Yakima Valley Memorial Laboratory Document

VALLEY IMAGING ISTAT CREATININE

PURPOSE:

Intended Use

The i-STAT Crea cartridge with the i-STAT System is intended for use in the *in vitro* quantification of creatinine in venous whole blood. Creatinine measurements are used in the diagnosis and treatment of renal diseases, in monitoring renal dialysis, and as a calculation basis for measuring other urine analytes.

Summary and Explanation/Clinical Significance

Elevated levels of creatinine are mainly associated with abnormal renal function and occur whenever there is a significant reduction in glomerular filtration rate or when urine elimination is obstructed. The concentration of creatinine is a better indicator of renal function than urea or uric acid because it is not affected by diet, exercise, or hormones. The creatinine level has been used in combination with BUN to differentiate between prerenal and renal causes of an elevated urea/BUN.

Biological Principals of the Procedure

Creatinine is measured amperometrically. It is hydrolyzed to creatine in a reaction catalyzed by the enzyme creatinine amidohydrolase. Creatine is then hydrolyzed to sarcosine by creatine amidinohydrolase. The oxidation of sarcosine, catalyzed by sarcosine oxidase, produces hydrogen peroxide (H2O2). The liberated hydrogen peroxide is oxidized at the platinum electrode to produce a current which is proportional to the sample creatinine concentration

SPECIMEN:

Maintaining Sample Integrity

Evacuated tubes with lithium heparin anticoagulant, fill to capacity. Test within 30 minutes of collection.

MATERIALS:

i-STAT Creatinine cartridges

Cartridge Storage and Stability

When refrigerated at 2-8 °C (35-46 °F), cartridges are stable until the expiration date.

Cartridges may be stored at room temperature at 18-30 °C (64-86 °F) for the timeframe indicated on the cartridge box (14 days).

Individual cartridges may be used after standing five minutes at room temperature. An entire box of cartridges should stand at room temperature for one hour prior to use. All cartridges should be used immediately after opening the portion pack (individual cartridge package). If the portion pack has been punctured, the cartridge should not be used.

Each i-STAT Creatinine cartridge contains all the necessary reagents for the test. A list of reactive ingredients is provided below:

Sensor	Reactive Ingredient	Biological Source	Minimum Quantity
Crea	Creatinine	N/A	158.4 µmol/L
	Creatine Amidinohydrolase	Microbial	0.01 IU
	Creatinine Amidohydrolase	Microbial	0.02 IU
	Sarcosine Oxidase	Microbial	0.001 IU

Cartridge Warnings and Precautions

For in vitro diagnostic purposes only. Cartridges are intended for single-use only. Do not reuse.

Although the sample is contained within the cartridge, cartridges should be disposed of as biohazardous waste according to local, state, and national regulatory guidelines. For additional warnings and precautions pertaining to the i-STAT System, refer to the i-STAT 1 System Manual.

Quality Control Storage and Stability

i-STAT TriControl Level 1 and Level 3 materials are liquid and should be stored at 2 to 8 ˚C (35 to 46 ˚F) until expiration date on box or ampule labels. Allow the materials to reach room temperature before beginning the test, minimum of 30 minutes. Control ampules may be stored at room temperature (18 to 30 ˚C or 64 to 86 ˚F) for up to 5days. Do not use after expiration date on box or ampule labels. Do not return controls to refrigerator once they have been brought to room temperature

QUALITY CONTROL:

Quality Control Procedure

Liquid quality Controls are run with each new lot, new shipment, or at least every 31 days. See Point of Care Quality Control Procedure for reference. i-STAT TriControl Level 1 and Level 3 are stored at 2 to 8 ˚C (35 to 46 ˚F). Allow the materials to reach room temperature before beginning the test, minimum of 30 minutes.

1. Turn on the iSTAT.

2. Select Menu  , 3-Quality Test, 1-Control.
3. Scan user ID badge.
4. Select 1-APOC, Select level (1 or 3).
5. Scan control lot number, scan cartridge lot number.
6. Open cartridge packaging and fill the cartridge from the control dropper top.
7. Seal Cartridge and insert it into the analyzer

Troubleshooting Failed QC

Verify that the following conditions are met and then repeat the test:

- The correct expected values insert is being used and the correct cartridge type and lot number listing is being used.
- Expiration date printed on cartridge pouch and control ampule or vial have not been exceeded.
- Room temperature expiration date for cartridge and control have not been exceeded.
- Cartridge and control have been stored correctly.
- The control has been handled correctly–see the directions for use.
- The analyzer being used passes the Electronic Simulator test.

If the results are still out of range despite meeting the above criteria, repeat the test using a new box of control solutions and/or cartridges. If the results are still out of range, refer to Support Services information in the Technical Bulletins section, call the Point of Care department in the lab 574-5847.

Target Values and Ranges

Target values (determined by testing multiple vials of each level using multiple lots of cartridges and i-STAT 1 analyzers that pass the Electronic Simulator test) are printed on a Value Assignment Sheet posted on the APOC website at www.pointofcare.abbott . The Value Assignment Sheet displays target values and ranges expected when controls and equipment are performing properly. See troubleshooting failed QC section for procedures to follow if control results are out of range. Target values are specific to the i-STAT System. Always ensure that the control material lot number and software revision on the Value Assignment Sheet matches the lot number of the vial in use and the software version in the handheld.

QUALITY ASSURANCE:

External simulator/thermal probe checks will be performed biennially following the software update.

CALIBRATION:

Calibration is not required.

PROCEDURE:

The i-STAT Creatinine cartridge requires a minimum sample volume of 65 µL to fill.

1. Press ⏻ to turn on the handheld.
2. Press 2- i-STAT cartridge.
3. Scan operator ID.
    - Position barcode 3-9 inches from scanner window on the handheld.
    - Press and hold to activate the scanner.
    - Align the red laser light so it covers the entire barcode.
    - The handheld will beep when it reads the barcode successfully.
4. Scan patient ID: wristband, lab draw barcode or chart label.
5. Scan the lot number on the cartridge pouch.
6. Continue normal procedures for preparing the sample, and filling and sealing the cartridge.
7. Push the sealed cartridge into the handheld port until it clicks into place.
8. Enter time (in military time including leading zeros if present) and sample type (select Menu and then required sample type).
9. Wait for the test to complete.
10. Review results. Indeterminate or questionable results should be repeated by different method.
11. Place device in downloader or transmit results by selecting 1-Test Options, 4-Transmit data. The device will automatically transmit data prior to it turning off or when placed in the downloader.

RESULT REPORTING:

The results will transmit to the patient's chart when the device is turned off, docked in the docking station, or when Transmit data is selected.

REFERENCE RANGES:

Reference range: 0.7 -1.4 mg/dL
Reportable range: 0.03 – 17.0 mg/dL

LIMITATIONS OF PROCEDURES:

The following substances were evaluated in plasma for relevant analyte at the test concentrations recommended in CLSI guideline EP7-A2 6 unless otherwise noted. For those identified as an interferant the interference is described.

Substance	Test Concentration (mmol/L)	Analyte	Interference (Yes/No)	Comment
Acetaldehyde	0.04 7	Crea	No	
Acetaminophen	1.32	Crea	Yes	Increased results
Acetaminophen (therapeutic)	0.132 [7]	Crea	No	
Acetylcysteine	10.2	Crea	Yes	Increased results
Acetylcysteine (therapeutic)	0.3 8 9	Crea	No	
Ascorbate	0.34	Crea	Yes	Increased by up to 0.3 mg/dL
Bicarbonate	35.0	Crea	No	
Bilirubin	0.342	Crea	No	
Bromide (therapeutic)	[2.5] 10 11 12	Crea	Yes	Increased results
Calcium Chloride	5.0	Crea	No	
Creatine	0.382	Crea	Yes	Increased by up to 0.3 mg/dL. See Other Factors Affecting Results below for CO_2 dependence
Dopamine	0.006	Crea	No	
Formaldehyde	0.133 [7]	Crea	No	
β -Hydroxybutyrate	6.0 13	Crea	No	
Glycolic Acid	10.0	Crea	Yes	Decreased results. Use another method.
Hydroxyurea	0.92	Crea	Yes	Increased results. Use another method.
Lactate	6.6	Crea	No	
Methyldopa	0.071	Crea	No	
Nithiodote (Sodium thiosulfate)	16.7 14	Crea	Yes	Increased results
Pyruvate	0.31	Crea	No	
Salicylate	4.34	Crea	No	
Uric Acid	1.4	Crea	No	

The degree of interference at concentrations other than those reported above might not be predictable. It is possible that interfering substances other than those tested may be encountered.

Relevant comments regarding interference are noted below:

- Acetaminophen has been shown to interfere with i-STAT creatinine results at a 1.32 mmol/L, a toxic concentration that is proscribed by the CLSI guideline. Acetaminophen at 0.132 mmol/L, which represents the upper end of the therapeutic concentration range, has been shown not to significantly interfere with i-STAT creatinine results.
- Acetylcysteine has been tested at two levels: the CLSI recommended level of 10.2 mmol/L and a concentration of 0.30 mmol/L. The latter is 3 times the peak plasma therapeutic concentration associated with treatment to reverse acetaminophen poisoning. APOC has not identified a therapeutic condition that would lead to levels consistent with the CLSI recommended level. Acetylcysteine at a concentration of 10.2 mmol/L increased i-STAT creatinine results, while acetylcysteine at a concentration of 0.3 mmol/L did not significantly interfere with i-STAT creatinine results.
- Bromide has been tested at two levels: the CLSI recommended level and a therapeutic plasma concentration level of 2.5 mmol/L. The latter is the peak plasma concentration

associated with halothane anesthesia, in which bromide is released. APOC has not identified a therapeutic condition that would lead to levels consistent with the CLSI recommended level. Bromide tested at concentrations of 2.5 and 37.5 mmol/L interfered with i-STAT creatinine results.

- Hydroxyurea is a DNA synthesis inhibitor used in the treatment of various forms of cancer, sickle cell anemia, and HIV infection. This drug is used to treat malignancies including melanoma, metastatic ovarian cancer, and chronic myelogenous leukemia. It is also used in the treatment of polycythemia vera, thrombocythemia, and psoriasis. At typical doses ranging from 500 mg to 2 g/day, concentrations of hydroxyurea in patients' blood may be sustained at approximately 100 to 500 µmol/L. Higher concentrations may be observed soon after dosing or at higher therapeutic doses.
- Nithiodote (sodium thiosulfate) is indicated for the treatment of acute cyanide poisoning. The journal article titled "Falsely increased chloride and missed anion gap elevation during treatment with sodium thiosulfate" indicated that sodium thiosulfate could be used in the treatment of calciphylaxis indicating that "the highest concentration likely to be seen in plasma [is] after infusion of a 12.5 g dose of sodium thiosulfate pentahydrate. Assuming that the 12.5 g dose of sodium thiosulfate pentahydrate is distributed in a typical blood volume of 5 L with a hematocrit of 40%, the peak sodium thiosulfate plasma concentration expected is 16.7 mmol/L."
- Creatines normal concentration in plasma is 0.17–0.70 mg/dL (13 – 53 µmol/L) in males and 0.35 – 0.93 mg/dL (27 – 71 µmol/L) in females. Creatine may be elevated in patients using creatine supplements, experiencing muscle trauma or other primary or secondary myopathies, taking statins for hyperlipidemia control, or in patients with hyperthyroidism or a rare genetic defect of the creatine transporter protein.
- CO_2 Dependence. The dependence of the i-STAT creatinine with respect to Carbon Dioxide (CO2) is as follows: For creatinine results ≤ 2.0 mg/dL, no correction for PCO2 is required. For creatinine results > 2.0 mg/dL, the following correction applies: $\text{Creatinine}_{\text{corrected}} = \text{creatinine} * (1 + 0.0025 * (PCO2 - 40))$

REFERENCES:

Creatinine Cartridge Test Information Sheet
i-STAT User's Manual

DOCUMENT REVIEW:

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Original Signature Date: 06/03/2021
Annual Review month: June
Effective Date for Use: 06/03/2021