



# Test Definition: AN2TS

Antineuronal Nuclear Antibody Type 2  
(ANNA-2) Titer, Serum

## Overview

### Useful For

Investigating middle-aged or older patients who present with unexplainable signs of midbrain/cerebellar/brain stem disorder and/or myelopathy, especially women with a previous history of breast cancer, and both sexes if there is a history of tobacco abuse or passive exposure

Investigating a smoker presenting with 1 or more elements of encephalomyeloradiculoneuropathy as a part of PAVAL / Paraneoplastic, Autoantibody Evaluation, Serum

Reporting an end titer result from serum specimens

### Testing Algorithm

If the indirect immunofluorescence (IFA) pattern suggests antineuronal nuclear antibody type 2 (ANNA-2), then this test will be performed at an additional charge.

### Method Name

Only orderable as a reflex. For more information see:

- PAVAL / Paraneoplastic, Autoantibody Evaluation, Serum
- DMS2 / Dementia, Autoimmune/Paraneoplastic Evaluation, Serum
- ENS2 / Encephalopathy, Autoimmune/Paraneoplastic Evaluation, Serum
- EPS2 / Epilepsy, Autoimmune/Paraneoplastic Evaluation, Serum
- MDS2 / Movement Disorder, Autoimmune/Paraneoplastic Evaluation, Serum
- MAS1 / Myelopathy, Autoimmune/Paraneoplastic Evaluation, Serum

Indirect Immunofluorescence Assay (IFA)

### NY State Available

Yes

## Specimen

### Specimen Type

Serum

### Specimen Required

Only orderable as a reflex. For more information see:

- PAVAL / Paraneoplastic, Autoantibody Evaluation, Serum
- DMS2 / Dementia, Autoimmune/Paraneoplastic Evaluation, Serum
- ENS2 / Encephalopathy, Autoimmune/Paraneoplastic Evaluation, Serum

- EPS2 / Epilepsy, Autoimmune/Paraneoplastic Evaluation, Serum
- MDS2 / Movement Disorder, Autoimmune/Paraneoplastic Evaluation, Serum
- MAS1 / Myelopathy, Autoimmune/Paraneoplastic Evaluation, Serum

### Specimen Minimum Volume

0.6 mL

### Reject Due To

Gross hemolysis	Reject
Gross lipemia	Reject
Gross icterus	Reject

### Specimen Stability Information

Specimen Type	Temperature	Time	Special Container
Serum	Refrigerated (preferred)	28 days	
	Ambient	72 hours	
	Frozen	28 days	

## Clinical & Interpretive

### Clinical Information

Antineuronal nuclear autoantibody type 2 (ANNA-2), also known as anti-Ri, is an IgG serologic marker of paraneoplastic neurologic autoimmunity and reflects an immune response to neuronal antigens expressed in certain breast, lung, or gynecologic cancers. These carcinomas are often occult, with patients presenting with unexplained signs of neurologic dysfunction. ANNA-2 is far less common than ANNA-1. It is one of the rarest paraneoplastic antibodies encountered in the Mayo Clinic Neuroimmunology Laboratory.

Patients who are seropositive for ANNA-2 usually present to a neurologist with signs of midbrain, brain stem, cerebellar, or spinal cord dysfunction. Some have sensorimotor neuropathy. Ocular opsoclonus-myoclonus, laryngospasm, or jaw-opening dystonia may be prominent. Peripheral neuropathic sign and symptoms may occur. These often reflect coexisting autoimmunity to other onconeural proteins (eg, ANNA-1, collapsin response-mediator protein-5 [CRMP-5], calcium channels); coexisting paraneoplastic autoantibodies are found in 73% of cases.

ANNA-2-positive patients are female in 64% of cases. Most have a primary carcinoma of breast or lung; gynecologic cancer is less frequent.

Treatment of the cancer can lead to progressive reduction in ANNA-2 titer and stabilization or striking improvement of the neurologic disorder.

ANNA-2 is not detected in serum or spinal fluid of healthy individuals. It is found in less than 2% of patients who have

---

small-cell lung carcinoma without evidence of neurologic dysfunction.

ANNA-2 is identified by an indirect immunofluorescence assay. It characteristically stains neurons in the central nervous system and spares neurons in the peripheral nervous system. ANNA-2 is also identifiable by neuronal Western blot characteristics.

**Reference Values**

Only orderable as a reflex. For more information see:

- PAVAL / Paraneoplastic, Autoantibody Evaluation, Serum
- DMS2 / Dementia, Autoimmune/Paraneoplastic Evaluation, Serum
- ENS2 / Encephalopathy, Autoimmune/Paraneoplastic Evaluation, Serum
- EPS2 / Epilepsy, Autoimmune/Paraneoplastic Evaluation, Serum
- MDS2 / Movement Disorder, Autoimmune/Paraneoplastic Evaluation, Serum
- MAS1 / Myelopathy, Autoimmune/Paraneoplastic Evaluation, Serum

<1:240

Neuron-restricted patterns of IgG staining that do not fulfill criteria for antineuronal nuclear antibody type 2 may be reported as "unclassified antineuronal IgG." Complex patterns that include nonneuronal elements may be reported as "uninterpretable."

**Interpretation**

Detection of antineuronal nuclear autoantibodies type 2 (ANNA) in serum or spinal fluid of patients with a clinically unexplainable neurologic disorder:

- Identifies the neurologic problem as autoimmune and almost certainly paraneoplastic
- Prompts a search for underlying malignancy (breast, lung, or gynecologic)
- Leads to early treatment of cancer and consideration of immunosuppressant therapy

**Cautions**

Seronegativity for antineuronal nuclear autoantibodies type 2 (ANNA-2) does not exclude malignancy.

**Clinical Reference**

1. Kiers L, Altermatt HJ, Lennon VA: Paraneoplastic anti-neuronal nuclear IgG autoantibodies (type 1) localize antigen in small cell lung carcinoma. *Mayo Clin Proc.* 1991 Dec;66(12):1209-1216
2. Lennon VA: Paraneoplastic autoantibodies: the case for a descriptive generic nomenclature. *Neurology.* 1994 Dec;44(12):2236-2240
3. Lennon VA, Kryzer TJ, Griesmann GE, et al: Calcium-channel antibodies in the Lambert-Eaton syndrome and other paraneoplastic syndromes. *N Engl J Med.* 1995 Jun 1;332(22):1467-1474
4. Chan KH, Vernino S, Lennon VA: ANNA-3 anti-neuronal nuclear antibody: marker of lung cancer-related autoimmunity. *Ann Neurol.* 2001 Sep;50(3):301-311
5. Pittock SJ, Lucchinetti CF, Lennon VA: Anti-neuronal nuclear autoantibody-type 2: paraneoplastic accompaniments. *Ann Neurol.* 2003 May;53(5):580-587
6. Horta ES, Lennon VA, Lachance DH, et al: Neural autoantibody clusters aid diagnosis of cancer. *Clin Cancer Res.* 2014 Jul 15;20(14):3862-3869
7. Vernino S, Lennon VA: New Purkinje cell antibody (PCA-2): marker of lung cancer-related neurological autoimmunity. *Ann Neurol.* 2000 Mar;47(3):297-305

## Performance

### Method Description

The patient's specimen is tested by a standardized immunofluorescence assay that uses a composite frozen section of mouse cerebellum, kidney, and gut tissues. After incubation with the specimen and washing, fluorescein-conjugated goat-antihuman IgG is applied. Neuron-specific autoantibodies are identified by their characteristic fluorescence staining patterns. Specimens that are scored positive for any neuronal nuclear or cytoplasmic autoantibody are titrated. Interference by coexisting non-neuron-specific autoantibodies can usually be eliminated by serologic absorption. (Honorat JA, Komorowski L, Josephs KA, et al. IgLON5 antibody: Neurological accompaniments and outcomes in 20 patients. *Neurol Neuroimmunol Neuroinflamm*. 2017;4[5]:e385. Published 2017 Jul 18. doi:10.1212/NXI.0000000000000385)

If antineuronal nuclear autoantibody type 1 (ANNA-1), antinuclear antibody, or antimitochondrial antibody titers equal or exceed ANNA-2, Western blot analysis is required to establish ANNA-2 specificity with certainty.

### PDF Report

No

### Day(s) Performed

Monday through Sunday

### Report Available

6 to 8 days

### Specimen Retention Time

2 days

### 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 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.

# Test Definition: AN2TS

Antineuronal Nuclear Antibody Type 2  
(ANNA-2) Titer, Serum

---

## CPT Code Information

86256

## LOINC® Information

Test ID	Test Order Name	Order LOINC® Value
AN2TS	ANNA-2 Titer, S	94343-1

Result ID	Test Result Name	Result LOINC® Value
43432	ANNA-2 Titer, S	94343-1