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MAYO CLINIC LABORATORIES

Test Definition: POXA1

Oxalate, Plasma

Overview

Useful For

Assessing the body pool size of oxalate in patients with enzyme deficiencies, such as primary hyperoxaluria (PH), or patients with enteric hyperoxaluria

Aiding in the diagnosis of PH in a patient with chronic kidney disease of indeterminate cause when urinary oxalate is not available

Monitoring patients with renal failure and primary or enteric hyperoxaluria in order to be sure they are receiving enough dialysis

Aiding in maintaining plasma oxalate levels below supersaturation (25-30 mcmol/L)

Testing Algorithm

See Hyperoxaluria Diagnostic Algorithm

Special Instructions

- Hyperoxaluria Diagnostic Algorithm

Method Name

Enzymatic

NY State Available

Yes

Specimen

Specimen Type

Plasma Na Heparin

Specimen Required

Any client who has never collected a specimen for this test should call 800-533-1710 or 507-266-5700 and ask for the Clinical Specialty Laboratory for more detailed instructions.

Patient Preparation:

1. Fasting: 12 hours, preferred but not required
2. For 24 hours before specimen collection, the patient should not take vitamin C supplements.

Specimen Type: Acidified plasma

Collection Container/Tube: Green top (sodium heparin)

Submission Container/Tube: Plastic vial

Specimen Volume: 5 mL
Collection Instructions:
1. Place specimen on wet ice immediately.
2. Within 1 hour of collection, centrifuge for 10 minutes at 3500 rpm. Use of a 4 degrees C refrigerated centrifuge is optimal but not required.
3. Aliquot plasma into a plastic vial.
4. Adjust the pH of the plasma specimen to a pH of 2.3-2.7 with approximately 10 mcL concentrated (12M) hydrochloric acid (or 20 mcL of 6M HCl) per 1 mL plasma.
Additional Information: Nonacidified specimens can be accepted if the heparinized plasma is properly frozen. A disclaimer will be added in nonacidified plasma, "Sample was received nonacidified and frozen. In nonacidified samples oxalate values may increase spontaneously." Although there can be a small absolute increase of plasma oxalate in nonacidified specimens, this will not change the clinical interpretation.

Forms
If not ordering electronically, complete, print, and send 1 of the following forms with the specimen:
-Kidney Transplant Test Request
-Renal Diagnostics Test Request (T830)

Specimen Minimum Volume
2 mL

Reject Due To

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

Specimen Stability Information

Specimen Type	Temperature	Time	Special Container
Plasma Na Heparin	Frozen	30 days	

Clinical & Interpretive

Clinical Information
Oxalate is an insoluble dicarboxylic acid, which is an end product of liver metabolism of glyoxalate and glycerate. Humans lack an enzyme to degrade oxalate, and thus it must be eliminated by the kidney.

Oxalate is a strong anion and tends to precipitate with calcium, especially in the urinary tract.

Consequently, about 75% of all kidney stones contain calcium oxalate in some proportion. In renal failure oxalate is retained in the body, and it can precipitate in tissues causing tissue toxicity, a condition called oxalosis.

In the absence of disease, up to 90% of the body pool of oxalate is produced by hepatic metabolism and the other 10% is provided by oxalate contained in various foods. However, in the presence of gastrointestinal diseases that cause fat malabsorption, the percentage of oxalate absorbed from food can be much greater. The oxalate content of fruits and vegetables is quite variable, some being quite high and others virtually zero.

Oxalate is freely filtered by the glomerulus. A smaller amount is also secreted in the proximal tubule. If the glomerular filtration rate (GFR) is decreased, oxalate begins to be retained in the body. However, in persons without primary hyperoxaluria (PH) or enteric hyperoxaluria (EH), plasma levels do not exceed the normal range until the GFR decreases below 10-20 mL/min/1.73 m(2).

Plasma oxalate concentration is a reflection of the body pool size. When the pool increases, oxalate may precipitate in tissues and cause toxicity. Plasma oxalate pool size can be increased in various situations:
Increased production and accumulation results from an abnormality in at least 3 different enzymes:
Alanine glyoxalate transferase is necessary for the conversion of glycolate to alanine. A deficiency or intracellular mistargeting of this hepatic enzyme results in increased oxalate production (primary hyperoxaluria type1).

Glycolate reductase/hydroxypyruvate reductase deficiency in the liver and elsewhere in the body results in increased glyceric acid formation, which leads to increased oxalate production (primary hyperoxaluria type 2).

A third type of PH was recently shown to be due to variants of *HOGA1* that encodes the enzyme

4-hydroxy-2-oxaloglutarate aldolase that is found in hepatic mitochondria (primary hyperoxaluria type 3).

Increased oxalate load can be caused by increased absorption from the intestines after consuming large amounts of oxalate-rich foods such as rhubarb, spinach, or nuts.

Certain abnormalities of the gastrointestinal tract can cause fat malabsorption including short bowel syndromes, inflammatory bowel disease, gastric bypass for obesity, and pancreatic insufficiency. All of these gastrointestinal abnormalities result in increased oxalate absorption from the intestinal tract. This condition referred to as EH is due to saponification of calcium by fatty acids in the colon, which in turn frees up oxalate anions for absorption.

Decreased urinary oxalate excretion in chronic kidney disease (CKD) also causes oxalate retention in the body.

Management of patients with PH and renal failure is difficult. Intensive dialyses are undertaken in an attempt to keep plasma levels below the level at which supersaturation and crystallization can occur in body tissues such as heart and bones (called oxalosis).

PH is typically diagnosed by measuring oxalate levels in urine. However, as kidney function decreases, the renal excretion of oxalate also decreases. In such situations, plasma oxalate levels are often be informative. Although plasma oxalate increases in CKD patients without PH, values are much higher in those CKD patients who do have PH or EH. Plasma oxalate is often used to monitor these patients during critical periods in and around kidney transplantation, dialysis, or liver transplantation.

Oxalate concentration in dialysate fluid is a reflection of the oxalate removed during dialysis.

Reference Values

< or =2.0 mcmol/L
Reference values have not been established for patients younger than 18 years of age or older than 87 years of age.

Interpretation

In patients with normal renal function, the presence of increased plasma oxalate concentration is good evidence for overproduction of oxalate (primary hyperoxaluria: PH).

In the presence of renal insufficiency, plasma oxalate levels can be markedly elevated in patients with PH or enteric hyperoxaluria (EH). Increased levels of plasma oxalate can be found in dialysis patients without EH or PH, but the degree of elevation is less.(1)

In patients with possible primary hyperoxaluria and renal insufficiency, the diagnosis often can be presumptively made by knowing the plasma level of oxalate. However, ancillary tests, such as the demonstration of oxalate crystals in tissues (other than the kidney) or increased glycolate in dialysate (for patients on dialysis) are frequently necessary to make an accurate diagnosis.

Cautions

Because increased production and decreased excretion rates of oxalate can increase the plasma oxalate concentration, the interpretation of any given plasma value must consider the patient's clinical setting.

Proper specimen processing and acidification are essential to obtain a quality result (see Specimen Required).

Nonacidified specimens can be accepted if the heparinized plasma is promptly frozen. However, in nonacidified plasma specimens, plasma oxalate values near the reference range can increase up to 50% due to spontaneous oxalate generation.

Extremely high levels of ascorbic acid (vitamin C) in the blood interfere with testing. Due to this, patients should refrain from vitamin C supplements prior to collection.

Supportive Data

A difference in plasma oxalate results between the previous and current methods was observed; Overall the new results were 2.5% higher by Bland-Altman analysis (2.5%, y=0.7284x + 2.0093, R[2] = 0.9537). However, the new method detected significantly lower results for samples with a plasma oxalate concentration greater than 20 mcmol/L (Bland-Altman bias =-25.6%).

Clinical Reference

1. Perinpam M, Enders FT, Mara KC, et al: Plasma oxalate in relation to eGFR in patients with primary hyperoxaluria, enteric hyperoxaluria and urinary stone disease. Clin Biochem. 2017 Dec;50(18):1014-1019
2. Edvardsson VO, Goldfarb DS, Lieske JC, et al: Hereditary causes of kidney stones and chronic kidney disease. Pediatr Nephrol. 2013 Oct;28(10):1923-1942

Performance

Method Description

This is an enzymatic method based on the reduction of oxalate by oxalate oxidase. The reaction releases hydrogen peroxide, which in the presence of peroxidase reacts with a dye to give a colored end point that is measured using a BioTek EPOCH plate spectrophotometer at 590 nm.(Package insert: Oxalate Kit. Trinity Biotech; V. 07/2016)

PDF Report
No

Day(s) Performed
Monday through Friday

Report Available
3 to 7 days

Specimen Retention Time
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
83945

LOINC® Information

Test ID	Test Order Name	Order LOINC® Value
POXA1	Oxalate, Plasma	15085-4

Result ID	Test Result Name	Result LOINC® Value
POXA1	Oxalate, Plasma	15085-4