MAYO CLINIC LABORATORIES

Test Definition: TICU

Titanium/Creatinine Ratio, Urine

Overview

Useful For

Measurement of titanium concentration as part of a profile to assess exposure and elimination of titanium

Method Name

Only orderable as part of a profile. For more information see TIUCR / Titanium/Creatinine Ratio, Random, Urine.

Inductively Coupled Plasma-Mass Spectrometry (ICP-MS)

NY State Available

Yes

Specimen

Specimen Type

Urine

Specimen Required

Only orderable as part of a profile. For more information see TIUCR / Titanium/Creatinine Ratio, Random, Urine.

Patient Preparation: High concentrations of gadolinium and iodine are known to interfere with most metal tests. If either gadolinium- or iodine-containing contrast media has been administered, **the specimen should not be collected for at least 96 hours**.
Supplies: Urine Tubes, 10 mL (T068)
Collection Container/Tube: Clean, plastic urine collection container
Submission Container/Tube: Plastic, 10-mL urine tube or a clean, plastic aliquot container with no metal cap or glued insert
Specimen Volume: 7 mL
Collection Instructions:
1. Collect a random urine specimen.
2. See Trace Metals Analysis Specimen Collection and Transport for complete instructions.

Specimen Minimum Volume

1 mL

Specimen Stability Information

Specimen Type	Temperature	Time	Special Container
Urine	Frozen	28 days	

Clinical & Interpretive

Clinical Information

Titanium is the ninth most abundant element in the earth's crust. Its light weight and high strength are useful in alloys for diverse applications. There is no evidence to date that titanium is an essential element. Due in part to titanium's oxide formation propensity, the element is considered to be nontoxic. Soils, drinking water, and air all contain trace amounts of titanium. The food processing industry uses large quantities of titanium as a food additive; processed foods contain higher levels than are found in most produce and organic food products. The average daily oral intake through food consumption is 0.1 to 1 mg/day, which accounts for more than 99% of exposure. Gastrointestinal absorption of titanium is low (approximately 3%), and most of ingested titanium is rapidly excreted in the urine and stool. The total body burden of titanium is usually in the range of 9 to 15 mg, a significant portion of which is contained in the lung. Titanium dust entering the respiratory tract is nonirritating and is almost completely nonfibrogenic in humans.

Titanium-containing alloys are used in some artificial joints, prosthetic devices, and implants. Titanium dioxide allows osseointegration between an artificial medical implant and bone. Despite their wide use, exposure to these materials has not been linked to toxicity. In one study, patients monitored up to 36 months following joint replacement with titanium-containing joints showed a statistically significant increase in detectable titanium. While titanium concentrations are not a measure of toxicity, they can be useful in determining whether implant breakdown is occurring.

Reference Values

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0-17 years: Not established
> or =18 years: <0.4 mcg/g Cr

Interpretation

Elevated concentrations of urinary titanium have been reported after documented exposures.

Cautions

Titanium is a trace metal commonly used in alloys and readily present in the environment. Thus, contamination of the collection site and of the specimen must be avoided. Failure to use metal-free collection procedures and devices may cause falsely increased results. See Specimen Required for collection and processing information.

Clinical Reference

1. Rifai N, Horvath AR, Wittwer, CT, eds. Tietz Textbook of Clinical Chemistry and Molecular Diagnostics 6th ed. Elsevier; 2018
2. Barry J, Lavigne M, Vendittoli PA. Evaluation of the method for analyzing chromium, cobalt and titanium ion levels in the blood following hip replacement with a metal-on-metal prosthesis. J Anal Toxicol. 2013;37(2):90-6
3. Sarmiento-Gonzalez, A, et al. High resolution ICP-MS determination of Ti, V, Cr, Co, Ni, and Mo in human blood and urine of patients implanted with a hip or knee prothesis. Anal Bioanal Chem. 2008;391(7):2583-9
4. Kim KT, Eo MY, Nguyen TTH, Kim SM. General review of titanium toxicity. Int J Implant Dent. 2019;5(1):10. Published 2019 Mar 11. doi:10.1186/s40729-019-0162-x
5. Jacobs JJ, Skipor AK, Patterson LM, et al. Metal release in patients who have had a primary total hip arthroplasty. A prospective, controlled, longitudinal study. J Bone Joint Surg Am. 1998;80(10):1447-1458
6. Liu TK, Liu SH, Chang CH, Yang RS. Concentration of metal elements in the blood and urine in the patients with

cementless total knee arthroplasty. Tohoku J Exp Med. 1998;185(4)
:253-262
7. Jin T, M Berlin: Titanium. G Nordberg B Fowler M Nordberg et al. Handbook on the toxicology of metals. 3rd ed 2007 Academic Press Amsterdam 861-870
8. Chao EY, Frassica F, Prichard DJ, Moyer TP. Metal ion release in patients with porous coated megaprostheses. 41st Annual Meeting of the Orthopaedic Research Society, Orlando, Florida, 1995 Feb 13-16

Performance

Method Description
Titanium in urine is analyzed by inductively coupled plasma triple-quadrupole mass spectrometry in mass shift mode using ammonia as a reaction gas, gallium as an internal standard, and a salt matrix calibration.(Unpublished Mayo method)

PDF Report
No

Day(s) Performed
Wednesday

Report Available
1 to 7 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
TICU	Titanium/Creat Ratio, U	No LOINC Needed

Result ID	Test Result Name	Result LOINC® Value
614615	Titanium/Creat Ratio, U	104656-4