MAYO CLINIC LABORATORIES

Test Definition: CUT

Copper, Liver Tissue

Overview

Useful For

Diagnosing Wilson disease and primary biliary cirrhosis using liver tissue specimens

Special Instructions

- Metals Analysis Specimen Collection and Transport

Method Name

Inductively Coupled Plasma Mass Spectrometry (ICP-MS)

NY State Available

Yes

Specimen

Specimen Type

Liver Tissue

Specimen Required

Supplies: Metal Free Specimen Vial (T173)
Container/Tube:
Preferred: Metal-free specimen vial
Acceptable: Paraffin block with no more than 1 or 2 cuts previously made
Specimen Volume: 2 mg
Collection Instructions: 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.
Specimen Stability Information:
Fresh or formalin-fixed liver tissue specimens: Frozen (-30 to -10 degrees C) at least 20 years
Paraffin-embedded (block) liver tissue specimens: Ambient (16 to 24 degrees C) at least 12 1/2 years
Additional Information: Paraffin blocks will be returned 7 days after analysis is complete.

Forms

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

Specimen Minimum Volume

Needle biopsy: See Specimen Required; 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 & Interpretive

Clinical Information

Homeostatic regulation of copper metabolism is 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 due to 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. Labile copper fraction (LBC fraction) is also elevated in untreated Wilson disease.

Reference Values

<50 mcg/g dry weight

Interpretation

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

VERY HIGH
>1000 mcg/g dry weight:
This finding is strongly suggestive of Wilson disease.

HIGH
250-1000 mcg/g dry weight:
This finding is suggestive of possible Wilson disease.

MODERATELY HIGH
50-250 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. 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 any of the above findings are without supporting histology and other biochemical test results, contamination during collection, handling, or processing should be considered. Genetic testing for Wilson disease is available; order WNDZ / Wilson Disease, *ATP7B* Full Gene Sequencing with Deletion/Duplication, Varies. If additional assistance is needed, call 800-533-1710.

In patients with elevated levels of copper without supporting histology and other biochemical test results, contamination during collection, handling, or processing should be considered.

Cautions

Specimen handling should be minimized.

Elevated copper levels without supporting histology or other biochemical test results should prompt 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) and then 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;48(4):1167-1174
2. Roberts EA, Schilsky ML. American Association for Study of Liver Diseases (AASLD). Diagnosis and treatment of Wilson disease: an update. Hepatology. 2008;47(6):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;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(1):115-120
5. Sodi R. Vitamins and trace elements. In: Rifai N, Chiu RWK, Young I, Burnham CAD, Wittwer CT, eds. Tietz Textbook of Laboratory Medicine. 7th ed. Elsevier; 2023:chap 39
6. Bitzer AC, Fox J, Day PL, et al. Establishment of a labile bound copper reference interval in a healthy population via an inductively coupled plasma mass spectrometry dual filtration-based assay. Arch Pathol Lab Med. 2024;148(7):818-827. doi:10.5858/arpa.2023-0259-OA

Performance

Method Description
The metal of interest is analyzed by inductively coupled plasma mass spectrometry.(Unpublished Mayo method)

PDF Report
No

Day(s) Performed
Monday, Thursday

Report Available
3 to 6 days

Specimen Retention Time
60 days

Performing Laboratory Location
Mayo Clinic Laboratories - Rochester Superior Drive

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
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