Test Definition: NIS

Nickel, S

Overview

Useful For

Confirmation of an elevated urinary nickel concentration

This test is **not useful for** the investigation of nickel hypersensitivity.

Special Instructions

- Trace Metals Analysis Specimen Collection and Transport

Method Name

Inductively Coupled Plasma-Mass Spectrometry (ICP-MS)

NY State Available

Yes

Specimen

Specimen Type

Serum

Ordering Guidance

Urine is the preferred specimen type for determining nickel exposure and potential toxicity. Order NIU / Nickel, Urine or NICRU / Nickel/Creatinine Ratio, Random, Urine.

This test should not be ordered for the investigation of nickel hypersensitivity. Instead, order lymphocyte proliferation to nickel test.

Specimen Required

Patient Preparation: High concentrations of gadolinium and iodine are known to interfere with most metals tests. If either gadolinium- or iodine-containing contrast media has been administered, a specimen should not be collected for 96 hours.

Supplies:

Metal Free B-D Tube (No Additive), 6 mL (T184)

Metal Free Specimen Vial (T173)

Collection Container/Tube: Royal blue-top (metal-free, no additive))

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

Specimen Volume: 2 mL

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 a Mayo metal-free, screw-capped vial, avoiding transfer of the cellular components of blood. **Do not** insert a pipet into the serum to accomplish transfer, and **do not** ream the specimen with a wooden stick to assist with serum transfer.

3. See Trace Metals Analysis Specimen Collection and Transport in Special Instructions for complete instructions.

Additional Information: If ordering the trace element blood collection tube from BD, order catalog #368380.

Specimen Minimum Volume

0.5 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)	7 days	METAL FREE
	Ambient	7 days	METAL FREE
	Frozen	7 days	METAL FREE

Clinical and Interpretive

Clinical Information

Nickel (Ni) is a highly abundant element with a silvery-white appearance. Nickel is frequently combined with other metals to form alloys and is essential for the catalytic activity of some plant and bacterial enzymes but has no known role in humans.

Nickel and its compounds have no characteristic odor or taste. Ni compounds are used for Ni plating, to color ceramics, to make some batteries, and as substances known as catalysts that increase the rate of chemical reactions. One of the most toxic Ni compounds is nickel carbonyl, Ni(CO)4, which is used as a catalyst in petroleum refining and in the plastics industry, is frequently employed in the production of metal alloys (which are popular for their anticorrosive and hardness properties), in nickel-cadmium rechargeable batteries, and is used as a catalyst in hydrogenation of oils. Ni(CO)4 is very toxic.

Occupational exposure to Ni occurs primarily via inhalation of Ni compounds. Inhalation of dust high in Ni content has been associated with development of lung and nasal cancer.

Food is the major source of exposure to Ni. Foods naturally high in Ni include chocolate, soybeans, nuts, and oatmeal. Individuals may also be exposed to nickel by breathing air, drinking water, or smoking tobacco containing Ni. Stainless steel and coins contain Ni. Some jewelry is plated with Ni or made from Ni alloys. Patients may be exposed to Ni in artificial body parts made from Ni-containing alloys.

The most common harmful health effect of Ni in humans is an allergic reaction. Approximately 10% to 20% of the

population is sensitive to Ni. The most serious harmful health effects from exposure to Ni, such as chronic bronchitis, reduced lung function, and cancer of the lung and nasal sinus, have occurred in people who have breathed dust containing certain Ni compounds while working in Ni refineries or nickel-processing plants.

Urine is the specimen of choice for the determination of Ni exposure but serum concentrations can be used to verify an elevated urine concentration.

Patients undergoing dialysis are exposed to Ni and accumulate Ni in blood and other organs; there appear to be no adverse health effects from this exposure. Hypernickelemia has been observed in patients undergoing renal dialysis. At the present time, this is considered to be an incidental finding as no correlation with toxic events has been identified. Routine monitoring of patients undergoing dialysis is currently not recommended.

Reference Values

<2.0 ng/mL

Interpretation

Values 2.0 ng/mL and higher represent possible environmental or occupational exposure to nickel (Ni).

Toxic Ni concentrations are greater or equal to 10 ng/mL.

Normal Ni values are based on a Mayo Clinic study using healthy volunteers. Toxic values have been deduced from observation and unpublished internal study.

Clinical concern about Ni toxicity should be limited to patients with potential for exposure to toxic Ni compounds. Hypernickelemia, in the absence of exposure, may be an incidental finding or could be due to specimen contamination.

Cautions

This test cannot determine the source compound (eg, nickel sulfate) responsible for the exposure.

Specimen collection procedures for nickel require special collection containers, rigorous attention to ultraclean specimen collection and handling procedures, and analysis in an ultraclean facility. Unless all of these procedures are followed, increased urinary nickel results may be an incidental and misleading finding.

Clinical Reference

1. Novelli EL, Rodrigues NL, Ribas BO: Superoxide radical and toxicity of environmental nickel exposure. Hum Exp Toxicol 1995;14:248-251

2. Nixon DE, Moyer TP, Squillace DP, McCarthy JT: Determination of serum nickel by graphite furnace atomic absorption spectrometry with Zeeman-effect background correction: values in a normal population and a population undergoing dialysis. Analyst 1989;114:1671-1674

3. US Department of Health and Human Services: Toxicological profile for nickel. Agency for Toxic Substances and Disease Registry. 2005 Accessed: 03/2020. Available at: https://www.atsdr.cdc.gov/ToxProfiles/tp15.pdf

4. Tietz Textbook of Clinical Chemistry and Molecular Diagnostics Sixth edition. Edited by N Rifai, AR Horvath, CT Wittwer. Elsevier, 2018

Performance

Method Description

This assay is performed on an inductively coupled plasma-mass spectrometer. Calibrating standards and blanks are diluted with an aqueous acidic diluent containing internal standards. Quality control specimens and patient samples are diluted in an identical manner. In turn, all diluted blanks, calibrating standards, quality control specimens, and patient specimens are aspirated into a pneumatic nebulizer and the resulting aerosol directed to the hot plasma discharge by a flow of argon. In the annular plasma the aerosol is vaporized, atomized, and then ionized. The ionized gases plus neutral species formed in the annular plasma space are aspirated from the plasma through an orifice into a quadrupole mass spectrometer. The mass range from 1 to 263 amu is rapidly scanned multiple times and ion counts tabulated for each mass of interest. Instrument response is defined by the linear relationship of analyte concentration vs. ion count ratio (analyte ion count/internal standard ion count). Analyte concentrations are derived by reading the ion count ratio for each mass of interest and determining the concentration from the response line.(Unpublished Mayo method)

PDF Report

No

Day(s) Performed

Thursday

Report Available

1 to 7 days

Specimen Retention Time

14 days

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 US Food and Drug Administration.

CPT Code Information

83885

LOINC® Information

Test ID	Test Order Name	Order LOINC Value
NIS	Nickel, S	5702-6

Result ID	Test Result Name	Result LOINC Value
8622	Nickel, S	5702-6