MOUNT SINAI MEDICAL SYSTEM

Emergency Department System Wide Guidelines

GUIDELINES FOR MANAGEMENT OF LOW RISK CHEST PAIN: TROPONIN TESTING AND POST-TROPONIN (PROVOCATIVE OR IMAGING) TESTING

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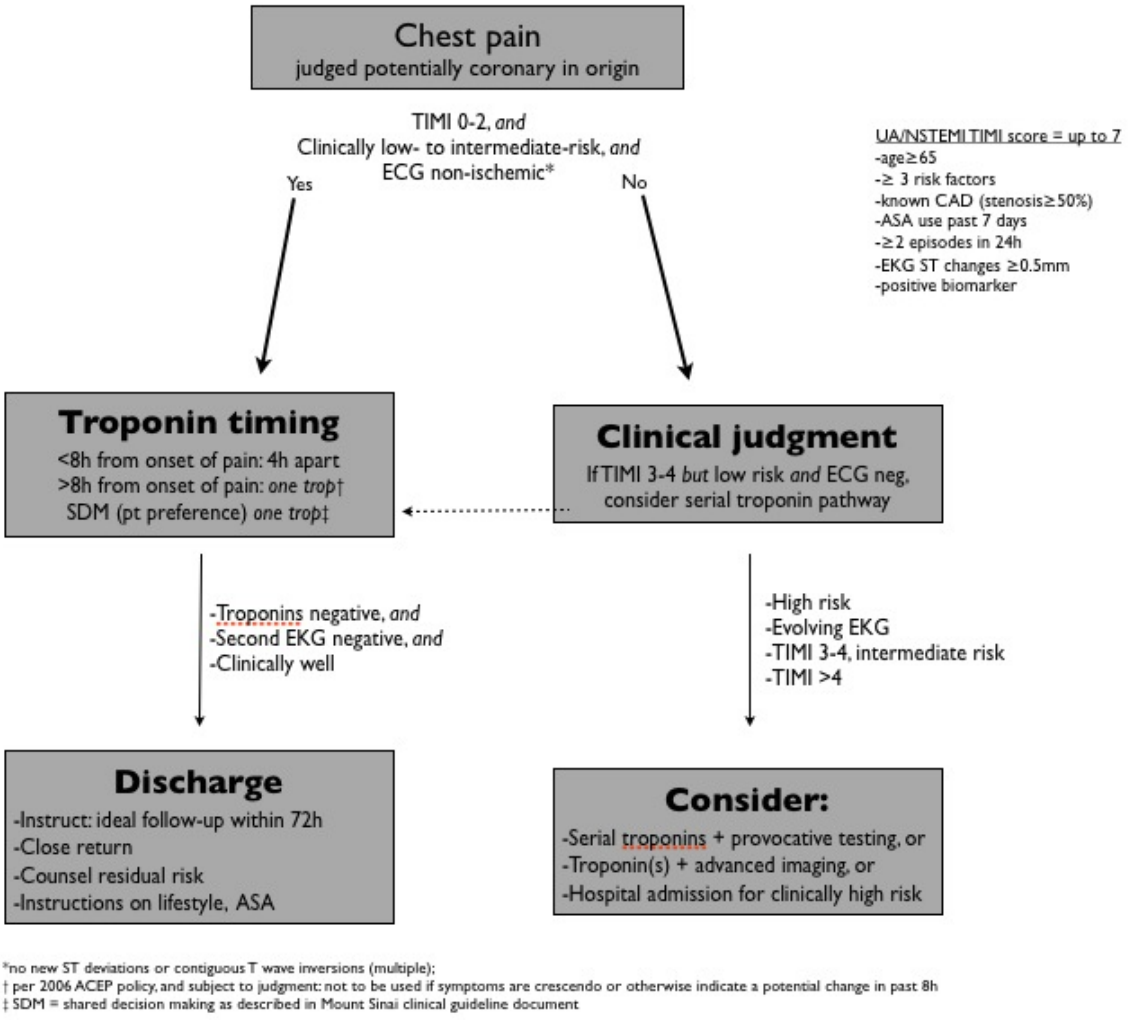
Figure:



PURPOSE:

These guidelines are designed to support a consistent, thorough, and safe process for the assessment and disposition of patients in whom coronary ischemia is a diagnostic concern during ED evaluation. Patients relevant to this guideline should be considered by the clinician to be at low- to intermediate-risk of adverse events (defined as death or myocardial infarction) during ED evaluation and during the next 30 days, should have non-ischemic electro-cardiograms (i.e. no new ST segment depressions or elevations, and no new T-wave inversions), and should have an initial troponin value that is negative (i.e. below the local positive threshold or consistent with prior baseline values).

GUIDELINES:

IMPORTANT: Clinician judgment supersedes these guidelines. In any individual case when a clinician believes a patient is at unusually high risk of adverse event this guideline should be considered inapplicable and judgment should guide management. ***Similarly, when clinician judgment suggests that a patient's presentation is not consistent with coronary ischemia (i.e. below the test threshold and therefore more likely to be harmed than helped by further testing for the condition) troponin and other cardiac testing should be avoided.***

<u>Troponin testing and evaluation:</u>

Serial troponin testing is standard in the evaluation of potential coronary ischemia and is now considered the 'gold' (reference) standard for its detection. While coronary insufficiency and future coronary events are often impossible to rule out with perfect certainty regardless of the chosen diagnostic tool, important authoritative bodies and individual leaders in the field of cardiology have recently asserted that when appropriately timed troponin testing is negative this effectively rules out active or imminently dangerous coronary ischemia. This troponin-based change in the definition and identification of coronary ischemia is reflected in the Third Universal Definition of Myocardial Infarction, which no longer includes the term 'unstable angina',(1) and is again reflected in a recent and prominent concepts review paper.(2)

There is, however, considerable variation in the nature and timing of serial troponin testing, with no broadly accepted standard for assay subtype, timing of serum testing, or threshold for positivity. Individual institutions and health systems are therefore left to make these decisions based on local norms and typical practice and within the range of standards offered by existing, commonly cited literature. This guideline offers a standardized approach to these issues.

Timing of serial troponin tests

With the intent of using a conservative (i.e. highly sensitive) threshold, and to make this guideline applicable to all troponin assay types currently in use in the Mount Sinai healthcare system, this guideline endorses a 4-hour serial troponin testing algorithm in which patients willing to stay for serial testing will undergo two separate serum troponin blood draws approximately 4 hours apart. This is for the purpose of 'ruling out' myocardial infarction and dangerous, active coronary ischemia, and also for the purpose of risk stratifying patients to an extremely low (<1%) chance of adverse event in 30 days. This time period may be extended to

6 hours in patients for whom physician judgment suggests that an acute event (i.e. the onset of the symptoms) may have begun in the 2 hours immediately prior to ED arrival and that an event might be missed without this extra delay, though current generation troponins are much more sensitive and 4h is likely to be adequate in virtually all cases. This protocol is modeled on Hamm et al., 1997,(3) in which an extremely high risk group of 773 chest pain patients (47% with a final diagnosis of coronary ischemia), were evaluated using first generation troponin assays. The troponin assay reliably identified all patients except one with a 30-day adverse event (representing a 0.3% miss rate for troponin testing). Notably, this performance was based on troponin I testing with positivity thresholds roughly 10x higher than the thresholds utilized today for the same molecule.

Single troponin testing to rule out myocardial infarction and coronary ischemia

The American College of Emergency Physicians, in their most recent clinical policy statement reviewing the evidence relating to the detection of myocardial infarction using troponin tests, finds that a single troponin assay, when drawn 8 hours or more ***from the onset of chest pain***, approaches 100% sensitivity and thus effectively rules out the condition.(4) We agree, based on review of the same literature and an additional systematic review of first generation troponin assays for detecting myocardial infarction (again the assays were judged based on performance standards for positivity thresholds 10x higher than those used today).(5) This 2006 ACEP policy is under review and may eventually be updated to reflect even shorter durations based on more recent literature and increasingly sensitive troponin assays. For the time being, however, this policy and literature review is the most relevant to the question of single troponin testing, and confirms that this is a safe and expedient approach to testing in patients for whom the provider judges that chest pain (or other coronary ischemia equivalent) has been present for >8 hours *and has not changed substantially in the 8 hours preceding blood draw.* In cases where clinicians judge that pain may have 'crescendoed', or 'stepped up' in the <8 hours prior to blood draw, judgment should supersede and serial troponin testing or other appropriate evaluation may be considered. (See Chest Pain flow chart algorithm, '†').

Single troponin testing based on Shared Decision Making (SDM)

Single troponin testing may also be considered in the context of SDM for those patients who understand the risks of foregoing a second troponin test, prefer this option, and are actively engaged in weighing the potential harms and benefits of the decision. The approach of engaging patients with potential coronary ischemia in a SDM process has been tested in trials and found to be safe, and associated with increased patient knowledge, decreased decisional conflict, and improved satisfaction with the process.(6) In any discussion with such patients it should be made clear that rare outcomes associated with missed myocardial infarction may potentially include unexpected sudden death, further myocardial infarction, and lasting cardiac damage. Patients who exhibit decisional capacity, with the understanding that risk profiles are low (<1%) but not zero, may decide to forego testing. This does not require 'Against Medical Advice' discharge paperwork, though conversations and final decisions must be documented. (See Chest Pain flow chart algorithm, '‡').

<u>Provocative and imaging tests following troponin testing</u>

The intent of provocative (i.e. stress testing) and imaging tests (coronary CT, angiography, etc.) following troponin testing in ED chest pain patients, according to current guidelines is two-fold: 1) to risk stratify patients with regard to 30-day adverse event rate, and 2) to identify potential candidates for revascularization (stent placement, angioplasty, bypass graft surgery).(7)

There is now a substantial body of literature demonstrating that low- and intermediate- risk chest pain patients with negative serial troponin evaluation have 30-day (and in some cases 6-month) event rates approaching zero (≤1%) regardless of diagnostic strategy after negative troponin testing.(8-13) This makes further risk stratification mathematically difficult, a circumstance neither mentioned nor anticipated by early guidelines, mostly based on datasets of higher risk patients and suggesting that all emergency department chest pain patients should routinely be subjected to provocative testing.(7)

Importantly, acute revascularization among patients with negative troponin testing appears to offer little or no tangible benefit.(14-16) The pursuit of provocative testing and imaging for such patients also leads to high false positive rates and thus overdiagnosis, and incurs risks associated with invasive procedures and interventions. Data recently published from the Mount Sinai health system reporting on the diagnostic outcomes of precisely this group of low- to intermediate-risk chest pain patients during a six-year period suggest that the potential revascularization yield in this group, according to American Heart Association appropriateness criteria, also approaches zero.(17)

With extremely low event rates, and potential therapeutic yield rates of less than 1%, post-troponin testing in this group is below published test thresholds for coronary testing,(18,19) suggesting that any such testing is more likely to harm patients than to benefit them. Editorials and analyses of the issue therefore now recommend avoiding post-troponin testing altogether with the exception of unusual cases deemed high risk by clinical judgment.(20,21) Other than in patients with unusually high risk features, therefore, or based on clinician judgment of high pre-test probability that coronary ischemia remains likely despite negative troponin testing, further testing is discouraged.

A cautionary note: these conclusions are intended to support a modernized, evidence-based, and patient-centered approach to low- and intermediate-risk chest pain for the Mount Sinai healthcare system. Despite this approach, it is clear that no algorithm or tool for coronary ‘rule-out’ can reduce risk to zero. Even after negative serial troponin testing a small amount of residual risk for myocardial infarction and death remains (typically <0.5% based on literature cited above). Moreover, the largest and perhaps most rigorous study cited by the American Heart Association guideline pertaining to emergency department-based observation units for potential coronary symptoms includes a roughly 0.3% rate of 30-day fatal and nonfatal myocardial infarction, despite an extended 9-hour observation period with serial troponin and provocative testing in every subject. This suggests that no tool can reduce risk to zero and that rare cases of important missed ischemia, even after stress testing and extended observation, will occur. These guidelines are an attempt to reduce this risk to a level that will, in aggregate, lead to more benefit than harm by identifying the overwhelming majority (>99%) of patients at risk for a short term adverse event while also avoiding the established harms that unavoidably occur with attempts to achieve zero risk.

PROCEDURE:

See flow chart, Figure. When relevant ED patients have been identified by the treating provider as low- to intermediate-risk based on clinician judgment AND as having a non-ischemic electrocardiogram, a single troponin (>8hrs ***from onset of symptoms***, or SDM) or 4-6 hour serial troponin protocol should be initiated. Based on common practice (but little to no explicit published data) the provider may also choose to check a repeat electrocardiogram *at the time of the 2nd serial troponin* to ensure that no apparently ischemic evolution of the electrocardiogram has occurred. If troponin values are negative, and both electrocardiograms (or one electrocardiogram if only one was performed) are judged non-ischemic (i.e. no new ST segment deviations and no new T-wave inversions), the patient does not require further serum testing or observation or stress testing for coronary ischemia unless a clinician judges that the patient remains at unusually high risk. At this point the patient may be discharged for appropriate short term follow-up with primary care or for cardiologic evaluation.

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