a very low hs-TnT concentration at presentation (i.e., defined as levels below the LOD of the assay) can be included in the rule-out group for having a low probability of acute myocardial injury. For the currently available hs-TnT assay, the lower LOD (using Cobas e411) is 5 ng/L, which has been adopted as the rule-out cutoff for these recommendations.

The single-measurement strategy using a low cutoff has been validated for hs-TnT assays to have a negative predictive value (NPV) between 94% and 99.6% for AMI, whereas a higher cutoff tended to have significantly lower NPV that led to ACS patients being missed. A meta-analysis showed that the use of a cutoff value of 5ng/L had a pooled sensitivity of 98.7% (95% confidence interval (CI) 96.6%, 99.5%). In contrast, at 14ng/L, the summary sensitivity was 89.5% (95% CI 86.3%, 92.1%). Hence, the Expert Committee decided to use 5ng/L (LOD, CV <20%) instead of 14ng/L as the single-measurement rule-out cutoff to minimize the likelihood of missing a patient with ACS. At this cutoff, a single measurement of \(<5\text{ng/L}\) ruled out ACS in 16% of patients, and none of these patients were eventually diagnosed with non-ST-segment elevation MI (NSTEMI). Importantly, among patients with no ischemic ECG changes, the NPV for the 30-day rate of AMI from a single-measurement hs-TnT \(<5\text{ng/L}\) was 99.8% (95% CI 99.7%, 99.9%) while the NPV for death was 100% (95% CI 99.9%, 100%). Preliminary data from an ongoing study also showed that this cutoff ruled out ACS in 106 patients and further follow-up showed none of the patients were eventually diagnosed with AMI (Inoue K, personal communication).

The diagnosis of significant obstructive CAD cannot be excluded in individuals with values \(<5\text{ng/L}\), and late increases in cardiac troponin have been reported in rare cases. Hence, serial measurements should be performed if the clinical suspicion remains high or whenever the patient develops recurrent chest pain. Furthermore, a single measurement rule-out strategy should not be used in patients who present \(<3\text{h}\) after symptom onset (i.e., early presenters), and a second measurement should be taken at 3 h or later after the onset of symptoms because of the time dependency of troponin release. A prospective study involving 4,368 patients with serial hs-TnT measurements, 30% of whom were early presenters, reported that serial measurements had an NPV (safety of rule-out) of 99.8%, with a positive predictive value (PPV; accuracy of rule-in) of 74.5%. Overall efficacy was high by assigning three-quarters of patients either to rule-out (57%) or rule-in (18%). Similarly, a recent prospective randomized comparison of a 0–1-h and 0–3-h protocols has confirmed a 30-day death or AMI rate of 0.4% among these receiving a rule-out recommendation with a NPV of 99.6% for those directly discharged from the ED.

An individual with chest pain and a hs-TnT concentration of 5–52 or 70ng/L would require a second hs-TnT measurement after 1–3 h in order to assess the presence of a rising or falling pattern that defines acute myocardial injury. Every effort should be made to aim for 1 h, but this consensus acknowledges that this may not be possible in many centers in the region.

The NPV for ACS with a single sample hs-TnT decreases considerably at values above the assay’s LOD; therefore, serial sampling is required for individuals with hs-TnT values of \(\geq5\text{ng/L}\) at presentation. A second measurement of \(<12\text{ng/L}\) and a dynamic change of \(<3\text{ng/L}\) may be classified in the rule-out group. An Asian validation study of this criterion had a NPV of 100% (95% CI 96.8%, 100%) and a sensitivity of 100% (95% CI 88.0%, 100%). This is supported by a larger randomized study, also using 12ng/L, again suggesting a very high NPV at this level. Furthermore, the 30-day mortality rate and 30-day rate of major adverse cardiac events (MACE) were both 0%. Approximately 40% of patients could be classified using this approach.

Individuals stratified to the rule-out group using the rapid disposition hs-TnT algorithm should be carefully assessed clinically, which may include the use of a risk score validated in ACS, used alongside hs-TnT values, to inform decisions on possible discharge or further assessments on an outpatient basis. Serious non-cardiac causes of chest pain should also be considered before discharge.

**Rule-in Recommendations**

- An initial hs-TnT \(>70\text{ng/L}\) may rule-in acute myocardial damage.

**Strength of recommendation: IR; Level of evidence, III**

- An initial hs-TnT of 5–70ng/L with an increase of \(\geq5\text{ng/L}\) at 1–3 h may rule-in acute myocardial damage.

**Strength of recommendation: IR; Level of evidence, III**

- Consider early coronary angiography for individuals stratified to the rule-in group.

**Strength of recommendation: SR; Level of evidence, I**

*A cutoff of 52ng/L may be used in highly specialized centers with readily available CT coronary angiography and catheterization facilities and/or higher prevalence of AMI in the ED.*

An individual with chest pain and a very high hs-TnT concentration at presentation can be stratified into the rule-in group and other evidence of coronary ischemia should be pursued in an attempt to make the diagnosis of AMI. However, the Expert Committee did not achieve full consensus on the most appropriate rule-in cutoff for the
A number of experts agreed to align with the cutoff of the European Society of Cardiology (52 ng/L), as this has been prospectively validated with a PPV of 77–84%. Therefore, this cutoff may be adopted by highly specialized centers in the Asia-Pacific where several options for selecting the next appropriate coronary investigation are available (e.g., readily available CT coronary angiography and catheterization facilities) and/or higher prevalence of AMI in the ED.

However, a cutoff at 52 ng/L alone is infrequently used as a decision point for management to expedite early coronary angiography. A majority of the Expert Committee recommended early coronary angiography using higher cutoffs as the pretest probability for an AMI rises with increasing cardiac troponin concentrations. Furthermore, the relatively low availability of cardiac catheterization in the region favors a higher cutoff. As various publications have defined very high cardiac troponin concentrations as >5-fold the upper limit of normal, and with the currently available hs-TnT assay having an upper limit of normal value of 14 ng/L, the rule-in cutoff adopted was 70 ng/L, considered to improve the PPV for AMI with the rule-in recommendation. This cutoff is considered appropriate in most centers in Asia where limited catheterization capacities or reimbursement issues prevent early catheterization in the majority of patients. Preliminary data from ongoing studies in the region report that this absolute cutoff, used in conjunction with dynamic changes for patients below the cutoff, results in a rule-in efficacy of 22% compared with 23% using the ESC 0 h/01 h algorithm (Inoue K, personal communication). Furthermore, a Troponin T Evaluation of kidney function, other cardiac and non-cardiac causes of myocardial injury. Echocardiography, other cardiac imaging modalities, and stress imaging are suitable diagnostic options for these patients. Other investigations include evaluation of kidney function, other cardiac and non-cardiac causes of myocardial injury, as well as the measurement of other cardiac biomarkers.

Functional tests help to differentiate ischemia-causing coronary lesions from bystander coronary lesions that are independent of the acute chest pain episode leading to ED presentation. Coronary CT angiography may be reserved for those with low to intermediate likelihood of NSTEMI. Coronary angiography, if feasible, may also be considered for those clinically evaluated as having a high likelihood of NSTEMI.

The rapid disposition hs-TnT algorithm provides general recommendations for assessing an individual’s risk of acute myocardial injury and should not be used as the sole diagnostic tool. It should be used in conjunction with all available clinical information, including details of the patient’s history, clinical presentation, ECG and the use of validated cardiac risk scores to establish the diagnosis of MI and estimate the risk of subsequent cardiac events. The treating physician’s clinical judgement remains paramount.

**Sex-Specific and Special Population Cutoff Values (Recommendations)**

- The hs-TnT cutoff values may be applied to both men and women, with no requirement for sex-specific cutoff values recommended in the algorithm.

**Strength of recommendation: SR; Level of evidence, I**

- No specific hs-TnT cutoff values are recommended for special populations with a moderate-to-high risk of cardiovascular disease in the algorithm. Instead, serial hs-TnT measurements are recommended for these individuals.

**Strength of recommendation: SR; Level of evidence, I**

- An initial hs-TnT of 5–70 ng/L requires subsequent hs-TnT testing at 1–3 h to determine the probability of acute myocardial injury, including a subsequent hs-TnT test at 1–3 h.
**Table 3. Summary of Recommendations**

<table>
<thead>
<tr>
<th>Rule-out recommendations</th>
<th>Strength of recommendation</th>
<th>Level of evidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>An initial hs-TnT &lt;5 ng/L may rule-out acute myocardial injury</td>
<td>SR</td>
<td>I</td>
</tr>
<tr>
<td>An initial hs-TnT &lt;12 ng/L at 0 h and an increase of &lt;3 ng/L after 1–3 h may rule-out acute myocardial injury</td>
<td>SR</td>
<td>I</td>
</tr>
<tr>
<td>Consider early coronary angiography for individuals stratified to the rule-in group</td>
<td>SR</td>
<td>I</td>
</tr>
<tr>
<td><strong>Rule-in recommendations</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>An initial hs-TnT &gt;70 ng/L may rule-in acute myocardial damage</td>
<td>IR</td>
<td>III</td>
</tr>
<tr>
<td>An initial hs-TnT of 5–70 ng/L with an increase of ≥5 ng/L at 1–3 h may rule-in acute myocardial damage</td>
<td>IR</td>
<td>III</td>
</tr>
<tr>
<td>Consider early coronary angiography for individuals stratified to the rule-in group</td>
<td>SR</td>
<td>I</td>
</tr>
<tr>
<td><strong>Observe recommendations</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>An initial hs-TnT of 5–70 ng/L requires subsequent hs-TnT testing at 1–3 h to determine the probability of acute myocardial injury, including a subsequent hs-TnT test at 1–3 h</td>
<td>SR</td>
<td>V</td>
</tr>
<tr>
<td>Among these patients, an increase in hs-TnT of 3 to &lt;5 ng/L at 1–3 h indicates a need for further observation and examination to determine the probability of acute myocardial injury</td>
<td>SR</td>
<td>V</td>
</tr>
<tr>
<td><strong>Recommendations for sex-specific and special populations cutoff values</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The hs-TnT cutoff values may be applied to both male and female individuals, with no requirement for sex-specific cutoff values recommended in the algorithm</td>
<td>IR</td>
<td>I</td>
</tr>
<tr>
<td>No specific hs-TnT cutoff values are recommended for special populations with a moderate-to-high risk of cardiovascular disease in the algorithm. Instead, serial hs-TnT measurements are recommended for these individuals</td>
<td>SR</td>
<td>I</td>
</tr>
<tr>
<td><strong>POC troponin assay recommendations</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The majority of the POC assays commercially available at present cannot be considered high-sensitivity assays</td>
<td>SR</td>
<td>I</td>
</tr>
<tr>
<td>POC troponin assays have not been cleared and should not be used in isolation to rule-out acute myocardial injury</td>
<td>NR</td>
<td>I</td>
</tr>
<tr>
<td>POC troponin assays that have received a label may be used to rule-in potential myocardial injury and to inform decision-making on follow-up examinations with high-sensitivity testing</td>
<td>SR</td>
<td>I</td>
</tr>
</tbody>
</table>

*A cutoff of 52 ng/L may be used in highly specialized centers with readily available CT coronary angiography and catheterization facilities and/or higher prevalence of acute myocardial infarction (AMI) in the emergency department (ED). AGS, acute coronary syndrome; POC, point of care.

**Cutoff Values by Sex**

Because of the physiological variations between men and women, such as cardiac mass and cell turnover, the 99th percentile for troponin concentrations in healthy populations differs between the sexes.\(^7\)\(^8\)\(^9\)\(^10\) Hence, the IFCC and the Fourth Universal Definition of Myocardial Infarction recommend the use of sex-specific cutoffs for hs-Tn assays.\(^7\)\(^8\)\(^9\)\(^10\) However, some guidelines do not espouse this recommendation.\(^7\) Studies have shown that women presenting with suspected ACS are generally 5–8 years older than their male counterparts.\(^13\)\(^26\)\(^27\) This higher age, which is associated with higher TnT levels, seems to be able to compensate for the lower TnT observed in women compared with similarly aged men. Hence, the use of sex-specific cutoff levels results in only a negligible number of patients being reclassified compared with the use of a single cutoff level for men and women, given the current cutoffs adopted by this consensus. Other studies have also shown that any reclassifications that resulted from the use of sex-specific hs-TnT measurements did not lead to significant improvements in clinical outcomes.\(^26\)\(^27\)

Finally, this algorithm states that patients, whether male or female, with a hs-TnT value of ≥5 ng/L (vs. the 9 ng/L cutoff advocated to improve detection of ACS in women)\(^28\) would, at least, be further evaluated for ACS. This approach has been validated for both sexes in prospective cohorts.\(^19\)\(^20\) Hence, the panel agreed that a unified cutoff is safe to use and will eliminate confusion with the application of various cutoff values that may have negligible impact.

Nevertheless, it should be mentioned that some studies using more conservative single-measure thresholds (i.e., 14 and 50 ng/L) resulted in significant reclassifications in women,\(^13\)\(^29\) although the long-term impact of this reclassification is unclear.

**Cutoff Values for Elderly Individuals**

No specific cutoff is recommended for elderly individuals, and the use of a single measurement to rule-out/rule-in ACS in elderly individuals is not recommended. This is because elderly individuals often suffer from different chronic comorbidities known to increase hs-TnT, and a single measurement has significantly reduced diagnostic accuracy in this subset of patients. In a subset analysis of data from 406 patients aged ≥70 years presenting with symptoms of ACS, a single hs-TnT measurement had a specificity of 1% (95% CI 0%, 3%) with a 5 ng/L cutoff and 49% (95% CI 44%, 55%) with a 14 ng/L cutoff.\(^30\)

Instead, serial measurements are recommended for differentiating acute from chronic hs-TnT changes, even in these patients with a higher background hs-TnT. Accuracy is significantly improved with the use of serial measurements,\(^30\) and the absolute hs-cTn changes during serial sampling do not differ between elderly and non-elderly NSTEMI patients.\(^23\)
**Cutoff Values for Patients With Renal Impairment**

Among individuals with renal dysfunction without ACS, elevations in cardiac troponin levels above the 99th percentile can be observed in up to 40%, with the proportion increasing with worsening renal function.\(^{10,31,32}\) The elevation of troponin in renal disease is not the result of impaired renal clearance, but is directly caused by myocardial injury resulting from uremia and indirectly from increased ventricular pressure, hypotension, obstruction of coronary microvasculature and anaemia.\(^{33,34}\)

Given the elevated baseline TnT of patients with renal impairment, the specificity of hs-TnT to detect ACS may potentially be reduced, though the NPV of these algorithms in those classified as rule-out remains high. There is currently sparse evidence to confidently set hard alternative cutoffs for patients with renal dysfunction and further insufficient evidence regarding the impact of hs-TnT decision algorithms on prognosis. Multiple hs-TnT measurements are recommended for these high-risk patients, together with referral to the Cardiology Department.

A subgroup analysis of the Advantageous Predictors of Acute Coronary Syndrome Evaluation (APACE) study among patients with renal dysfunction reported a higher prevalence of NSTEMI in patients with renal dysfunction (31% vs. 13%, \(P<0.001\)). Using hs-TnT, the 0h/1h algorithm ruled out a lower proportion of patients (18% vs. 68%), but detected all patients with NSTEMI (Sensitivity 100.0% [95% CI 97.6%, 100.0%]).\(^{34}\) The algorithm classified more patients into the observe group (49% vs. 19%), and the efficacy of rule-in was higher in those with renal dysfunction (33% vs. 13%). The diagnostic performance of hs-TnT at 0h (area under the receiver-operating characteristics curve) was 0.86–0.87, and this increased to 0.88–0.92 after the second measurement at 1 h. These findings support the use of serial measurements in patients with renal dysfunction.

**POC Troponin Assays (Recommendations)**

- **Strength of recommendation: SR; Level of evidence, I**
  - The majority of the POC assays commercially available at present cannot be considered high-sensitivity assays.

- **Strength of recommendation: NR; Level of evidence, I**
  - POC troponin assays have not been cleared and should not be used in isolation of other clinical information or validated risk tools to rule-out acute myocardial injury.

- **Strength of recommendation: SR; Level of evidence, I**
  - POC troponin assays have received a label to rule-in potential myocardial injury and to inform decision-making on follow-up examinations with high-sensitivity testing.

**POC troponin assays are still often used in EDs, outpatient clinics and rural centers because of the quick turnaround times, particularly in settings where access to central laboratories with more sensitive assays is limited. However, these assays are characterized by lower sensitivities and analytical precision compared with hs-TnT assays,\(^{35,37}\) which limit their use in decision-making for patients in the ED suspected of ACS, especially in ruling out ACS – even if the measurement is taken beyond 3 h.

One study reported that the specificity of a POC TnT using the manufacturer’s cutoff of 17ng/L had a specificity of 88% compared with 77% for hs-TnT using a cutoff of 14ng/L. In contrast, the respective sensitivities using the aforementioned cutoffs were 81% and 80%.\(^{38}\)

A prospective, observational study evaluated the performance of POC troponin tests in evaluating patients with symptoms of ACS in primary health care centers in Sweden. The study reported that the sensitivity of POC TnT tests in detecting AMI was 67% with a specificity of 98%.\(^{36}\) The authors pointed out that the use of POC TnT tests, when used to rule-out patients, missed 29% of patients with AMI or unstable angina.

Hence, we do not recommend the use of POC troponin assays in ruling out ACS in the ED. However, these assays may be used to rule-in potential myocardial injury and to inform decision-making on follow-up high-sensitivity testing, particularly in areas where hs-TnT assays are not readily available or accessible, and specifically for centers where laboratories cannot deliver and communicate hs-TnT results within 60min.\(^{37}\)

When using such devices to rule-in acute myocardial injury, the condition and calibration of the device should be ensured prior to use. Other quality control and assurance measures should be implemented for both the test and blood samples, including training of operators and comparison of results between the POC test and the central laboratory.\(^9\) Close consultation between local clinicians and laboratory specialists regarding the requirements for safe implementation and quality assurance is crucial before deciding to use a POC assay in clinical care.

**Table 3** is a summary of all recommendations.

**Conclusions**

These APSC consensus recommendations on the use of hs-TnT in the assessment of individuals with suspected ACS were developed with the majority of the centers in the Asia-Pacific region in mind. Although primarily considering the safety of patients, it also attempts to improve efficiency in healthcare by providing a tool for rapid clinical decision-making in the ED. Our proposed algorithm avoids delayed discharge of those with low probability of ACS while ensuring that those with a high probability of ACS, which are in most need of early angiography, will be prioritized in catheterization laboratories. Furthermore, the treating physician should also consider the availability of diagnostic and therapeutic modalities to ensure that the best level of care is given to the patient.

**Disclosures**

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**References**


