

Overview**Useful For**

Detecting the macro forms of creatine kinase (CK)

Identifying the source of a CK elevation

Profile Information

Test ID	Reporting Name	Available Separately	Always Performed
CK	Creatine Kinase (CK), S	Yes	Yes
CKER	CK Isoenzyme Elec, Specimen Only	No	Yes

Reflex Tests

Test ID	Reporting Name	Available Separately	Always Performed
CKE	CK Isoenzyme Electrophoresis, S	No	No

Testing Algorithm

Testing begins with total creatine kinase analysis (CK). If the total CK activity is below 100 U/L, testing is complete.

If total CK activity is 100 U/L or greater, then isoenzyme electrophoresis (CKE) will be performed at an additional charge.

Method Name

CK: Photometric, Creatine Phosphate + ADP

CKE: Electrophoresis, Densitometry

NY State Available

Yes

Specimen**Specimen Type**

Serum

Ordering Guidance

This test is not appropriate for the detection of myocardial injury and should not be used for that purpose. For diagnosis of an acute myocardial infarction order TRPS / Troponin T, 5th Generation, Plasma.

Necessary Information

1. Patient's age and sex are required.

2. Include date and time of draw.

Specimen Required

Container/Tube:

Preferred: Serum gel

Acceptable: Red top

Specimen Volume: 2 mL

Collection Instructions:

1. Serum gel tubes should be centrifuged within 2 hours of collection.
2. Red-top tubes should be centrifuged and aliquoted within 2 hours of collection.

Specimen Minimum Volume

0.75 mL

Reject Due To

Gross hemolysis	Reject
Gross lipemia	OK
Gross icterus	OK

Specimen Stability Information

Specimen Type	Temperature	Time	Special Container
Serum	Refrigerated (preferred)	7 days	
	Frozen	28 days	

Clinical and Interpretive

Clinical Information

Creatine kinase (CK) activity is found in the cytoplasm of several human tissues; major sources of CK include skeletal muscle, myocardium, and the brain. Cytoplasmic CK isoenzymes are dimers of the subunits M and B (MM, MB, or BB). Brain tissue contains predominantly CK-BB (CK1). Skeletal muscle contains almost exclusively CK-MM (CK3). The myocardium contains approximately 30% of CK-MB (CK2), which has been called the "heart-specific" isoenzyme. CK-MB is increased in acute myocardial infarction (AMI); however, CK-MB has been replaced by troponin as the preferred biomarker for the diagnosis of AMI.

Mitochondrial CK, located at the outer surface of the inner mitochondrial membrane, has been suggested to catalyze the rate-limiting step of energy transfer from mitochondrial adenosine triphosphate (ATP) with the formation of creatine phosphatase (CP). The CP molecule, which is smaller in size than ATP, diffuses to target organelles in the

cytoplasm where its energy is transferred to ATP by cytoplasmic CK. CK activity results in nonaerobic production of ATP in muscle tissues during work.

Macro CK refers to at least 2 forms of CK. Macro CK type I is an antibody-bound form of cytoplasmic CK. It migrates between CK-MM and CK-MB. Macro CK type II (mitochondrial CK) migrates slightly cathodic of CK-MM. Detection of macro forms of CK is the primary reason for electrophoresis of CK activity.

Reference Values

CREATINE KINASE, TOTAL

Males

< or =3 months: not established

>3 months: 39-308 U/L

Females

< or =3 months: not established

>3 months: 26-192 U/L

Reference values have not been established for patients that are less than 3 months of age.

Note: Strenuous exercise or intramuscular injections may cause transient elevation of creatine kinase (CK).

CREATINE KINASE ISOENZYMES

MM: 100%

MB: 0%

BB: 0%

Interpretation

Creatine kinase (CK)-MB appears in serum 4 to 6 hours after the onset of pain in a myocardial infarction, peaks at 18 to 24 hours, and may persist for 72 hours.

CK-MB may also be elevated in cases of carbon monoxide poisoning, pulmonary embolism, hypothyroidism, crush injuries, and muscular dystrophy.

Extreme elevations of CK-MB can be associated with skeletal muscle cell turnover as in polymyositis, and to a lesser degree in rhabdomyolysis, as seen in strenuous exercise, particularly in the conditioned athlete.

CK-BB can be elevated in patients with head injury, in neonates, and in some cancers such as prostate cancer and small cell carcinoma of the lung. It can also be elevated in other malignancies; however, the clinical usefulness of CK-BB as a tumor marker needs further investigation.

The presence of macro CK can explain an elevation of total CK. It does not rise and fall as rapidly as CK-MM and CK-MB in muscle injury.

Macro CK type II (mitochondrial CK) is rarely observed. It is only seen in acutely ill patients with malignancies and

other severe illnesses with a high-associated mortality, such as liver disease and hypoxic injury.

Cautions

In some patients, the presence of creatine kinase (CK)-MB is method dependent.

CK-MB values that exceed 50% of the total CK probably reflect unusual B subunit synthesis since heart muscle rarely exceeds 30% MB.

Clinical Reference

1. Apple FS, Quist HE, Doyle PJ, et al: Plasma 99th percentile reference limits for cardiac troponin and creatine kinase MB mass for use with European Society of Cardiology/American College of Cardiology consensus recommendations. Clin Chem 2003 Aug;49(8):1331-1336
2. Danese E, Montagnana M: An historical approach to the diagnostic biomarkers of acute coronary syndrome. Ann Transl Med 2016;4(10):194 doi:10.21037/atm.2016.05.19

Performance**Method Description**

Creatine Kinase, Total:

Creatine kinase (CK) is determined by a coupled enzyme reaction where the rate of NADPH formation is measured photometrically and is directly proportional to the CK activity. (Package insert: Roche CK reagent. Indianapolis, IN, July 2016)

Creatine Kinase Isoenzymes:

Electrophoresis is the migration of charge particles in an electrical field. The rate of migration is dependent on such factors as: 1) net electrical charge of the molecule, 2) size and shape of the molecule, 3) strength of the electrical field, 4) properties of the supporting medium, and 5) temperature of the operation.

In this procedure, serum CK is separated into the 3 main isoenzymes of CK (MM, MB, and BB) by electrophoretic separation on agarose gel. After electrophoresis, the separated CK isoenzymes are visualized using a chromogenic substrate. The amount of resulting chromogenic product (formazan precipitate) is proportional to the CK enzymatic activity.

The films are then dried and densitometry is used to quantitate the bands. (Package insert: Sebia Hydragel ISO-CK, Sebia, Norcross, GA March 2016)

PDF Report

No

Day(s) Performed

CK, total: Monday through Sunday

CK isoenzymes: Tuesday, Thursday

Report Available

1 to 8 days

Specimen Retention Time

1 week

Performing Laboratory Location

Rochester

Fees and Codes**Fees**

- Authorized users can sign in to [Test Prices](#) for detailed fee information.
- Clients without access to Test Prices can contact [Customer Service](#) 24 hours a day, seven days a week.
- Prospective clients should contact their Regional Manager. For assistance, contact [Customer Service](#).

Test Classification

This test has been cleared, approved, or is exempt by the US Food and Drug Administration and is used per manufacturer's instructions. Performance characteristics were verified by Mayo Clinic in a manner consistent with CLIA requirements.

CPT Code Information

82550-CK, total

82552-CK isoenzymes (If appropriate)

LOINC® Information

Test ID	Test Order Name	Order LOINC Value
CKELR	Creatine Kinase Isoenzyme Reflex, S	2157-6

Result ID	Test Result Name	Result LOINC Value
CK	Creatine Kinase (CK), S	2157-6
CKER	CK Isoenzyme Elec, Specimen Only	31208-2