MAYO CLINIC LABORATORIES

Test Definition: GDS

Gadolinium, Serum

Overview

Useful For

Aiding in documenting previous exposure to gadolinium-based contrast agents using serum 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

Serum

Specimen Required

Patient Preparation: High concentrations of gadolinium and iodine are known to potentially interfere with most inductively coupled plasma mass spectrometry-based metal tests. If either gadolinium- or iodine-containing contrast media has been administered **a specimen should not be collected for at least 96 hours.**

Supplies: Metal Free Specimen Vial (T173)

Collection Container/Tube: Plain, royal blue-top Vacutainer plastic trace element blood collection tube

Submission Container/Tube: 7-mL Mayo metal-free, screw-capped, polypropylene vial

Specimen Volume: 0.35 mL Serum

Collection Instructions:

1. Allow the specimen to clot for 30 minutes; then centrifuge the specimen to separate serum from the cellular fraction.
2. Remove the stopper. Carefully pour specimen into Mayo metal-free, screw-capped vial, avoiding transfer of the cellular components of blood. **Do not** insert a pipette into the serum to accomplish transfer, and **do not** ream the specimen with a wooden stick to assist with serum transfer.
3. See Metals Analysis Specimen Collection and Transport for complete instructions.

Forms

If not ordering electronically, complete, print, and send a Renal Diagnostics Test Request (T830) with the specimen.

Specimen Minimum Volume

Serum: 0.25 mL

Reject Due To

Gross hemolysis	OK
Gross lipemia	OK
Gross icterus	OK

Specimen Stability Information

Specimen Type	Temperature	Time	Special Container
Serum	Refrigerated (preferred)	28 days	METAL FREE
	Ambient	28 days	METAL FREE
	Frozen	28 days	METAL FREE

Clinical & Interpretive

Clinical Information

Gadolinium is a member of the lanthanide series of the periodic table of elements and is considered a nonessential element. Due to its paramagnetic properties, chelated gadolinium is commonly employed as contrast media (gadolinium-based contrast agents: GBCA) for magnetic resonance imaging and computer tomography scanning.

Gadolinium is primarily eliminated via the kidneys, so exposure can be prolonged in patients with kidney insufficiency. Patients with reduced kidney function and some patients with normal kidney function may exhibit a prolonged gadolinium elimination half-life.

To date, the only known adverse health effect related to gadolinium retention is a rare condition called nephrogenic systemic fibrosis (NSF). NSF is a relatively uncommon condition in which fibrous plaques develop in the dermis and often in deeper connective tissues. Reported cases have occurred almost exclusively in patients with severe kidney disease, and almost all have been associated with prior use of GBCA. NSF is a painful skin disease characterized by thickening of the skin, which can involve the joints and cause significant limitation of motion within weeks to months. Over the past decade, changes in clinical practice guidelines have almost eliminated completely the incidence of NSF. However, the association of NSF and observed elevated gadolinium concentrations is still not fully understood.

Reference Values

<0.5 ng/mL

Interpretation

Elevated gadolinium observed in serum specimens collected more than 96 hours after administration of gadolinium-containing contrast media is not typical of most patients with normal kidney function and may indicate prolonged elimination of gadolinium and exposure to anthropogenic sources.

Cautions

The current reference interval was established using healthy individuals with no recent exposure gadolinium. A recent study found that 95% of patients who received gadobutrol-enhanced magnetic resonance imaging (MRI) did not show serum gadolinium concentrations below the unexposed reference interval (<0.5 ng/mL) until approximately 56 days after imaging.(1) This elevation is due to residual gadolinium present from contrast media infusion. An elevated serum

gadolinium in a specimen collected after contrast media infusion does not definitively indicate risk of nephrogenic systemic fibrosis or significant gadolinium toxicity. Ultimately, individuals should consult with their healthcare professionals to interpret any test results.

Supportive Data

A small number of patients studied at Mayo Clinic have demonstrated measurable (0.6-2.1 ng/mL) gadolinium in serum collected 30 days after gadolinium infusion, so some prolonged elimination is possible.

Serum gadolinium concentrations above the stated reference range may indicate prolonged elimination, residual gadolinium retention, or continuing environmental exposure. However, elevated serum gadolinium concentrations do not necessarily indicate toxicity.

Clinical Reference

1. McDonald JS, Day PL, Spears GM, Bornhorst JA, McDonald RJ, Jannetto PJ. Serum and urine gadolinium reference intervals in patients with normal renal function following gadobutrol administration. Invest Radiol. 2025;60(9):586-591. doi:10.1097/RLI.0000000000001165
2. Christensen KN, Lee CU, Hanley MM, Leung N, Moyer TP, Pittelkow MR. Quantification of gadolinium in fresh skin and serum samples from patients with nephrogenic systemic fibrosis. J Am Acad Dermatol. 2011;64(1):91-96
3. Telgmann L, Sperling M, Karst U. Determination of gadolinium-based MRI contrast agents in biological and environmental samples: A review. Anal Chim Acta. 2013;764:1-16
4. Daftari Besheli L, Aran S, Shaqdan K, Kay J, Abujudeh H. Current status of nephrogenic systemic fibrosis. Clin Radiol. 2014;69(7):661-668
5. Aime S, Caravan P. Biodistribution of gadolinium-based contrast agents, including gadolinium deposition. J Magn Reson Imaging 2009;30(6):1259-1267
6. McDonald RJ, McDonald JS, Kallmes DF, et al. Intracranial gadolinium deposition after contrast-enhanced MR imaging. Radiology. 2015;275(3):772-782
7. Attari H, Cao Y, Elmholdt TR, Zhao Y, Prince MR. A systematic review of 639 patients with biopsy-confirmed nephrogenic systemic fibrosis. Radiology. 2019;292(2):376-386
8. Woolen SA, Shankar PR, Gagnier JJ, MacEachern MP, Singer L, Davenport MS. Risk of nephrogenic systemic fibrosis in patients with stage 4 or 5 chronic kidney disease receiving a group II gadolinium-based contrast agent: A systematic review and meta-analysis. JAMA Intern Med. 2020;180(2):223-230
11. Bornhorst J, Wegwerth P, Day P, et al. Urinary reference intervals for gadolinium in individuals without recent exposure to gadolinium-based contrast agents. Clin Chem Lab Med. 2020;58(3):e87-e90
12. Alwasiyah D, Murphy C, Jannetto P, Hogg M, Beuhler MC. Urinary gadolinium levels after contrast-enhanced MRI in individuals with normal renal function: a pilot study. J Med Toxicol. 2019;15(2):121-127
13. Othersen JB, Maize JC, Woolson RF, Budisavljevic MN. Nephrogenic systemic fibrosis after exposure to gadolinium in patients with renal failure. Nephrol Dial Transplant. 2007;22(11):3179-3185

Performance

Method Description

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

PDF Report

No

Day(s) Performed
Thursday

Report Available
2 to 8 days

Specimen Retention Time
14 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
83018

LOINC® Information

Test ID	Test Order Name	Order LOINC® Value
GDS	Gadolinium, S	80912-9

Result ID	Test Result Name	Result LOINC® Value
29251	Gadolinium, S	80912-9