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 Journal Club
 Alicia Devine, M.D.

P: In patients undergoing evaluation for chest pain
 I: Do serial POC tests for troponin I alone
 C: Compared to central lab results for CPK, CK-MB and troponin
 O: Offer diagnostic/economic advantages

Clinical Scenario: A 40 year old man presents to the emergency department complaining of chest pain of several hours duration. He has no personal or family history of cardiac disease and no history of diabetes, obesity or tobacco use. His EKG is non-diagnostic and vital signs and physical exam are normal. He has never had a stress test or angiography. Can he be discharged from the E.D. after two sets of negative i-STAT troponin?

Search Strategy: MD consult, BestBETs, Cochrane.
 Search terms: "i-stat troponin", "cardiac biomarkers", "point-of-care testing"

Search Outcome:

Author, date and country	Patient group	Study type	Outcomes	Key results	Study weaknesses
Apple F et al 2006 USA	367 patients with sxs c/w ACS, measured cTnl with i-STAT, investigation of prognostic value of i-STAT cTnl for risk stratification by assessing adverse outcomes in ACS patients	prosp	ACS, cardiac death and MI at 60 days	Odds ratios with 95% confidence intervals for increased cTnl above 99 th percentile for all-cause death, MI or ACD, MI or cardiac death at 60 days were all statistically significant after adjustment for age, diabetes, HTN, and h/o renal failure	1. Data not obtained on 11, 19 lost to f/u 2. small sample size 3. No doc on EKG changes, meds, creatinine.
Caragher et al 2002 USA	205 patients over 16 day period presenting to ED with CP comparison of 12-24 hour CP protocol using serial lab measurements of cTnl, myoglobin and CK-MB (ACPP) to measurements obtained from quantitative POC for cTnl, Myo and CK-MB (POCT-ED)	prosp trial, retrosp review of data	sensitivity and specificity for diagnosis of ACS turnaround time	Sensitivity: POCT 100%; ACPP 66% Specificity: POCT near 100% (172/173); ACPP 100% mean time-to-result for ACPP was 87 minutes and for the POCT-ED was 39 minutes.	1. MD's not blinded to results of POCT 2. small sample size

<p>Altinier S et al 2001 USA</p>	<p>100 consec pts admitted to ED with CP and sxs c/w ACS</p> <p>serial measurements of CK-MB, Myo and cTnI using two diff quantitative POC devices (Stratus CS and Triage Cardiac Panel), compared to values obtained in lab</p>	<p>prosp</p>	<p>Correlation between lab results and POC results</p>	<p>Both POC systems tested had satisfactory analytical efficiency; the Status CS had a coefficient of variation of less than 5.6% for Myo and less than 10% for TnI</p> <p>Variability found between results of the two POC systems resulting in inappropriate admission of 5 patients</p>	<p>Small sample size</p>
<p>Hamm et al 1997 Germany</p>	<p>773 consec patients with CP < 12 hrs had cTnT and cTnI measured serially x2 with qualit POC testing; evaluated the diagnostic and prognostic value of rapid bedside troponin T and troponin I for early triage in ED</p>	<p>prosp</p>	<p>death from cardiac causes and nonfatal AMI during hospitalization and after discharge</p> <p>sensitivity of POC testing of cTnT and cTnI</p>	<ul style="list-style-type: none"> •cTnT was + in 123 (16%) and cTnI was + in 171 (22%) •of the 47 patients with evolving MI, cTnT was + in 44 (94%) and cTnI was + in 47 (100%) •among 315 with UA, cTnT was + in 70 (22%) and cTnI was + in 114 (36%) •during 30 days of f/u, there were 20 deaths and 14 nonfatal MI's •false negative for cTnT was 1.1% and for cTnI was 0.3%; NPV 98.9% for cTnT and 99.7% for cTnI •correspondence between POC and control was 94.8% for cTnT and 98.7% for cTnI) 	
<p>Newby et al 2000 USA (CHECKMATE)</p>	<p>1005 patients with CP, comparison of serial POC testing of two multimarker strategies (MMS I=Myo, CK-MB and cTnI; MMS II = CK-MB and cTnI) with local lab results (LL)</p>	<p>Multi-center, prosp</p>	<p>relationship of marker status with 30 day death or infarction</p> <p>eff of bedside testing on time to detection of positive results</p>	<ul style="list-style-type: none"> •more patients positive by 24 hours with MMS than LL (MMS I 23.9%; MMS II 18.8%; LL 8.8%) •pts became positive sooner with MMS I (2.5 hours) vs MMS II (2.8 hours) or LL 3.4 hours) •relationship between baseline MMS status and 30 day death or infarct was stronger •MMS I discriminated 30 day death better (pos 2.0% vs negative 0%; p = 0.007) than MMS II (pos 1.8% vs negative 0/2%; p = 0.055) or LL (positive 0.0% vs negative 0.5%; p = 1.000) 	<p>clinical decisions based on results from local lab</p>

Goldmann et al 2004 Germany	741 consec patients with chest pain < 12 hrs; comparison of results of serial quant POC test for Myo and cTnT (Cardiac Reader) to local lab results	prosp, multi-center	comparison of POC testing to local lab results cardiac complic or interventions during hosp stay and 30 days after E.D. visit	Sens of POC cTnT = 62% at presentation to E.D. (LL CK-MB 52%) 97% after 2 nd set Sens of POC cTnT greater than POC myoglobin at presentation (65.5% vs. 59.3%) and at 4 hrs (84.8% vs. 81.2%)	
Yamamoto et al. 2004 Japan	34 consec patients with AMI and cath, serial measurments of cTnT and Myo with quant POC ("Cardiac reader"), compared to local lab results for cTnT and CK-MB	prosp	correlation of results of POC quant test for cTnT and Myo with local lab results for CK-MB and cTnT	Cardiac reader PLUS LL results for CK-MB more sensitive in early phase than any of other tests individually and is equivalent in sensitivity to CK-MB (conventional) after 3 hours.	1. very small sample size 2. patients with AMI only 3. confusing comparisons
Kratz et al. 2002 USA	412 consec patients presenting to ED with possible ACS who had positive result on POC test (qualit for CK-MB, Myo and cTnI)	prosp	correlation between results on POC and local lab results assess PPV for ACS of multimarker POC	overall PPV of any positive marker on POC is 36% PPV increases to 76% when all 3 markers positive (compared to PPV of 59% for CK-MB and 78% for cTnT with local lab)	1. data for 143 patients could not be used 2. one time measurement at presentation
McCord et al. 2001 USA	817 patients presenting to ED with possible AMI, comparison of serial measurements of POC Myo CK-MB and cTnI with central lab results for CK-MB	prosp	diagnosis of AMI	Combin. of cTnI and Myo results at 0 and 90 minutes had highest NPV (99.6%) and sensitivity (96.7%) for determination of AMI during the first 3 hours. Lab result reporting was 57 minutes faster with POC assay	Used CK-MB as standard rather than troponin
Hirschl et al. 2000 Germany and Austria	510 patients with suspected AMI in E.D. and ICU, serial measurements of qual cTnT compared to lab results for cTnT and CK-MB	prosp	diagnosis of AMI or UA	AMI: POC cTnT 25% sens at 4 hours, 95% sens at 8 hours. Specificity: 88%. NPV for cTnT 97% for interval 4-8 hours. U/A: cTnT sensitivity 100%, specificity 69-96%	
McCullough et al. 2002 USA	1,024 consec. pts eval for AMI in E.D., serial enzymes in local lab and quant POC for Myo, CK-MB and cTnI	retrospectiv e review of data collected prospectively	Creatinine clearance 30 day outcomes AMI	100% sens, 54.3% specificity, 13.8% PPV and 100% NPV for any one marker being positive. Troponin I as a stand alone test had 99.9% sensitivity, 64.1% specificity, 19.3% PPV and 99.9% NPV	1. retrospective 2. low rate of actual MI

Clinical bottom line: Cardiac Troponin I POC testing (two sets drawn 4-9 hours apart) as a stand alone test has been shown to have good sensitivity (99.9-100%) and good negative predictive value (99.7-99.9%) for the detection of acute myocardial infarction in prospective and retrospective studies.

The faster turn around time for results of point-of-care Troponin I as compared to central lab results decreases length of stay in the emergency department by as much as two hours.

Apple FS, Ler R et al. Point-of-care i-STAT cardiac troponin I for assessment of patients with symptoms suggestive of acute coronary syndrome. *Clin. Chem.* 2006; 52:322-325.

Caragher TE, Fernandez B et al. Evaluation of quantitative cardiac biomarker point-of-care testing in the emergency department. *J Emerg Med.* 2002;22(1):1-7.

Altinier S, Zaninotto M et al. Point-of-care testing of cardiac markers: results from an experience in an emergency department. *Clin. Chim Acta* 2001;311:67-72.

Hamm CW, Goldmann BU et al. Emergency room triage of patients with acute chest pain by means of rapid testing for cardiac troponin T or troponin I. *New Engl J Med* 1997;337 (23):1648-1653.

Newby LK, Storrow AB et al. Bedside multimarker testing for risk stratification in chest pain units (CHECKMATE study). *Circulation* 2001;103:1832-1837.

Goldmann BU, Langenbrink L et al. Quantitative bedside testing of troponin T: is it equal to laboratory testing? *Clin Lab* 2004;50:1-10.

Yamamoto M, Komiyama N et al. Usefulness of rapid quantitative measurement of myoglobin and troponin T in early diagnosis of acute myocardial infarction. *Circ J* 2004; 68:639-644

Kratz A, Januzzi JL et al. Positive predictive value of a point-of-care testing strategy on first-draw specimens for the emergency department-based detection of acute coronary syndromes. *Arch Pathol Lab Med* 2002;126:1487-1493.

McCord J, Nowak RM et al. Ninety-minute exclusion of acute myocardial infarction by use of quantitative point-of-care testing of myoglobin and troponin I. *Circulation* 2001;104:1483-1488.

Hirschl MM, Herkner H et al. Analytical and clinical performance of an improved qualitative troponin T rapid test in laboratories and critical care units. *Arch Pathol Lab Med* 2000; 124:583-587.

McCullough PA, Nowak RM et al. Performance of multiple cardiac biomarkers measured in the emergency department in patients with chronic kidney disease and chest pain. *Acad Emerg Med* 2002; 9(12) 1389-1396.

Apple FS, Murakami MM et al. Analytical performance of the i-STAT cardiac troponin I assay. *Clin Chim Acta* 2004; 345:123-127.

Singer AJ, Ardise J et al. Point-of-care testing reduces length of stay in emergency department chest pain patients. *Ann Emerg Med* 2005; 45(6):587-591.

