MAYO CLINIC LABORATORIES

Test Definition: CARTF

Carbamazepine Profile, Serum

Overview

Useful For

Monitoring patients exhibiting symptoms of carbamazepine toxicity whose total serum carbamazepine concentration is within the therapeutic range, but who may be producing significant levels of the active metabolite epoxide

Free carbamazepine concentration may also be useful to monitor in patients with altered or unpredictable protein binding capacity

Profile Information

Test Id	Reporting Name	Available Separately	Always Performed
CARTA	Carbamazepine, Tot, S	Yes	Yes
1011E	Carb-10,11-Epoxide, S	No	Yes
CARF	Carbamazepine, Free, S	Yes	Yes

Method Name

CARTA: Homogeneous Microparticle Agglutination Immunoassay
1011E: Liquid Chromatography Tandem Mass Spectrometry (LC-MS/MS)
CARF: Ultrafiltration followed by Homogeneous Microparticle Agglutination Immunoassay

NY State Available

Yes

Specimen

Specimen Type

Serum Red

Specimen Required

Container/Tube: Red top
Specimen Volume: 2 mL
Submission Container/Tube: Plastic vial
Collection Instructions:
1. Draw blood 12 hours (trough value) after last dose.
2. Centrifuge and aliquot serum into a plastic vial within 2 hours of collection.

Forms

If not ordering electronically, complete, print, and send a Therapeutics Test Request (T831) with the specimen.

Specimen Minimum Volume

1 mL

Reject Due To

Gross hemolysis	Reject
Gross lipemia	Reject
Gross icterus	Reject

Specimen Stability Information

Specimen Type	Temperature	Time	Special Container
Serum Red	Refrigerated (preferred)	7 days	
	Ambient	48 hours	
	Frozen	28 days	

Clinical & Interpretive

Clinical Information

Carbamazepine is a common antiepileptic drug. It is a first-line drug for treatment of partial seizures and trigeminal neuralgia.

Carbamazepine is metabolized by the liver to carbamazepine-10,11-epoxide (CBZ10-11), which is pharmacologically active and potentially toxic. CBZ10-11 is, in turn, inactivated by hepatic conversion to a transdiol derivative.

CBZ10-11 may be responsible for the congenital abnormalities that are sometimes associated with the use of carbamazepine during early pregnancy. There have been cases of severe seizures exacerbation when serum epoxide levels were increased. Toxic levels of CBZ10-11 can occur during:
-Concomitant administration of other drugs that induce hepatic oxidizing enzymes (eg, most antiepileptic drugs [with the exception of valproic acid and the benzodiazepines], propoxyphene)
-Concomitant administration of drugs that inhibit its breakdown such as valproic acid, felbamate, and lamotrigine
-High-dose carbamazepine therapy, especially in combination with the above conditions

Reference Values

CARBAMAZEPINE, TOTAL
Therapeutic: 4.0-12.0 mcg/mL
Critical value: > or =15.0 mcg/mL

CARBAMAZEPINE-10,11-EPOXIDE
Therapeutic: 0.4-4.0 mcg/mL
Toxic concentration: > or =8.0 mcg/mL

CARBAMAZEPINE, FREE
Therapeutic: 1.0-3.0 mcg/mL

Critical value: > or =4.0 mcg/mL

Interpretation

The clinically acceptable serum concentration of carbamazepine-10,11-epoxide (CBZ10-11) is not well established, but 4.0 mcg/mL has often been used as an upper limit for its therapeutic range.

The ratio of CBZ10-11 to carbamazepine is usually less than or equal to 0.2 mcg/mL in symptomatic adults and less than or equal to 0.3 mcg/mL in children.

Clinical correlation is aided by comparing values obtained when the patient is symptomatic with those obtained when the patient has improved.

Cautions

Routine determination of carbamazepine-10,11-epoxide (CBZ10-11) is not clinically indicated. It should be considered when the source of treatment in associated symptoms is not obvious.

Clinical Reference

1. Theodore WH, Narang PK, Holmes MD, et al: Carbamazepine and its epoxide: relation of plasma levels to toxicity and seizure control. Ann Neurol 1989;25:194-196
2. Tomson T, Almkvist O, Nilsson BY, et al: Carbamazepine-10, 11-epoxide in epilepsy. A pilot study. Arch Neurol 1990;47:888-892
3. McKauge L, Tyrer JH, Eadie MI: Factors influencing simultaneous concentrations of carbamazepine and its epoxide in plasma. Ther Drug Monit 1981;3:63-70
4. Brodie MJ, Forrest G, Rapeport WG: Carbamazepine-10,11-epoxide concentrations in epileptics of carbamazepine alone and in combination with other anticonvulsants. Br J Clin Pharmacol 1983;16:747-749
5. Shoeman JF, Elyas AA, Brett EM, Lascelles PT: Correlation between plasma carbamazepine-10,11-epoxide concentration and drug side-effects in children with epilepsy. Dev Med Child Neurol 1984;26:756-764

Performance

Method Description

Carbamazepine, Total:
The ONLINE TDM Carbamazepine Gen.4 assay is a homogeneous microparticle agglutination immunoassay. It is a 2-reagent system used for the detection of carbamazepine in serum. Kinetic interaction of microparticles (KIMS) will be measured using automated analyzers. In this technology, biotinylated drug hapten attached to streptavidin-coated latex beads serves as the binding partner to anti-carbamazepine antibody. A competitive reaction to a limited amount of specific anti-carbamazepine antibody takes place between the latex bound hapten and free carbamazepine in the serum sample. A decrease in the apparent signal is proportional to the amount of drug present in the sample.(Package insert: Carbamazepine reagent. Roche Diagnostics; 06/2024)

Carbamazepine, Free:
Free carbamazepine is isolated from serum by ultrafiltration. The ONLINE TDM Carbamazepine Gen.4 assay is a homogeneous microparticle agglutination immunoassay. It is a 2-reagent system used for the detection of carbamazepine in serum. Kinetic interaction of microparticles (KIMS) will be measured using automated analyzers. In

this technology, biotinylated drug hapten attached to streptavidin-coated latex beads serves as the binding partner to anti-carbamazepine antibody. A competitive reaction to a limited amount of specific anti-carbamazepine antibody takes place between the latex bound hapten and free carbamazepine in the serum sample. A decrease in the apparent signal is proportional to the amount of drug present in the sample.(Package insert: Carbamazepine reagent. Roche Diagnostics; 06/2024)

Carbamazepine-10,11-Epoxide:
Carbamazepine-10,11-epoxide is extracted by mixing serum samples with methanol (containing deuterated internal standard) to precipitate proteins. The supernatant is removed and diluted with water. It is then analyzed by a laboratory-developed liquid chromatography tandem mass spectrometry method.(Unpublished Mayo method)

PDF Report
No

Day(s) Performed
CARTA, CARF: Monday through Sunday
1011E: Tuesday

Report Available
Same day/1 to 7 days

Specimen Retention Time
CARTA: 1 week; CARF: 1 week; 1011E: 2 weeks

Performing Laboratory Location
Mayo Clinic Laboratories - Rochester Main Campus

Fees & 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 account representative. For assistance, contact Customer Service.

Test Classification
This test has been modified from the manufacturer's instructions. Its performance characteristics were determined by Mayo Clinic in a manner consistent with CLIA requirements. This test has not been cleared or approved by the US Food and Drug Administration.

CPT Code Information
80156-Carbamazepine, total
80157-Carbamazepine, free
80161-Carbamazepine-10,11-Epoxide

Test Definition: CARTF

Carbamazepine Profile, Serum

LOINC® Information

Test ID	Test Order Name	Order LOINC® Value
CARTF	Carbamazepine Profile, S	50337-5

Result ID	Test Result Name	Result LOINC® Value
7467	Carb-10,11-Epoxide, S	9415-1
CARTA	Carbamazepine, Tot, S	3432-2
CARF	Carbamazepine, Free, S	3433-0