MAYO CLINIC LABORATORIES

Test Definition: NIS

Nickel, Serum

Overview

Useful For

Confirmation of an elevated urinary nickel concentration

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

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

Ordering Guidance

Urine is the preferred specimen type for determining nickel exposure and potential toxicity. Order NIU / Nickel, 24 Hour, Urine or NIUCR / Nickel/Creatinine Ratio, Random, Urine.

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

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 96 hours**.
Supplies: 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: 0.55 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 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 Metals Analysis Specimen Collection and Transport for complete instructions.

Specimen Minimum Volume

Serum: 0.35 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 & Interpretive

Clinical Information

Nickel 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 (including in several pathogenic and symbiotic species in humans) but has no known role in humans.

Nickel and its compounds have no characteristic odor or taste. Nickel compounds are used for nickel 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 nickel 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 such as stainless steel (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 and is lipid-soluble, allowing it to cross cell membranes.

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

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

The most common harmful health effect of nickel in humans is an allergic reaction. Approximately 10% to 20% of the population is sensitive to nickel. 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 nickel compounds while working in nickel refineries or nickel-processing plants.

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

Patients undergoing dialysis are exposed to nickel and accumulate nickel in blood and other organs; there appear to be no adverse health effects from this exposure. Hypernickelemia has been observed in patients undergoing kidney 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.

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

Normal nickel 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 nickel toxicity should be limited to patients with potential for exposure to toxic nickel 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 serum nickel results may be an incidental and misleading finding.

Clinical Reference

1. Moreno ME, Acosta-Saavedra LC, Mez-Figueroa D, et al. Biomonitoring of metal in children living in a mine tailings zone in Southern Mexico: A pilot study. Int J Hyg Environ Health. 2010;213(4):252-258. doi:10.1016/j.ijheh.2010.03.005
2. Schulz C, Angerer J, Ewers U, Heudorf U, Wilhelm M, Human Biomonitoring Commission of the German Federal Environment Agency. Revised and new reference values for environmental pollutants in urine or blood of children in Germany derived from the German Environmental Survey on Children 2003-2006 (GerES IV). Int J Hyg Environ Health. 2009;212(6):637-647. doi:10.1016/j.ijheh.2009.05.003
3. US Department of Health and Human Services: Toxicological profile for nickel. Agency for Toxic Substances and Disease Registry. HHS; 2005. Accessed September 6, 2023. Available at www.atsdr.cdc.gov/ToxProfiles/tp15.pdf
4. Rifai N, Chiu RWK, Young I, Burnham CAD, Wittwer CT, eds. Tietz Textbook of Laboratory Medicine. 7th ed. Elsevier; 2023
5. Zambelli B, Ciurli S. Nickel and human health. In: Sigel A, Sigel H, Sigel R, eds. Interrelations between Essential Metal Ions and Human Diseases. Metal Ions in Life Sciences. Vol 13. Springer, Dordrecht; 2013:321-357
6. Begum W, Rai S, Banerjee S, et al. A comprehensive review on the sources, essentiality and toxicological profile of nickel. RSC Adv. 2022;12(15):9139-9153doi:10.1039/d2ra00378c

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
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