

## 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, which can accumulate to concentrations equivalent to carbamazepine

### Profile Information

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

### Method Name

CARTA: Homogeneous Microparticle Agglutination Immunoassay

1011E: High-Performance Liquid Chromatography (HPLC)

### NY State Available

Yes

## Specimen

### Specimen Type

Serum Red

### Specimen Required

**Collection Container/Tube:** Red top

**Submission Container/Tube:** Plastic vial

**Specimen Volume:** 2 mL

#### Collection Instructions:

1. Draw blood 12 hours (trough value) after last dose.
2. Centrifuge and aliquot serum into a plastic vial.

### 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 concentration: 0.4-4.0 mcg/mL

Toxic concentration: > or =8.0 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 < or =0.2 mcg/mL in symptomatic adults and < or =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**

CARTA: 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: Roche Carbamazepine reagent, Roche Diagnostic Corp, Indianapolis, IN)

1011E: High-performance liquid chromatography (HPLC).(Chelberg RD, Gunawan S, Treiman DM: Simultaneous high-performance liquid chromatography determination of carbamazepine and its principal metabolites in human plasma and urine. *Ther Drug Monit* 1988;10:188-193)

**PDF Report**

No

**Day(s) Performed**

CARTA: Monday through Sunday

1011E: Tuesday

**Report Available**

Same day/1 to 7 days

**Specimen Retention Time**

CARTA: 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 was developed and its performance characteristics determined by Mayo Clinic in a manner consistent with CLIA requirements. It has not been cleared or approved by the US Food and Drug Administration.

**CPT Code Information**

80156-Carbamazepine, Tot, S

80161-Carbamazepine-10,11-Epoxide

**LOINC® Information**

| Test ID | Test Order Name                | Order LOINC® Value |
|---------|--------------------------------|--------------------|
| CARBG   | Carbamazepine-10,11-Epoxide, 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              |