Test Definition: CUT

Copper, Liver Ts

Overview

Useful For

Diagnosing Wilson disease and primary biliary cirrhosis using liver tissue specimens

Method Name

Inductively Coupled Plasma-Mass Spectrometry (ICP-MS)

NY State Available

Yes

Specimen

Specimen Type

Liver Tissue

Specimen Required

Patient Preparation: Gadolinium is known to interfere with most metals tests. If gadolinium-containing contrast media has been administered a specimen should not be collected for 96 hours.

Supplies: Metal Free Specimen Vial (T173)

Container/Tube:

Preferred: Mayo metal-free specimen vial (blue label)

Acceptable: Paraffin block if no more than 1 or 2 cuts have been made to it for slides

Specimen Volume: 2 mg

Collection Instructions:

1. **Two mg of liver tissue is required.** This is typically a piece of tissue from a 22-gauge needle biopsy at least 2 cm long. If an 18-gauge needle is used, the tissue must be at least 1 cm in length.

2. Any specimen vial other than a Mayo metal-free vial used should be plastic, leached with 10% nitric acid for 2 days, rinsed with redistilled water, and dried in clean air.

Additional Information: Paraffin blocks will be returned 3 days after analysis.

Forms

If not ordering electronically, complete, print, and send a Gastroenterology and Hepatology Client Test Request (T728) with the specimen.

Specimen Minimum Volume

2 cm (22-gauge needle)
1 cm (18-gauge needle)
2 mm x 2 mm (punch) 0.3 mg by dry weight

Reject Due To

All specimens will be evaluated at Mayo Clinic Laboratories for test suitability.

Specimen Stability Information

Specimen Type	Temperature	Time	Special Container
Liver Tissue	Refrigerated (preferred)		
	Ambient		
	Frozen		

Clinical and Interpretive

Clinical Information

Homeostatic regulation of copper metabolism is very complex. The liver is the key organ to facilitate copper storage and incorporation of copper into the transport protein ceruloplasmin. Intestinal absorption and biliary excretion also play major roles in the regulation of copper homeostasis.

Abnormal copper metabolism is associated with liver disease. Elevated serum copper concentrations are seen in portal cirrhosis, biliary tract disease, and hepatitis, probably because excess copper that would normally be excreted in the bile is retained in circulation. In primary biliary cirrhosis, ceruloplasmin is high, resulting in high serum copper. Lesser elevations of hepatic copper are found in chronic copper poisoning, obstructive jaundice, and certain cases of hepatic cirrhosis. Reduced serum copper concentration is typical of Wilson disease (hepatolenticular degeneration). Wilson disease is characterized by liver disease, neurologic abnormalities, and psychiatric disturbances. Kayser-Fleischer rings are normally present and urinary copper excretion is increased, while serum copper and ceruloplasmin are low.

Reference Values

10-35 mcg/g dry weight

>1,000 mcg/g dry weight: VERY HIGH

This finding is strongly suggestive of Wilson disease. If this finding is without supporting histology and other biochemical test results, contamination during collection, handling, or processing should be considered. Fresh tissue would be appropriate for copper measurement. Genetic test for Wilson disease (WDZ / Wilson Disease, Full Gene Analysis, Varies) is also available at Mayo Clinic. Call 800-533-1710 or 507-266-5700 if you need further assistance.

250-1,000 mcg/g dry weight: HIGH

This finding is suggestive of possible Wilson disease. If this finding is without supporting histology and other biochemical test results, contamination during collection, handling, or processing should be considered. Fresh tissue would be appropriate for copper measurement. Genetic test for Wilson disease (WDZ / Wilson Disease, Full Gene Analysis, Varies) is also available at Mayo Clinic. Call 800-533-1710 or 507-266-5700 if you need further assistance.

35-250 mcg/g dry weight: HIGH

Excessive copper at this level can be associated with cholestatic liver disease, such as primary biliary cirrhosis,

primary sclerosing cholangitis, autoimmune hepatitis, and familial cholestatic syndrome. Heterozygous carriers for Wilson disease occasionally have modestly elevated values, but rarely higher than 125 mcg/g of dry weight. In general, the liver copper content is higher than 250 mcg/g dried tissue in patients with Wilson disease. If this finding is without supporting histology and other biochemical test results, contamination during collection, handling, or processing should be considered. Fresh tissue would be appropriate for copper measurement. Genetic test for Wilson disease (WDZ / Wilson Disease, Full Gene Analysis, Varies) is also available at Mayo Clinic. Call 800-533-1710 or 507-266-5700 if you need further assistance.

Interpretation

The constellation of symptoms associated with Wilson disease (WD), which includes Kayser-Fleischer rings, behavior changes, and liver disease, is commonly associated with liver copper concentration above 250 mcg/g dry weight.

VERY HIGH: Above 1,000 mcg/g dry weight. This finding is virtually diagnostic of WD; such patients should be showing all the signs and symptoms of WD.

HIGH: 250 mcg/g dry weight to 1,000 mcg/g dry weight. This finding is suggestive of WD unless signs and symptoms, supporting histology, and other biochemical results (low serum ceruloplasmin, low serum copper, and high urine copper) are not evident.

HIGH: 35 mcg/g dry weight to 250 mcg/g dry weight. Excessive copper at this level can be associated with cholestatic liver disease, such as primary biliary cirrhosis, primary sclerosing cholangitis, autoimmune hepatitis, and familial cholestatic syndrome. The heterozygous carriers for WD occasionally have modestly elevated values, but rarely higher than 125 mcg/g of dry weight. In general, the liver copper content is higher than 250 mcg/g dried tissue in WD patients.

In patients with elevated levels of copper without supporting histology and other biochemical test results, contamination during collection, handling, or processing should be considered. Fresh tissue would be appropriate for copper measurement. Genetic test for WD (WDZ / Wilson Disease, Full Gene Analysis, Varies) is available at Mayo Clinic.

Cautions

Specimen handling should be minimized.

Elevated copper levels without supporting histology or other biochemical test results should instigate an investigation into whether the specimen has been contaminated.

A minimum tissue dry weight of 0.3 mg is required for analysis. This is the equivalent of a piece of tissue from a 22-gauge needle approximately 0.5 cm long, or approximately 0.3 cm in length when taken with an 18-gauge needle. Since the specimen must be manipulated during analysis, more than the minimal amount described in the previous sentence must be submitted for analysis.

Paraffin blocks that have been cut for slides may be contaminated if the microtome was previously used to cut specimens that had been fixed with a copper-containing solution. Many fixatives, such as Hollande's, contain high levels of copper. Any object that has been exposed to these fixatives (eg, cutting boards, towels, containers, utensils) that comes into contact with the tissue can potentially contaminate the specimen. Rinsing and washing will not remove the copper contaminant. Therefore, submission of fresh-frozen, unfixed tissue is strongly recommended.

Clinical Reference

1. Korman J, Volenberg I, Balko J, et al: Screening for Wilson disease in acute liver failure: a comparison of currently available diagnostic tests. Hepatology 2008 Oct;48(4):1167-1174

2. Roberts EA, Schlisky ML: Diagnosis and Treatment of Wilson Disease: AASLD Practice Guidelines. Hepatology 2008;47:2089-2111

3. de Bie P, Muller P, Wijmenga C, Klomp LW: Molecular pathogenesis of Wilson and Menkes disease: correlation of mutations with molecular defects and disease phenotypes. J Med Genet 2007 November;44(11):673-688

4. Merle U, Schaefer M, Ferenci P, Stremmel W: Clinical presentation, diagnosis and long-term outcome of Wilson's disease: a cohort study. Gut 2007;56:115-120

5. Nader R, Horwath AR, Wittwer CT: Tietz Textbook of Clinical Chemistry and Molecular Diagnostics. Sixth Edition. St. Louis: Elsevier 2018

Performance

Method Description

After digestion of the liver tissue with nitric acid and hydrogen peroxide, the digest is diluted and tissue copper concentration is analyzed by ICP-MS using gallium (Ga) as an internal standard and an aqueous acidic calibration.(Unpublished Mayo method)

PDF Report

No

Day(s) and Time(s) Test Performed

Monday, Wednesday, Friday; 11 a.m.

Analytic Time

2 days

Maximum Laboratory Time

5 days

Specimen Retention Time

Fresh tissue: Frozen; Block: Ambient

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 was developed and its performance characteristics determined by Mayo Clinic in a manner consistent with CLIA requirements. This test has not been cleared or approved by the U.S. Food and Drug Administration.

CPT Code Information

82525

LOINC® Information

Test ID	Test Order Name	Order LOINC Value
CUT	Copper, Liver Ts	8198-4

Result ID	Test Result Name	Result LOINC Value
8687	Copper, Liver Ts	8198-4