T-050

Evaluation of the Stratus CS/Stratus CS 200 Acute Care Diagnostic Systems and ADVIA Centaur XP Immunoassay System for Cardiac Troponin I

Author: Bethoney C.
Siemens Healthcare Diagnostics Inc., Norwood, MA, U.S.

Abstract

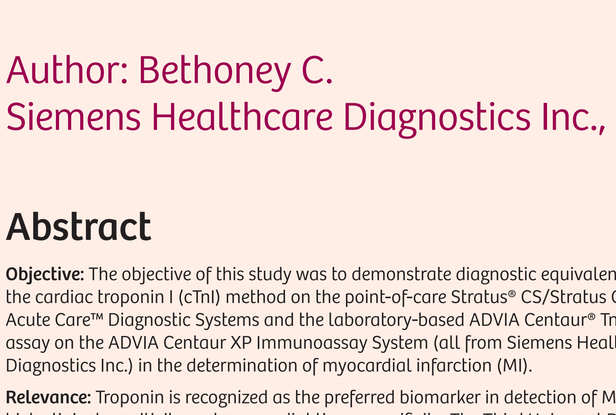
Objective: The objective of this study was to demonstrate diagnostic equivalence between the cardiac troponin I (cTnI) method on the point-of-care Stratus® CS/Stratus CS 200* Acute Care™ Diagnostic Systems and the laboratory-based ADVIA Centaur® TnI-Ultra™ assay on the ADVIA Centaur XP Immunoassay System (all from Siemens Healthcare Diagnostics Inc.) in the determination of myocardial infarction (MI).

Relevance: Troponin is recognized as the preferred biomarker in detection of MI given its high clinical sensitivity and myocardial tissue specificity. The Third Universal Definition of MI, endorsed by the European Society of Cardiology (ESC), the American College of Cardiology Foundation (ACCF), the American Heart Association (AHA), and the World Heart Federation (WHF) and adopted by the World Health Organization (WHO), requires at least one cTnI value above the 99th percentile upper reference limit (URL) during patient monitoring for detection of MI. The cTnI methods on the Stratus CS/Stratus CS 200 and ADVIA Centaur XP systems are considered guideline-acceptable as they each display optimal precision at their 99th percentile URL with a coefficient of variation (CV) ≤10%, allowing reliable detection of changing cTnI values.

Background

ADVIA Centaur XP Immunoassay System

The ADVIA Centaur XP Immunoassay System is a fully automated platform used in the central laboratory for increased levels of efficiency. The concentration of cTnI of a given sample is measured using acridinium ester (AE) technology. The measuring interval for the ADVIA Centaur TnI-Ultra assay on the ADVIA Centaur XP system is 0.006–50.0 ng/mL, with a 99th percentile URL for MI of 0.04 ng/mL.



ADVIA Centaur XP Immunoassay System

Stratus CS 200 and Stratus CS Acute Care Diagnostic Systems

The Stratus CS 200 and Stratus CS Acute Care systems are near-patient benchtop analyzers typically used in the emergency department for the evaluation of patients with suspected MI. The concentration of cTnI of a given sample is measured using dendrimer-enhanced radial partition immunoassay (DE RPIA) technology. The measuring interval for the cTnI assay on the Stratus CS platforms is 0.03–50.0 ng/mL, with a 99th percentile URL for MI of 0.07 ng/mL.

Stratus CS 200 Acute Care System

Stratus CS Acute Care System

Method

A concordance study was performed at the Siemens Healthineers Edgewater site in Norwood, MA, using frozen, lithium heparinized plasma samples from 110 patients suspected of having MI. Two time points were obtained per patient, including at time of presentation and the next sequential blood draw. Specimens were collected under IRB protocol from MultiCare Good Samaritan and Tacoma General Hospitals in the state of Washington. Samples were frozen and shipped for concurrent processing on the Stratus CS platforms and ADVIA Centaur XP Immunoassay System. Patients were categorized as positive or negative for MI based on the presence or absence of at least one elevated cTnI value between both patient draws for each platform relative to the URL. Final diagnosis according to the Third Universal Definition of MI was provided for each patient as the reference standard for comparison.

Results

Contingency tables (Tables 1–3) were generated in accordance with CLSI EP12-A2, User Protocol for Evaluation of Qualitative Test Performance; Approved Guideline, comparing the patient outcome as determined by the Stratus CS platforms and ADVIA Centaur XP Immunoassay System to the reference standard. The Stratus CS system analysis has three fewer patients due to sample volume constraints during testing. The ADVIA Centaur XP system correctly classified all tested patients as either positive or negative for MI. The Stratus CS/Stratus CS 200 systems incorrectly classified the same two positive MI patients based on cTnI values alone. Changes in cTnI were detected; however, the values were reported below the 99th percentile URL of 0.07 ng/mL. It is important to note the Third Universal Definition of MI also requires ischemic symptoms and/or electrocardiogram findings consistent with MI in conjunction with an elevated cTnI value, and patients will be treated based on all clinical findings, which was outside the scope of this study.

Table 1. Overall patient outcome: ADVIA Centaur XP Immunoassay System vs. Diagnosis.

	Diagnosis		
ADVIA Centaur XP System	**Positive**	**Negative**	**Total**
Positive	50	0	50
Negative	0	60	60
Total	50	60	110

Table 2. Overall patient outcome: Stratus CS 200 Acute Care Diagnostic System vs. Diagnosis.

	Diagnosis		
Stratus CS 200 System	**Positive**	**Negative**	**Total**
Positive	48	0	48
Negative	2	60	62
Total	50	60	110

Table 3. Overall patient outcome: Stratus CS Acute Care Diagnostic System vs. Diagnosis.

	Diagnosis		
Stratus CS System	**Positive**	**Negative**	**Total**
Positive	47	0	47
Negative	2	58	60
Total	49	58	107

Comparative receiver operating characteristic (ROC) curves were generated for each time point in accordance with CLSI EP24-A2, Assessment of the Diagnostic Accuracy of Laboratory Tests Using Receiver Operating Characteristic Curves; Approved Guideline, in order to visually display the sensitivity and specificity of each platform across the measuring interval. Figures 1 and 2 show comparative ROC curves for each patient draw.

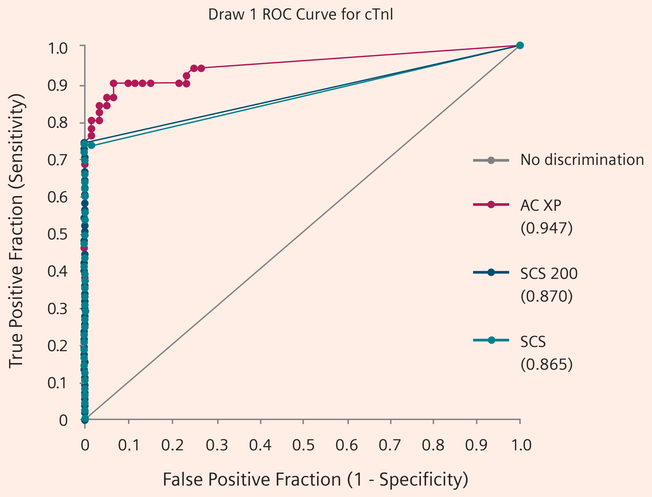


Figure 1. Comparison of Draw 1 receiver operating characteristic (ROC) curves for cTnI on the Stratus CS 200 system, Stratus CS system, and ADVIA Centaur XP system.

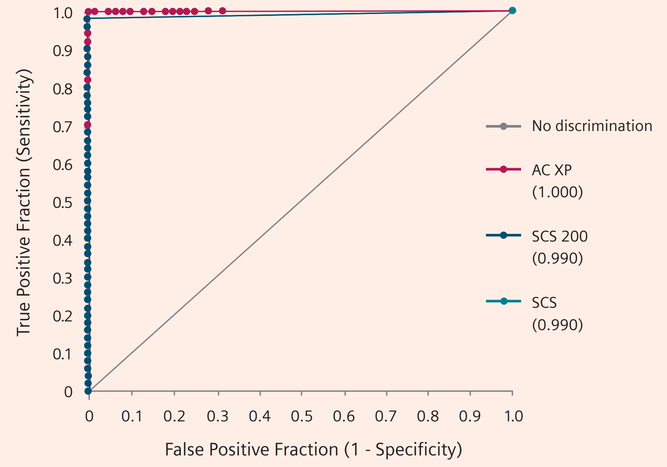


Figure 2. Comparison of Draw 2 receiver operating characteristic (ROC) curves for cTnI on the Stratus CS 200 system, Stratus CS system, and ADVIA Centaur XP system.

Table 4 lists performance measures for each system, including sensitivity, specificity, predictive values, and areas under each curve (AUC). A test with an AUC of 1 indicates perfect classification of MI and non-MI patients.

Table 4. Diagnostic performance measures for cTnI on Stratus CS 200, Stratus CS, and ADVIA Centaur XP systems.

Measure	ADVIA Centaur XP System	Stratus CS 200 System	Stratus CS System
Sensitivity, 95% confidence interval (%)	100.0 (92.9–100.0)	96.0 (86.5–98.9)	95.9 (86.3–98.9)
Specificity, 95% confidence interval (%)	100.0 (94.0–100.0)	100.0 (94.0–100.0)	100.0 (93.8–100.0)
Positive predictive value (%)	100.0	100.0	100.0
Negative predictive value (%)	100.0	96.8	96.7
Draw 1 area under the curve, 95% confidence interval	0.947 (0.902–0.991)	0.870 (0.809–0.931)	0.865 (0.801–0.929)
Draw 2 area under the curve, 95% confidence interval	1.000 (1.000–1.000)	0.990 (0.970–1.000)	0.990 (0.970–1.000)

Comparative performance measures for the Stratus CS and CS 200 systems versus the ADVIA Centaur XP system are provided in Table 5, including the differences in sensitivity, specificity, and the areas under each curve, along with the *p* values associated with a test of significance. A *p* value >0.05 indicates no statistical difference between AUC values of the assays being compared. The *p* values for comparisons between the Stratus CS/Stratus CS 200 systems versus the ADVIA Centaur XP system were <0.05 for Draw 1 AUC values, while the addition of a second patient draw generated *p* values that were >0.05, indicating no statistical difference between the point-of-care and central laboratory systems in the ability to classify MI from non-MI patients when serial patient draws for cTnI are performed.

Table 5. Comparisons between the Stratus CS 200, Stratus CS, and ADVIA Centaur XP systems for diagnostic performance measures for cTnI.

Comparison	Measure	Difference (%)	95% Confidence Interval *p* Value
Stratus CS 200 system vs. ADVIA Centaur XP system	Sensitivity	−4.0	−13.5 to 3.7
	Specificity	0.0	−6.0 to 6.0
	Draw 1 AUC	−0.08	−0.13 to −0.03 *0.0037*
	Draw 2 AUC	−0.01	−0.03 to 0.01 *0.3173*
Stratus CS system vs. ADVIA Centaur XP system	Sensitivity	−4.1	−13.7 to 3.6
	Specificity	0.0	−6.2 to 6.0
	Draw 1 AUC	−0.08	−0.13 to −0.03 *0.0026*
	Draw 2 AUC	−0.01	−0.03 to 0.01 *0.3173*

Conclusion

Clinical concordance was demonstrated for the cardiac troponin I method between the Stratus CS and CS 200 point-of-care analyzers and the laboratory-based ADVIA Centaur XP Immunoassay System in the determination of myocardial infarction.

*Stratus CS 200 Acute Care Diagnostic System is not available for sale in the U.S.
Product availability varies by country.

A91DX-POC-170034-GC1-4A00

siemens.com/healthineers