



JOHNS HOPKINS  
M E D I C I N E

High Sensitivity Troponin I @ JHH

**MAY 16<sup>TH</sup> Go-Live**

# Introduction to High Sensitivity Troponin (HsTnI)

- Definition of High Sensitivity (Next Generation) Cardiac Troponin Assays
  - HsTn assays are now able to detect troponin in normal individuals. This allows for improved sensitivity in detecting elevated troponin using the upper reference limit – also known as the 99<sup>th</sup> percentile.
  - Coefficient of Variation <10%
- At JHH, no change in assay manufacturer.
- Same molecule measured, just at much lower concentrations

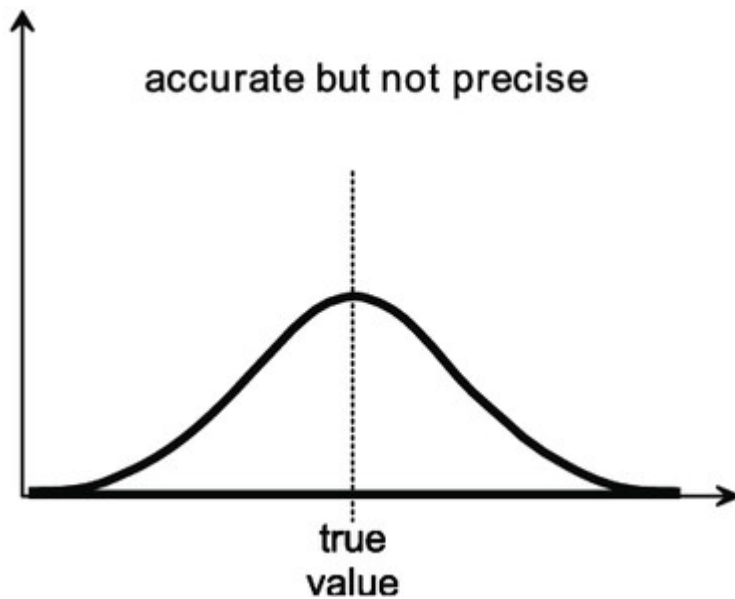
# Why Change?

- “High sensitivity cardiac troponins are the preferred standard for establishing a biomarker diagnosis of acute myocardial infarction, allowing for more accurate detection and exclusion of myocardial injury.”
- Yield a **faster diagnosis** of acute MI
- US catching up to the rest of the world
- Sunsetting of contemporary assays
- Provides sex-specific cutoffs

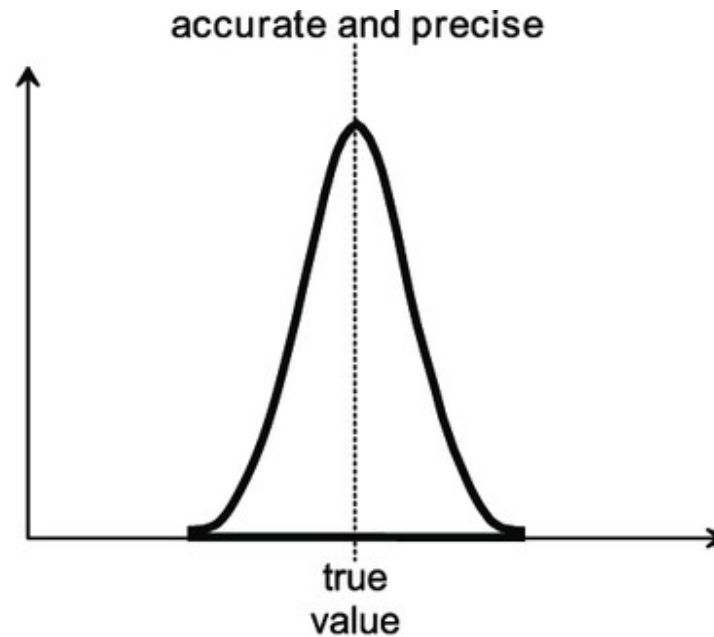
2021 AHA/ACC/ASE/CHEST/SAEM/SCCT/  
SCMR Guideline for the Evaluation and Diagnosis  
of Chest Pain

# Conventional Troponin Vs High sensitivity Troponin

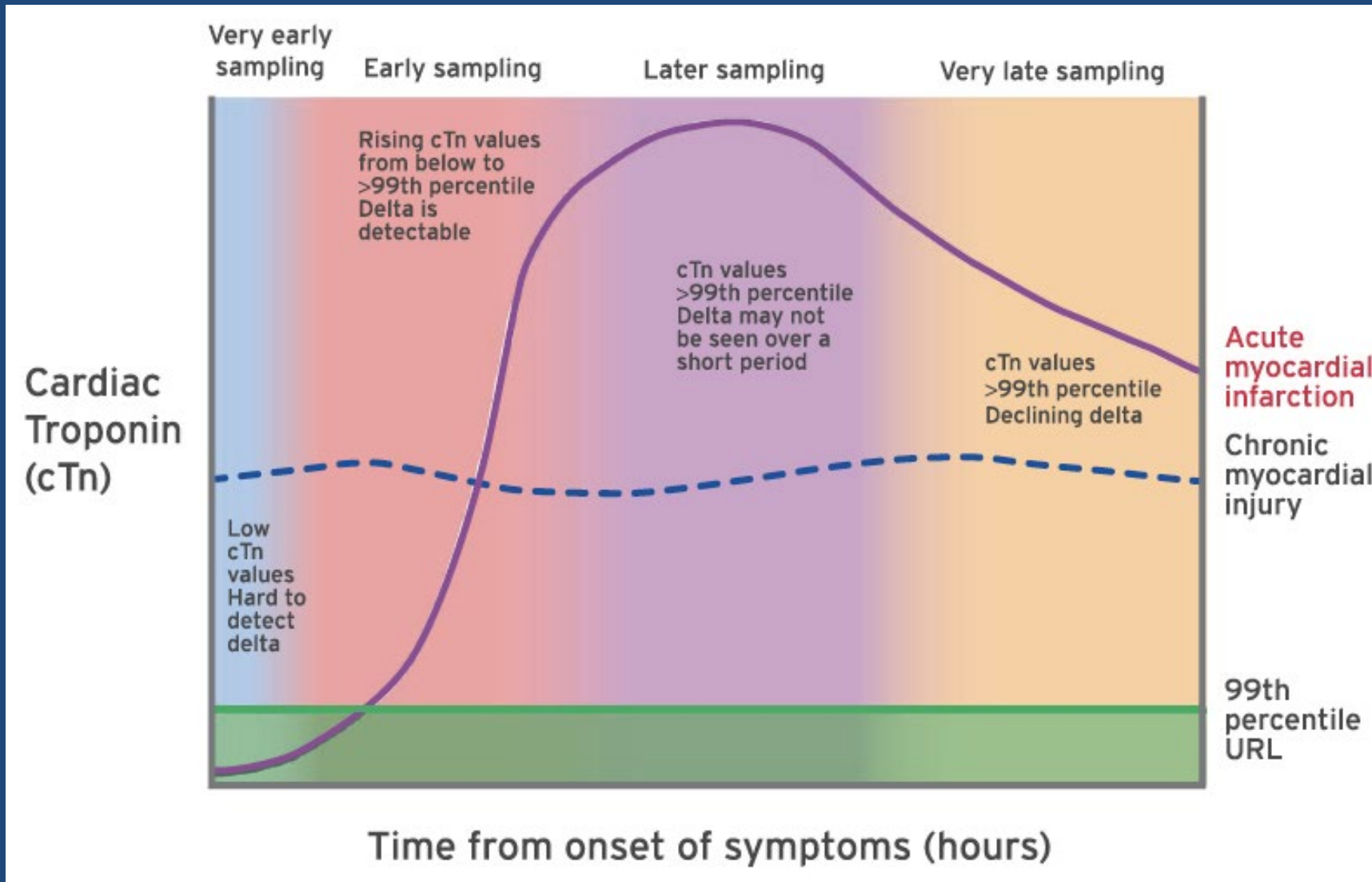
## Conventional Troponin



## High Sensitivity Troponin

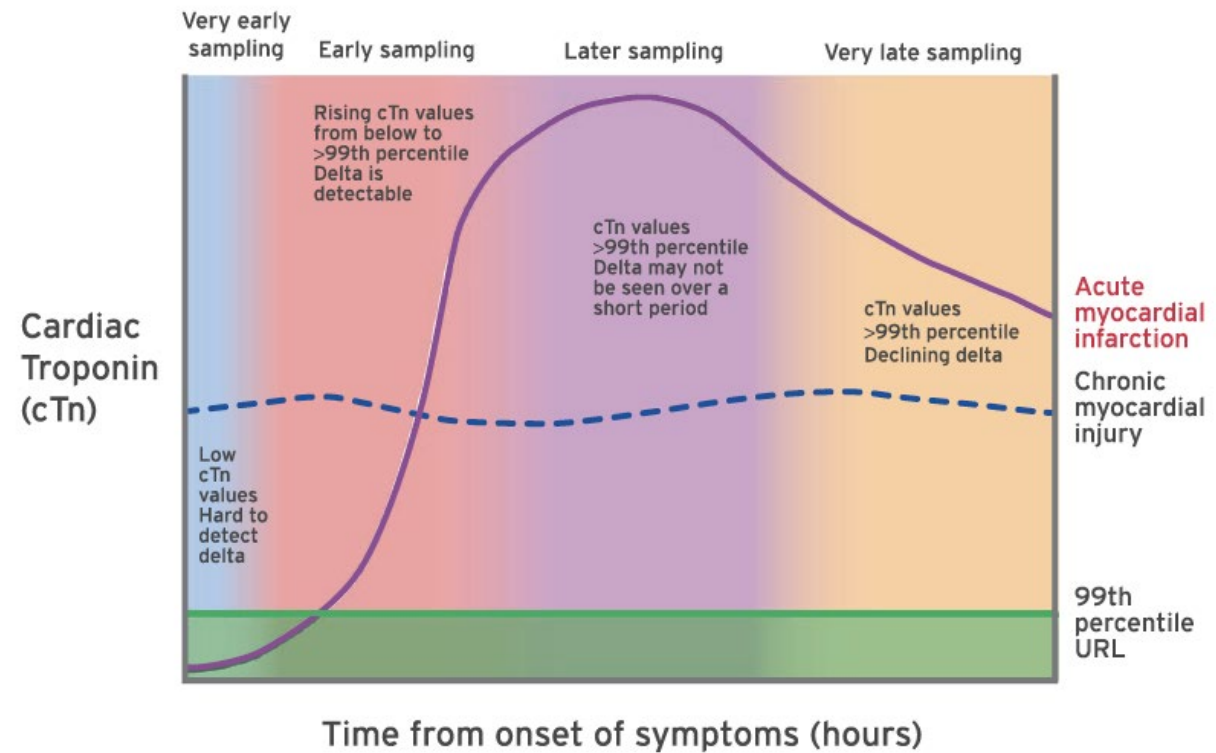


# Serial sampling and kinetics



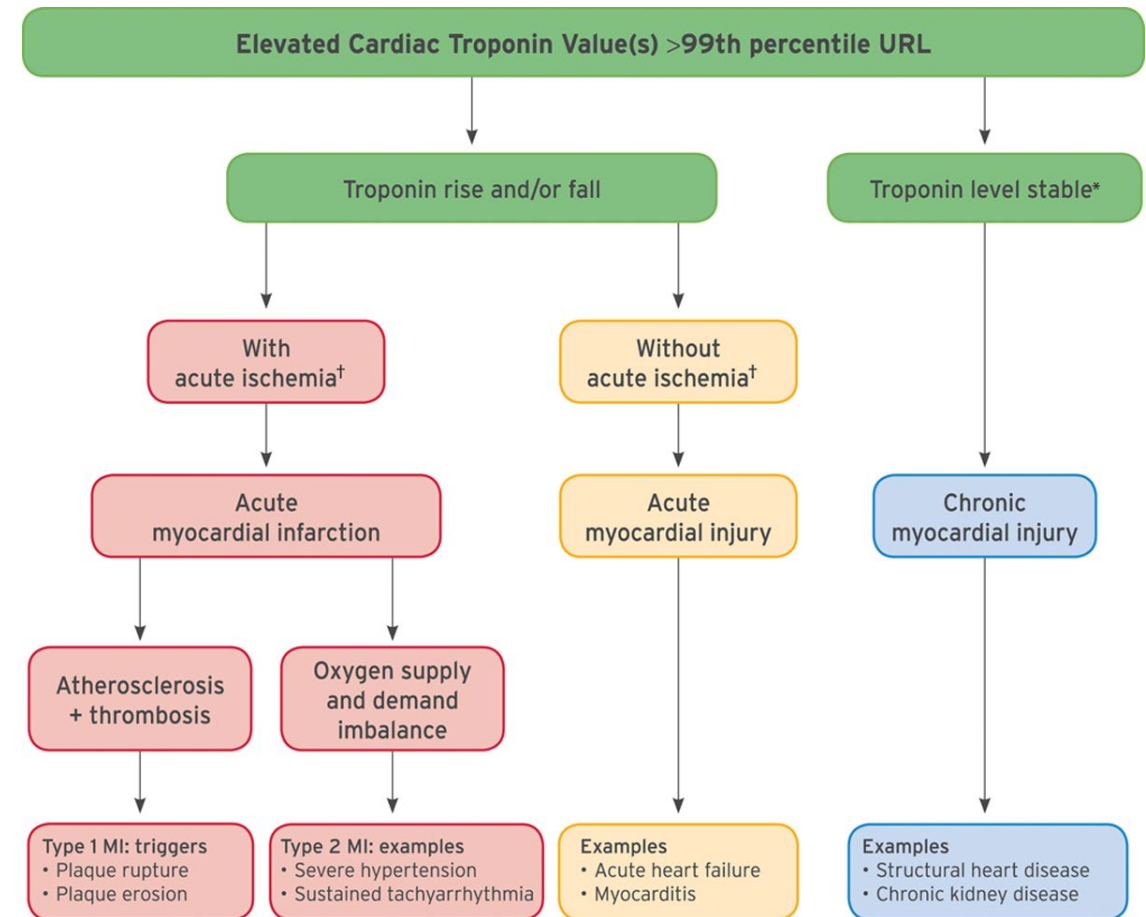
# Transition to High sensitivity Troponin I

1. HS Troponin allows for improved sensitivity allowing for earlier detection AND rule out of myocardial injury in many patients.
2. Results may be positive by degree of elevation OR by significant change on serial testing
  1. **Delta Value** – Change (rise or fall) in the troponin over time. The delta value maybe significant whether the change in troponin positive or negative.
  2. A delta value > 15 ng/L (1hr); or > 25 ng/L (3hrs) rules in for an acute myocardial process similar to a significantly elevated absolute value of troponin.



# Broad Differential for Positive HS Troponin






1. There will be an increase in numbers of patients with positive troponin.
2. Abnormal Cardiac troponin does NOT equal Myocardial Infarction.



# Appropriate Ordering and Resulting

There are 3 orderables for HS Troponin

- A) Single Troponin
- B) ED Series (0, 1, 3 hour)
- C) Inpatient Series (0, 3 hour)

Procedures ^						
	Name	Type	Pref List	Code	JH	BV
 	HS-TROP-I (JHH BMC)- IP SERIES (0, 3 HR)	Lab		LAB53745	Y	Y
 	HS-TROP-I (JHH BMC) - ED SERIES (0, 1, 3 HR)	Lab		LAB53743	Y	Y
	HS-TROP-I (JHH BMC)	Lab		LAB53686	Y	Y

- Single order troponin is indicated when the primary concern is to assess for myocardial injury with low or no suspicion for an acute myocardial process; for example: myocarditis, pulmonary embolus.
- **Timely collection of blood sample is essential!**
- Delta values may be difficult to interpret for results not drawn within the recommended time.



# Laboratory Considerations

- New units (ng/L) = current units (ng/mL) x 1000
- 0.04 ng/ml = 40 ng/L
- Values in integers
- New specimen type (lithium heparin plasma) and tube (SAP #137781)
  - Light (mint) green preferred
  - Dark green acceptable
- Add-ons no longer possible



# HsTnI Reference Ranges and Interpretation

JHH HsTnI Interpretation				
	Undetectable	Detectable	Elevated	Critical
Male	<4 ng/L	4 – 20 ng/L	21 – 99 ng/L	≥ 100 ng/L
Female		4 – 12 ng/L	13 – 99 ng/L	
Unspecified		4 – 18 ng/L	19 – 99 ng/L	

# Delta Changes and Interpretation

## JHH Delta HsTnl - Absolute Change from Baseline

Note: The absolute value of the delta (whether positive or negative) should be used to determine clinical significance.

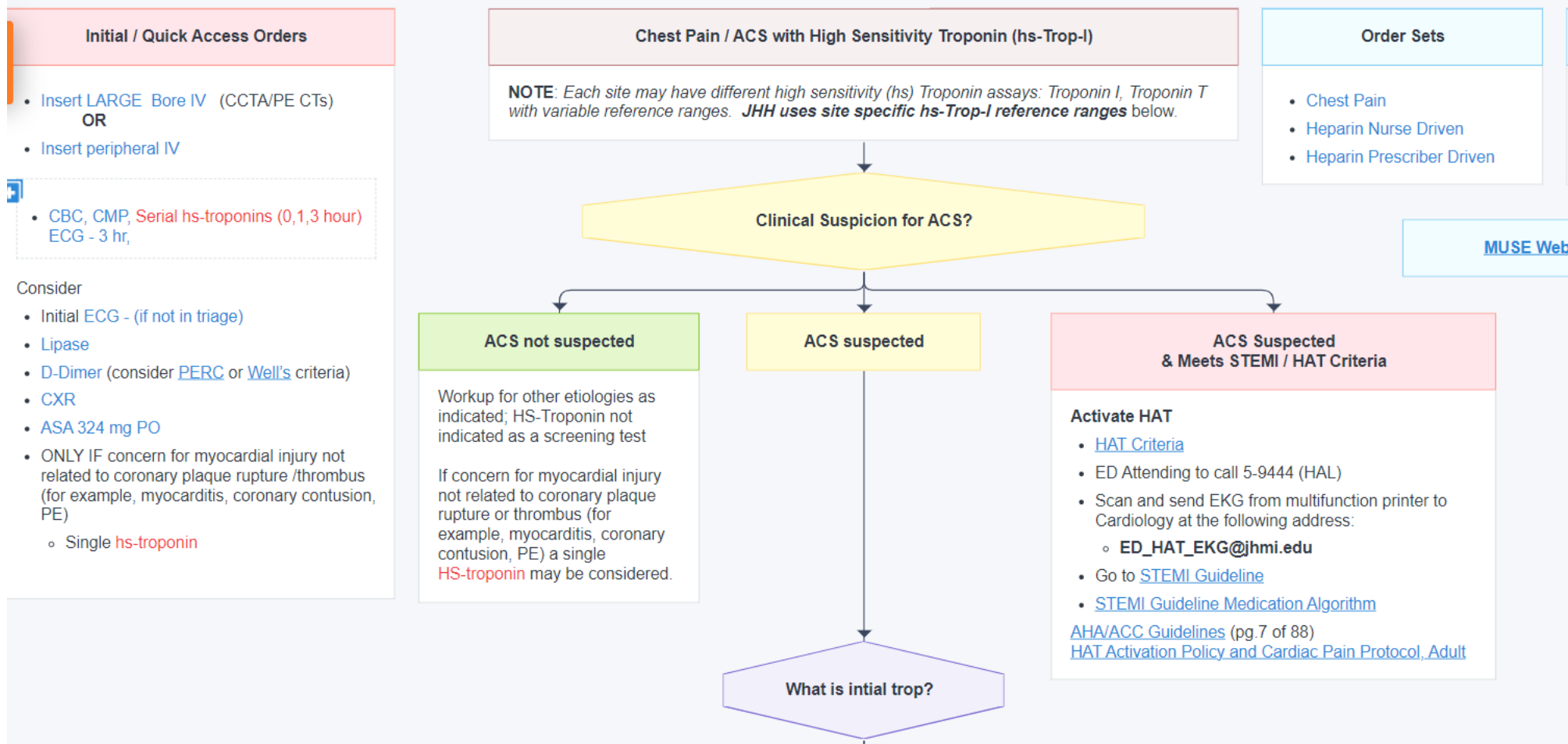
Time Interval	Delta Not changing	Delta Significant Change
0 hr – 1 hr	<15 ng/L	≥15 ng/L
0 hr – 3 hr	<25 ng/L	≥25 ng/L
1 hr – 3 hr	<20 ng/L	≥20 ng/L

Please See AgileMD guidelines for clinical context

# Hopkins ED Guidelines – See AgileMD in EPIC

## Chest Pain / ACS (Adult ED)

JHUSOM Appropriate Use Criteria; Approved by Emergency Medicine Best Practice Council, v4, May 2023

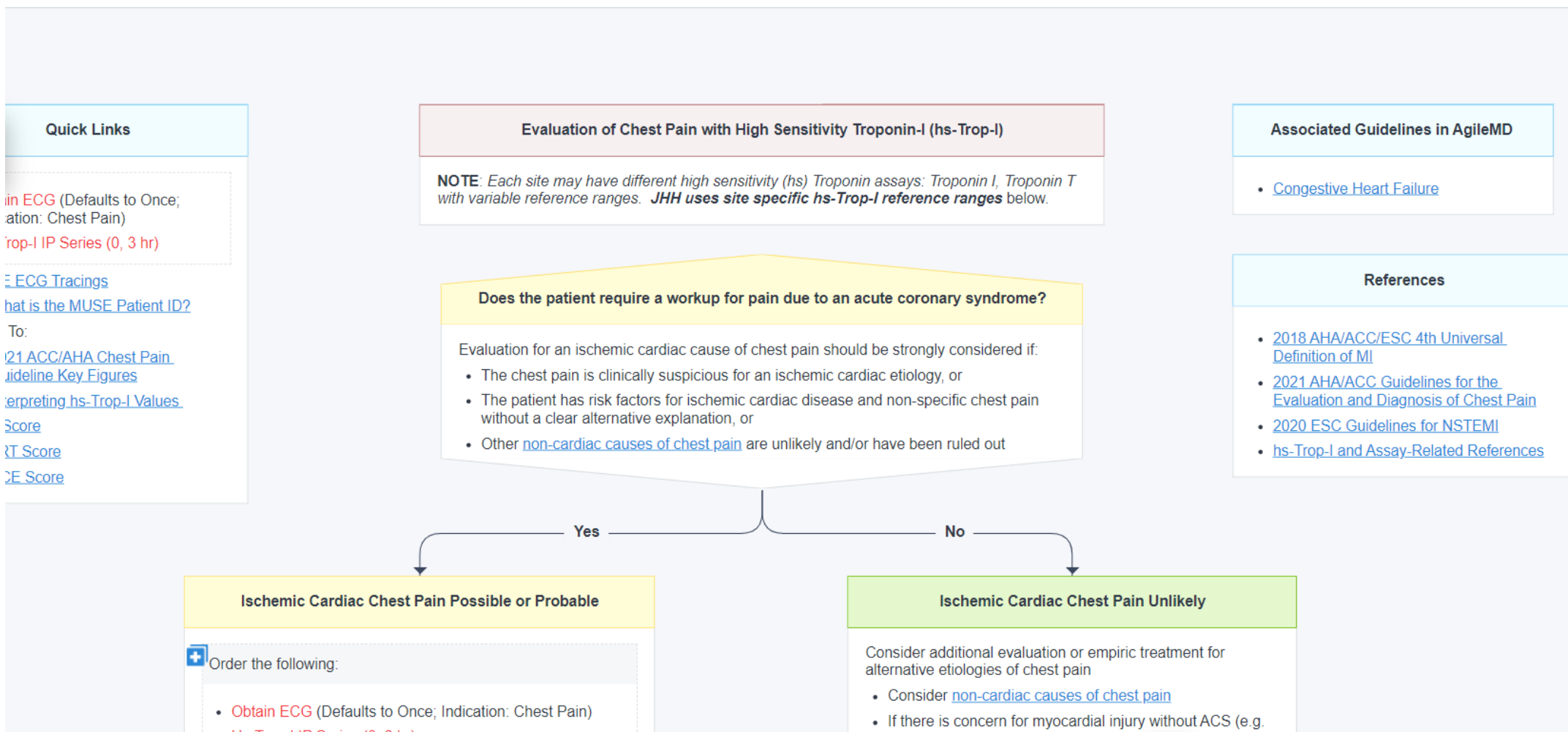


# Hopkins Inpatient Guidelines – See AgileMD in EPIC



Chest Pain Evaluation with High Sensitivity Troponin (Adult Inpatient) [JHH]

v1 April 2023







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High Sensitivity Troponin I @ JHH  
**CLINICAL CASE SUPPLEMENT**  
MAY 16<sup>TH</sup> Go-Live

# Case Example 1 (Arrival $\geq 3$ hr)

- Male Atypical Chest pain  $> 3$  hours ago
- EKG normal or non-diagnostic
- HsTnl at time 0 hr:  $<4$  ng/L Troponin undetectable
- Diagnosis: Non-cardiac chest pain; ACS ruled out.



JHH HsTnl Interpretation				
	Undetectable	Detectable	Elevated	Critical
Male	$<4$ ng/L	4 – 20 ng/L	21 – 99 ng/L	$\geq 100$ ng/L
Female		4 – 12 ng/L	13 – 99 ng/L	
Unspecified		4 – 18 ng/L	19 – 99 ng/L	



# Case Example 2 (ED 1 hr)

- Low risk for ACS - Female presents to ED with Chest pain starting < 3 hours ago
- EKG normal or non-diagnostic
- Time 0 HsTnl → result <4 ng/L
- Time 1 hr HsTnl → result 10 ng/L Delta (change from baseline) >5; Need Repeat 3 hour
- Time 3 hr HsTnl → result 9 ng/L Delta (change from baseline) Not Significant; Ruled out
- Diagnosis: Low risk for Acute Myocardial Infarct.

↓

JHH Delta HsTnl - Absolute Change from Baseline		
Note: The absolute value of the delta (whether positive or negative) should be used to determine clinical significance.		
Time Interval	Delta Not changing	Delta Significant Change
0 hr – 1 hr	<15 ng/L	≥15 ng/L
0 hr – 3 hr	<25 ng/L	≥25 ng/L
1 hr – 3 hr	<20 ng/L	≥20 ng/L

↓

JHH HsTnl Interpretation				
	Undetectable	Detectable	Elevated	Critical
Male		4 – 20 ng/L	21 – 99 ng/L	≥ 100 ng/L
Female	<4 ng/L	4 – 12 ng/L	13 – 99 ng/L	
Unspecified		4 – 18 ng/L	19 – 99 ng/L	

# Case Example 3 (ED High Risk)

- Female (High risk – HEAR score 6) presents to ED with chest pain starting < 3 hours ago
- EKG non-diagnostic
- Time 0 HsTnl → result 6 ng/L
- Time 1 hr HsTnl → result 13 ng/L Delta (change from baseline) = 7; Obtain 3 hour HS troponin
- Time 3 hr HsTnl → result 17 ng/L Delta (change from baseline) = 11; Ruled out
- Diagnosis: Delta not Change, ACS ruled Out.  
However, for high risk patients (HEAR Score 7), may require further risk stratification.



JHH Delta HsTnl - Absolute Change from Baseline		
Note: The absolute value of the delta (whether positive or negative) should be used to determine clinical significance.		
Time Interval	Delta Not changing	Delta Significant Change
0 hr – 1 hr	<15 ng/L	≥15 ng/L
0 hr – 3 hr	<25 ng/L	≥25 ng/L
1 hr – 3 hr	<20 ng/L	≥20 ng/L



JHH HsTnl Interpretation				
	Undetectable	Detectable	Elevated	Critical
Male	<4 ng/L	4 – 20 ng/L	21 – 99 ng/L	≥ 100 ng/L
Female		4 – 12 ng/L	13 – 99 ng/L	
Unspecified		4 – 18 ng/L	19 – 99 ng/L	

# Case Example 4 (Rising/Falling)

- Male presents to ED with Chest pain starting > 3 hours ago
- EKG non-diagnostic
- Time 0 HsTnl → result 30 ng/L
- Time 1hr HsTnl → result 20 ng/L Delta (change from baseline) = 10 ; Ruled out
- Time 3 hr HsTnl → result <4 ng/L Delta (change from baseline) = 26; Ruled IN
- Diagnosis: ACS Ruled IN. Based on clinical profile, consider next steps.

↓

<b>JHH Delta HsTnl - Absolute Change from Baseline</b>		
Note: The absolute value of the delta (whether positive or negative) should be used to determine clinical significance.		
Time Interval	Delta Not changing	Delta Significant Change
0 hr – 1 hr	<15 ng/L	≥15 ng/L
0 hr – 3 hr	<25 ng/L	≥25 ng/L
1 hr – 3 hr	<20 ng/L	≥20 ng/L

↓

<b>JHH HsTnl Interpretation</b>				
	Undetectable	Detectable	Elevated	Critical
Male		4 – 20 ng/L	21 – 99 ng/L	≥ 100 ng/L
Female	<4 ng/L	4 – 12 ng/L	13 – 99 ng/L	
Unspecified		4 – 18 ng/L	19 – 99 ng/L	

# Epic Reporting Example – No Delta Change



## hs-Trop-I (JHH BMC) 1 hr

Order: 7677768 - Part of Panel Order 7677763

Status: Final result Visible to patient: No (inaccessible in MyChart) Next appt: None

### 0 Result Notes

Component 1 d ago

Ref Range & Units

hs-Trop-I (JHH BMC) 1 hr 7

<=20 ng/L

Comment: Troponin Detectable

Delta hs-Trop-I (JHH BMC) 2

0-1 hr

>-15 to <15 ng/L ng/L

Comment: Delta not changing

Note: The absolute value of the delta (whether originally a positive or negative value) should be used to determine clinical significance.

Resulting Agency

JHH Labs

### Narrative

Performed by: JHH Labs

The presence of human anti-mouse antibodies (HAMA), which can result from mouse monoclonal antibodies used for diagnosis or therapy, or heterophile antibodies, may cause an interference in this assay.

High Sensitivity Troponin I performed at JHH on the Beckman Coulter Access 2 Immunoassay Analyzer.

	4/6/23 13:35	4/6/23 11:33	4/6/23 10:32
<b>CARDIAC CHEMISTRY</b>			
hs-Trop-I (JHH BMC) 0 hr			5
hs-Trop-I (JHH BMC) 1 hr		7	
hs-Trop-I (JHH BMC) 3 hr	10		
Delta hs-Trop-I (JHH BMC) 0-1 hr		2	
Delta hs-Trop-I (JHH BMC) 0-3 hr	5		

### Delta hs-Trop-I (JHH BMC) 0-1 hr

4/6/2023 11:33 (Collected)

2 ng/L

Ref range: >-15 to <15 ng/L ng/L

Resulting Lab: JOHNS HOPKINS MEDICAL LABS (J.H.M.L.)

Delta not changing

Note: The absolute value of the delta (whether originally a positive or negative value) should be used to determine clinical significance.

Related Results

# Epic Reporting Example –Delta Change



**! hs-Trop-I (JHH BMC) 1 hr** Order: 7674554 - Part of Panel Order 7674549

Status: Final result Visible to patient: No (inaccessible in MyChart) Next appt: None

0 Result Notes

Component	1 d ago
<input checked="" type="checkbox"/> <b>hs-Trop-I (JHH BMC) 1 hr</b> Ref Range & Units: <=12 ng/L Comment: Troponin Elevated	<b>65 ^</b>
<input checked="" type="checkbox"/> <b>Delta hs-Trop-I (JHH BMC) 0-1 hr</b> Ref Range & Units: >-15 to <15 ng/L ng/L Comment: Delta significant change Note: The absolute value of the delta (whether originally a positive or negative value) should be used to determine clinical significance.	<b>25 ^</b>

Resulting Agency: [JHH Labs](#)   [JHH Labs](#)   [JHH Labs](#)

**Narrative** Performed by: JHH Labs

The presence of human anti-mouse antibodies (HAMA), which can result from mouse monoclonal antibodies used for diagnosis or therapy, or heterophile antibodies, may cause an interference in this assay.

High Sensitivity Troponin I performed at JHH on the Beckman Coulter Access 2 Immunoassay Analyzer.

	4/6/23 13:56	4/6/23 11:54	4/6/23 10:50
<b>CARDIAC CHEMISTRY</b>			
hs-Trop-I (JHH BMC) 0 hr			40 ^
hs-Trop-I (JHH BMC) 1 hr		65 ^	
hs-Trop-I (JHH BMC) 3 hr	90 ^		
Delta hs-Trop-I (JHH BMC) 0-1 hr		25 ^	
Delta hs-Trop-I (JHH BMC) 0-3 hr	50 ^		

**Delta hs-Trop-I (JHH BMC) 0-1 hr**  
4/6/2023 11:54 (Collected)

**25 ^** ng/L

Ref range: >-15 to <15 ng/L ng/L  
Resulting Lab: JOHNS HOPKINS MEDICAL LABS (J.H.M.L.)

Delta significant change  
Note: The absolute value of the delta (whether originally a positive or negative value) should be used to determine clinical significance.

Related Results ⌵





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High Sensitivity Troponin I @ JHH  
**NURSING SUPPLMENT**  
MAY 16<sup>TH</sup> Go-Live

# ED Series

hs-Trop-I (JHH BMC) – ED Series (0, 1, 3 hr) ✓ Accept ✗ Cancel

Frequency:  Once STAT AM Draw Timed PM Draw

At  
 Today Tomorrow

Specimen Type:

Release result to MyChart:  
Immediate Manual

Add-on: Test has no expiration time

Comments: [+ Add Comments](#)

ⓘ Next Required Link Order ✓ Accept ✗ Cancel



# Orders – Manage Orders (ED provider view)

Navigation: Chart Review | Results | SnapShot | Review Visit | My Note | Manage Orders

## Manage Orders

Active | **ED Orders** | Signed & Held | Home Meds | Cosign | Pended | Quick List | Post-Disch Orders | Order History

Code, Isolation and Restraint Orders  
(From admission, onward)  
None

ED Imaging Orders  
(From admission, onward)  
None

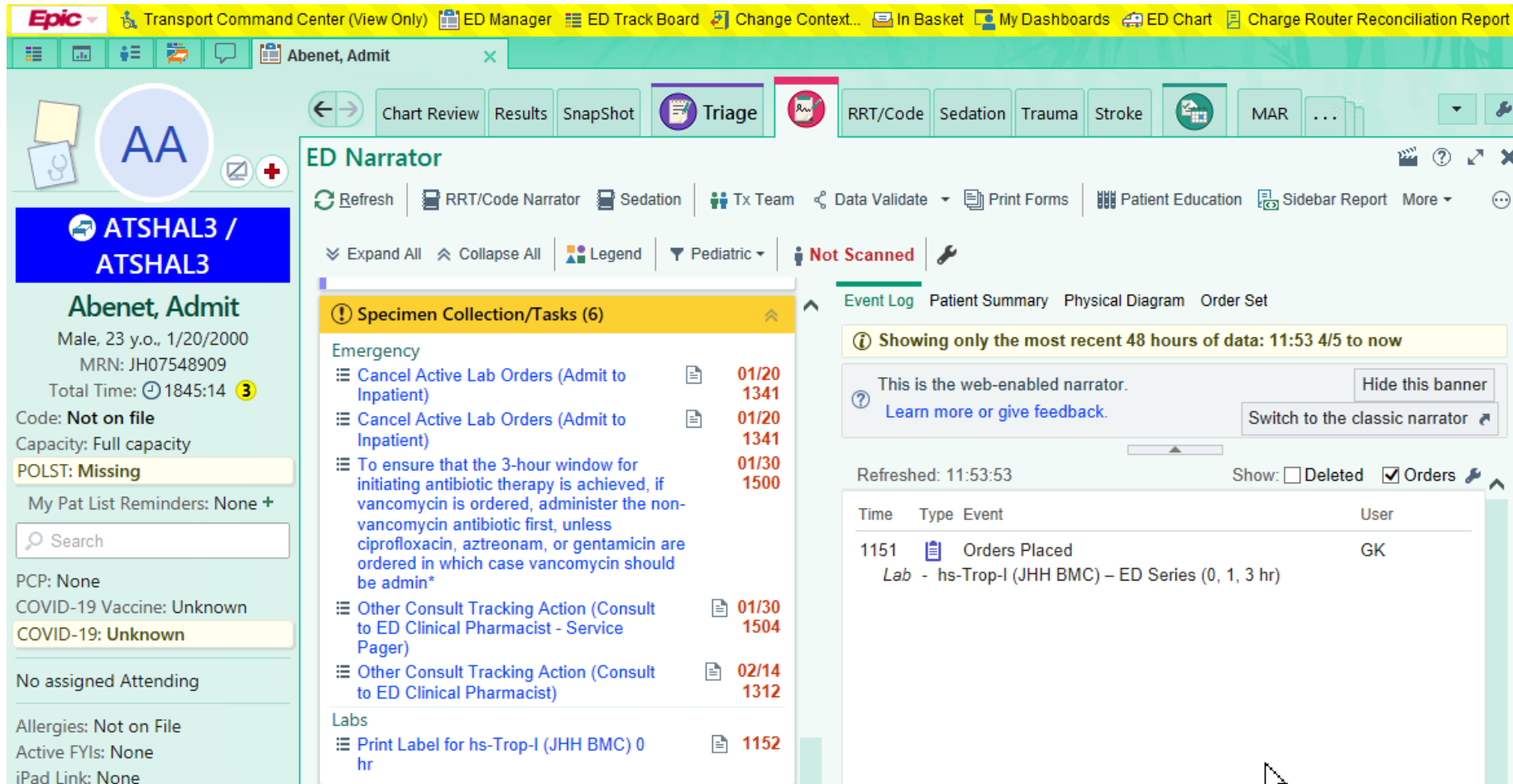
ED Micro, Lab, POCT  
(From admission, onward) [Expand](#) | [Hide](#)

Ordered	Start	Status	Ordering Provider	Notify Me
04/07/23 1151	04/07/23 1152	hs-Trop-I (JHH BMC) – ED Series (0, 1, 3 hr) STAT <a href="#">Discontinue</a>	KELEN, GABOR DAVID	
04/07/23 1151	04/07/23 1152	hs-Trop-I (JHH BMC) 0 hr PROCEDURE ONCE <a href="#">Collect</a> <a href="#">Discontinue</a>	KELEN, GABOR DAVID	

# Orders – ED Narrator for ED timed series



## Only 0 hr appears for collection



**Epic** Transport Command Center (View Only) ED Manager ED Track Board Change Context... In Basket My Dashboards ED Chart Charge Router Reconciliation Report

Abenet, Admit

Chart Review Results SnapShot Triage RRT/Code Sedation Trauma Stroke MAR

### ED Narrator

Refresh RRT/Code Narrator Sedation Tx Team Data Validate Print Forms Patient Education Sidebar Report More

Expand All Collapse All Legend Pediatric Not Scanned

**Specimen Collection/Tasks (6)**

- Emergency
  - Cancel Active Lab Orders (Admit to Inpatient) 01/20 1341
  - Cancel Active Lab Orders (Admit to Inpatient) 01/20 1341
  - To ensure that the 3-hour window for initiating antibiotic therapy is achieved, if vancomycin is ordered, administer the non-vancomycin antibiotic first, unless ciprofloxacin, aztreonam, or gentamicin are ordered in which case vancomycin should be admin\* 01/30 1500
  - Other Consult Tracking Action (Consult to ED Clinical Pharmacist - Service Pager) 01/30 1504
  - Other Consult Tracking Action (Consult to ED Clinical Pharmacist) 02/14 1312
- Labs
  - Print Label for hs-Trop-I (JHH BMC) 0 hr 1152

Event Log Patient Summary Physical Diagram Order Set

Showing only the most recent 48 hours of data: 11:53 4/5 to now

This is the web-enabled narrator. [Learn more or give feedback.](#) [Hide this banner](#) [Switch to the classic narrator](#)

Refreshed: 11:53:53 Show:  Deleted  Orders

Time	Type	Event	User
1151	Orders Placed	Lab - hs-Trop-I (JHH BMC) – ED Series (0, 1, 3 hr)	GK

ATSHAL3 / ATSHAL3


**Abenet, Admit**  
Male, 23 y.o., 1/20/2000  
MRN: JH07548909  
Total Time: 1845:14 3

Code: **Not on file**  
Capacity: Full capacity  
POLST: **Missing**  
My Pat List Reminders: None +  
Search  
PCP: None  
COVID-19 Vaccine: Unknown  
COVID-19: **Unknown**  
No assigned Attending  
Allergies: Not on File  
Active FYIs: None  
iPad Link: None

# Orders – 0 hr collection is Stat

Collect specimens for Admit Abenet, Male, 23 yrs, MRN:JH07548909 X

**Pre-collection Steps** ——— **Blood Specimens** ——— ✎ Change Performing Lab

 Patient scan overridden  
✓ Select label printer

**Collection Sequence** ———

LTGREEN4.5  
hs-Trop-I (JHH BMC) 0 hr

LTGREEN4.5 (Blood, peripheral) Lab: JHH CORE LAB

hs-Trop-I (JHH BMC) 0 hr Scheduled: 4/7/2023 1152 ! STAT ↻ Collect Later

Label Printer:  Print Labels

# Orders – 0 hr received in lab

## Receiving - LAB CP Receiving - 1 out of 1

Refresh Remove Labels Documents

Add to Scanned List Scanned Recent Expected

H..	F..	Q..	C..	R..	Container	Collector	Patient
✓	↑				23JC-097CH00...	Cathleen Lindauer,...	Abenet, Adm

**Abenet, Admit**  
 MRN JH07548909  
 M, 23 years, 1/20/2000  
 JHH EMERGENCY MEDICINE, ATSHAL3, ATSHAL3

**23JC-097CH0002**  
 Blood, Blood, peripheral

Collected  
 04/07/2023 1157

Draw Type  
 Venipuncture

### Collection Info [0]

Apply All

Date/Time: 4/7/2023 1157 [1] Now  
 Collector: EMERGENCY, NUR... [2] EMERGENCY, N...  
 Department: JHH EMERGENCY MEDICINE [3] JHH EMERGENC...  
 Draw Type: Venipuncture [4] Venipuncture  
 Type: Blood  
 Source: Blood, peripheral  
 Container Type: Lt Green LiHep PST 4.5mL  
 Site:  
 A/C:

Specimen Flags:

Lab Comments

### 23JC-097CH0002

#### Abenet, Admit (MRN JH07548909)

M, 23 yrs, 1/20/2000 Coll. Dept: JHH EM  
 Location: JHH EMERGENCY MEDICINE,  
 ATSHAL3, ATSHAL3

**Blood, Blood, peripheral**

Collected Today 1157 by Cathleen Lindauer, RN  
 Container: 1 LTGREEN4.5 Draw type: Venipuncture

### Container Temperature

Room Temperature

### Destinations

Test	Accessioned	Destination List
hs-Trop-I (JHH BMC) 0 hr	Current Lab	Current Lab

### hs-Trop-I (JHH BMC) 0 hr

23JC-097CH0002.1 ↑

Order Question Answer  
 Release result to Immediate

Receive

# Specimen Collection Considerations

- New specimen type (lithium heparin plasma) and tube
  - Light (mint) green\* preferred
  - Dark green acceptable
- Sample handling is critical for accurate results
  - Completely fill tube
  - Mix tube with gentle inversion 8 times
- Timely collection of blood sample is essential!



\*SAP #137781

# Epic Reporting Example – No Delta Change



## hs-Trop-I (JHH BMC) 1 hr

Order: 7677768 - Part of Panel Order 7677763

Status: Final result Visible to patient: No (inaccessible in MyChart) Next appt: None

### 0 Result Notes

Component 1 d ago

Ref Range & Units

hs-Trop-I (JHH BMC) 1 hr 7

<=20 ng/L

Comment: Troponin Detectable

Delta hs-Trop-I (JHH BMC) 2

0-1 hr

>-15 to <15 ng/L ng/L

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Resulting Agency

JHH Labs

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hs-Trop-I (JHH BMC) 1 hr		7	
hs-Trop-I (JHH BMC) 3 hr	10		
Delta hs-Trop-I (JHH BMC) 0-1 hr		2	
Delta hs-Trop-I (JHH BMC) 0-3 hr	5		

### Delta hs-Trop-I (JHH BMC) 0-1 hr

4/6/2023 11:33 (Collected)

2 ng/L

Ref range: >-15 to <15 ng/L ng/L

Resulting Lab: JOHNS HOPKINS MEDICAL LABS (J.H.M.L.)

Delta not changing

Note: The absolute value of the delta (whether originally a positive or negative value) should be used to determine clinical significance.

Related Results

# Epic Reporting Example –Delta Change



**! hs-Trop-I (JHH BMC) 1 hr** Order: 7674554 - Part of Panel Order 7674549  
 Status: Final result Visible to patient: No (inaccessible in MyChart) Next appt: None

0 Result Notes

Component	1 d ago
Ref Range & Units	
<input checked="" type="checkbox"/> hs-Trop-I (JHH BMC) 1 hr	65 ^
<=12 ng/L	
Comment: Troponin Elevated	
<input checked="" type="checkbox"/> Delta hs-Trop-I (JHH BMC) 0-1 hr	25 ^
>-15 to <15 ng/L ng/L	
Comment: Delta significant change	
Note: The absolute value of the delta (whether originally a positive or negative value) should be used to determine clinical significance.	
Resulting Agency	JHH Labs JHH Labs JHH Labs

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Delta hs-Trop-I (JHH BMC) 0-1 hr		25 ^	
Delta hs-Trop-I (JHH BMC) 0-3 hr	50 ^		

**Delta hs-Trop-I (JHH BMC) 0-1 hr**  
 4/6/2023 11:54 (Collected)

**25 ^** ng/L

Ref range: >-15 to <15 ng/L ng/L  
 Resulting Lab: JOHNS HOPKINS MEDICAL LABS (J.H.M.L.)

Delta significant change  
 Note: The absolute value of the delta (whether originally a positive or negative value) should be used to determine clinical significance.

Related Results ⌵





# Workgroup Members

- Emergency Medicine
  - **Mustapha Saheed, MD**
  - Michael Ehmann, MD
  - Jeremiah Hinson, MD, Ph.D.
  - Daniel Swedien, MD
- Internal Medicine
  - Benjamin Bodnar, MD
- Cardiology
  - Joshua Kiss, MD
  - Thomas Metkus, MD, Ph.D.
- Nursing
  - Barbara Maliszewski
  - Tracy Colburn
- Pathology
  - Lori Sokoll, Ph.D.