MAYO CLINIC LABORATORIES

Test Definition: GFAPP

Glial Fibrillary Acidic Protein (GFAP), Plasma

Overview

Useful For
As a biomarker of astrocyte activation related to brain injury and various neurological disorders

Highlights
This assay measures glial fibrillary acidic protein in human plasma.

Method Name
Chemiluminescent Enzyme Immunoassay (CLEIA)

NY State Available
Yes

Specimen

Specimen Type
EDTA Plasma

Shipping Instructions
Send refrigerated.

Specimen Required
Patient Preparation:
Fasting: 8 hours, required
Supplies: Sarstedt Aliquot Tube, 5 mL (T914)
Collection Container/Tube: Lavender top (EDTA)
Submission Container/Tube: Plastic vial
Specimen Volume: 1 mL plasma
Collection Information: Centrifuge and aliquot plasma into a plastic vial.

Specimen Minimum Volume
Plasma: 0.75 mL

Reject Due To

Gross hemolysis	Reject
Gross lipemia	Reject
Gross icterus	Reject

Specimen Stability Information

Specimen Type	Temperature	Time	Special Container
EDTA Plasma	Refrigerated (preferred)	14 days	
	Ambient	72 hours	
	Frozen	90 days	

Clinical & Interpretive

Clinical Information

Glial fibrillary acidic protein (GFAP) functions as the primary intermediate filament protein within the astrocyte cytoskeleton. Under pathological conditions such as inflammation, neurodegeneration or traumatic brain injury, GFAP expression is upregulated resulting in morphological alterations of astrocytes through reorganization of intermediate filaments. Increased GFAP concentrations correlate with the severity of neural damage, leading to structural hypertrophy of reactive astrocytes. In cases of severe and widespread brain injuries, astrocytes undergo extensive proliferation and form physical and chemical barriers surrounding lesion sites. This response is critical for containing damage and preventing its propagation to healthy tissues. The upregulation of GFAP acts as a marker of astrocyte activation following neural injury. GFAP is primarily localized intracellularly, but various mechanisms can induce its release into the cerebrospinal fluid (CSF) and subsequent entry to the bloodstream. The mechanism leading to release of GFAP into biofluids is not fully understood. Mechanisms such as astrocyte damage or death and neuroinflammation have been proposed to contribute to the release GFAP into the CSF and subsequently into the bloodstream. GFAP is a brain-specific protein with limited secretion into biofluids under physiological conditions, reinforcing its relevance as a neurodegenerative brain disease biomarker.

Reference Values

<40 years: < or =32.6 pg/mL
40-49 years: < or =50.5 pg/mL
50-59 years: < or =67.5 pg/mL
60-69 years: < or =90.3 pg/mL
> or = 70 years: < or =120.8 pg/mL

Interpretation

Increased glial fibrillary acidic protein (GFAP) concentrations have been observed during brain injury and in various neurological disorders. Currently, there are no disease-specific thresholds for interpretation; thus, results should be assessed according to established reference intervals. Some potential uses of GFAP are described below.

In traumatic brain injury (TBI), GFAP concentrations are increased in patients following mild to moderate TBI, and it may predict an unfavorable outcome.(1) GFAP has been shown to be detectable within one hour of injury, continues to rise and appears to peak within 20 to 24 hours, and then declines over 72 hours with a biological half-life of 24 to 48 hours.(2,3)

Glial fibrillary acidic protein concentrations have been reported to be higher in individuals with multiple sclerosis (MS) compared to healthy controls and individuals with non-inflammatory neurological disease.(4,5) Plasma GFAP concentrations have been shown to correlate with the severity of disability in patients with MS.(4,5)

In stroke, blood GFAP may be indicative of microglial injury as a result of intracerebral hemorrhage in individuals presenting with acute stroke symptoms. In this context, GFAP concentrations were higher in individuals with intracerebral hemorrhage than in patients with ischemic stroke.(6)

Increased blood GFAP concentrations have been detected in individuals with Alzheimer disease (AD), with rising levels observed at the preclinical phase of the disease.(7) Higher GFAP concentrations have been associated with an increased risk for future progression to dementia and a steeper cognitive decline.(8) In individuals with mild cognitive impairment, GFAP concentrations have been reported to predict future conversion to AD dementia.(7)

In individuals with autoimmune glial fibrillary acidic protein astrocytopathy (GFAP-A), an antibody-related astrocytic disease for which a specific GFAP antibody serves as a biological marker, elevations of plasma GFAP may be observed.(9) However, measurement of plasma GFAP is not recommended as part of the diagnostic evaluation for this rare autoimmune disease. In this context, measurement of GFAP-IgG antibodies in cerebrospinal fluid is recommended for the evaluation of individuals suspected of having GFAP-A.

Cautions

Glial fibrillary acidic protein results must be interpreted in conjunction with other diagnostic tools, such as neurological examination, neurobehavioral tests, imaging, and routine laboratory tests.

Results obtained with different assay methods or kits may be different and cannot be used interchangeably.

All immunometric assays can, on rare occasions, be subject to a hooking effect at extremely high analyte concentrations (false-low results), heterophilic antibody interference (false-high results), or autoantibody interference (unpredictable effects). If the laboratory result does not fit the clinical picture, these possibilities should be considered.

Clinical Reference

1. Abdelhak A, Foschi M, Abu-Rumeileh S, et al. Blood GFAP as an emerging biomarker in brain and spinal cord disorders. Nat Rev Neurol. 2022;18(3):158-172
2. Papa L, Brophy GM, Welch RD, et al. Time course and diagnostic accuracy of glial and neuronal blood biomarkers GFAP and UCH-L1 in a large cohort of trauma patients with and without mild traumatic brain injury. JAMA Neurol. 2016;73(5):551-560
3. Thelin EP, Zeiler FA, Ercole A, et al. Serial sampling of serum protein biomarkers for monitoring human traumatic brain injury dynamics: A systematic review. Front Neurol. 2017;8:300
4. Hogel H, Rissanen E, Barro C, et al. Serum glial fibrillary acidic protein correlates with multiple sclerosis disease severity. Mult Scler. 2020;26(2):210-219
5. Ayrignac X, Le Bars E, Duflos C, et al. Serum GFAP in multiple sclerosis: correlation with disease type and MRI markers of disease severity. Sci Rep. 2020;10(1):10923
6. Foerch C, Curdt I, Yan B, et al. Serum glial fibrillary acidic protein as a biomarker for intracerebral haemorrhage in patients with acute stroke. J Neurol Neurosurg Psychiatry. 2006;77(2):181-184
7. Oeckl P, Halbgebauer S, Anderl-Straub S, et al. Glial fibrillary acidic protein in serum is increased in Alzheimer's disease and correlates with cognitive impairment. J Alzheimers Dis. 2019;67(2):481-488. doi:10.3233/JAD-180325
8. Cicognola C, Janelidze S, Hertze J, et al. Plasma glial fibrillary acidic protein detects Alzheimer pathology and predicts future conversion to Alzheimer dementia in patients with mild cognitive impairment. Alzheimers Res Ther. 2021;13(1):68. Published 2021 Mar 27. doi:10.1186/s13195-021-00804-9
9. Huang J, Huang W, Zhou R, Lin W, Chen T, Long Y. Detection and significance of glial fibrillary acidic protein antibody in

autoimmune astocytopathy and related diseases. Ann Transl Med. 2023;11(7):288. doi:10.21037/atm-19-330

Performance

Method Description

The Lumipulse G GFAP Immunoreaction is an assay system for the quantitative measurement of glial fibrillary acidic protein (GFAP) in plasma specimens based on chemiluminescent enzyme immunoassay technology by a specific two-step immunoassay method on the Lumipulse G System. The specimen and assay-specific diluent are added to the antibody-coated particle solution. The GFAP in the specimen specifically binds to anti-GFAP monoclonal mouse antibody on the particles and antigen-antibody immunocomplexes are formed. The particles are washed and rinsed to remove unbound materials. Alkaline phosphatase-labeled anti-GFAP monoclonal antibodies specifically bind to immunocomplexes on the particles. The particles are washed and rinsed to remove unbound materials. The substrate solution is added and mixed with the particles.
3-(2'-Spiroadamantyl)-4-methoxy-4-(3''-phosphoryloxy)-phenyl-1,2-dioxetane (AMPPD) contained in the substrate solution is dephosphorylated by the catalysis of alkaline phosphatase indirectly conjugated to particles. Luminescence (at a maximum wavelength of 477 nm) is generated by the cleavage reaction of dephosphorylated AMPPD. The luminescent signal reflects the amount of GFAP present in the sample.(Package insert: Lumipulse G GFAP. Fujirebio Inc; ver 1, 07/2024)

PDF Report

No

Day(s) Performed

Wednesday

Report Available

1 to 9 days

Specimen Retention Time

180 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

Test Definition: GFAPP

Glial Fibrillary Acidic Protein (GFAP), Plasma

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

83520

LOINC® Information

Test ID	Test Order Name	Order LOINC® Value
GFAPP	Glial Fibrillary Acidic Protein, P	97604-3

Result ID	Test Result Name	Result LOINC® Value
GFAPP	Glial Fibrillary Acidic Protein, P	97604-3