130212006M:100 tests/kit
130612006M: 50 tests/kit
130712006M: 30 tests/kit

MAGLUMI® CMV IgM (CLIA)

INTENDED USE

The kit is an *in vitro* chemiluminescence immunoassay for the qualitative determination of CMV IgM in human serum and plasma using the MAGLUMI series Fully-auto chemiluminescence immunoassay analyzer and Biolumi series Integrated System, and the assay is used for an aid in the diagnosis of acute or recent CMV infection and used for pre-natal screening of women.

SUMMARY

Cytomegalovirus (CMV) is a member of the herpesvirus family and is a large enveloped virus that is widely distributed in human population[1]. CMV is transmitted person-to-person via close non-sexual contact, sexual activity, breastfeeding, blood transfusions, and organ transplantation[2]. CMV is a universally distributed pathogen. The highest prevalence is found in countries in the developing world[3]. By the age of 40, between 50%–85% of adults are infected by CMV[4].

CMV infection can be primary or secondary. Primary infection may be acquired through different transmission routes and in different periods of life (i.e., congenital and post -natal infections). Following primary infection, CMV enters a latency phase[1,2]. Subsequent reactivation of viral replication (secondary infection) may take place. In immunocompetent individuals primary CMV infection is usually mild or asymptomatic[5,6]. Patients commonly present with a mononucleosis-like syndrome, including fever, sore throat, cervical lymphadenopathy, malaise, headache, muscle ache and joint pains[1]. Recurrent infections are common in immunocompromised patients[7]. CMV infection is also a particular concern for women of child-bearing age[8].

Primary CMV infection is reported in 1-4 % of seronegative women during pregnancy and the risk of transmission to the fetus is estimated to be about 30-40 %. Reactivation of CMV infection during pregnancy is reported in 10-30 % of seropositive women and, in this circumstance, the risk of transmission of the virus is about 1-3 %[6]. If seronegative women contract primary CMV infection during pregnancy, sequelae may be abortion, stillbirth or neonatal malformation. Overall, prenatal CMV infection occurs in 0.6-0.7 % of all life births in the developed world[6,9]. The majority of babies born with congenital CMV infection are asymptomatic at birth[10,11]. Approximately 10% of congenitally infected infants exhibit symptoms of infection, such as jaundice, pneumonia, central nervous system disorder, psychomotor retardation, deafness, retinochoroiditis, microcephaly, hydrocephalus, cardiac disease, hepatitis, hepatosplenomegaly and thrombocytopoenia at birth. The mortality rate is quite high[6,12].

At risk for CMV infection and disease are also immunocompromised patients such as transplant recipients and HIV infected patients where the virus can cause life-threatening diseases[13]. Reactivation of latent CMV infection or acquisition of primary CMV infection in immunocompromised individuals can result in symptoms that include encephalitis, pneumonitis, hepatitis, uveitis, retinitis, colitis, and graft rejection[14].

Within the appropriate clinical context, the first step in diagnosing acute primary CMV infection is most commonly made by the detection of anti-CMV-specific IgG and IgM antibodies[6]. Samples being reactive for IgM antibodies indicate an acute, recent or reactivated infection. For further analysis of a primary CMV infection the determination of the CMV IgG avidity is used as an aid. A positive IgM result in combination with a low avidity index for IgG is a strong indication of a recent primary CMV infection[9]. Seroconversion to CMV IgM and IgG may also indicate a recent CMV infection[1].

TEST PRINCIPLE

Indirect chemiluminescence immunoassay.

The prediluted sample, buffer, magnetic microbeads coated with CMV antigen are mixed thoroughly and incubated, performing a wash cycle after a precipitation in a magnetic field. ABEI labeled with anti-human IgM monoclonal antibody are then added and incubated, reacting to form immuno-complexes. After precipitation in a magnetic field, the supernatant is decanted and then a wash cycle is performed. Subsequently, the Starter 1+2 are added to initiate a chemiluminescent reaction. The light signal is measured by a photomultiplier as relative light units (RLUs), which is proportional to the concentration of CMV IgM present in the sample.

REAGENTS

Kit Contents

Component	Description	100 tests/kit	50 tests/kit	30 tests/kit
Magnetic Microbeads	Magnetic microbeads coated with CMV antigen (~4.00 μg/mL) in Tris-HCl buffer, NaN_3 (<0.1%).	2.5 mL	1.5 mL	1.0 mL
Calibrator Low	A low concentration of CMV IgM in PBS buffer, NaN_3 (<0.1%).	1.0 mL	1.0 mL	1.0 mL
Calibrator High	A high concentration of CMV IgM in PBS buffer, NaN_3 (<0.1%).	1.0 mL	1.0 mL	1.0 mL
Buffer	PBS buffer, NaN_3 (<0.1%).	12.5 mL	7.0 mL	4.8 mL
ABEI Label	ABEI labeled with anti-human IgM monoclonal antibody (~25.0 ng/mL) in Tris-HCl buffer, NaN_3 (<0.1%).	22.5 mL	12.0 mL	7.8 mL
Diluent	PBS buffer, NaN_3 (<0.1%).	25.0 mL	13.5 mL	8.0 mL
Negative Control	PBS buffer, NaN_3 (<0.1%).	1.0 mL	1.0 mL	1.0 mL
Positive Control	A high concentration of CMV IgM (7.00 AU/mL) in PBS buffer, NaN_3 (<0.1%).	1.0 mL	1.0 mL	1.0 mL

All reagents are provided ready-to-use.

Warnings and Precautions

- For *in vitro* diagnostic use.
- For professional use only.
- Exercise the normal precautions required for handling all laboratory reagents.
- Personal protective measures should be taken to prevent any part of the human body from contacting samples, reagents, and controls, and should comply with local operating requirements for the assay.
- A skillful technique and strict adherence to the package insert are necessary to obtain reliable results.
- Do not use kit beyond the expiration date indicated on the label.
- Do not interchange reagent components from different reagents or lots.
- Avoid foam formation in all reagents and sample types (specimens, calibrators and controls).
- All waste associated with biological samples, biological reagents and disposable materials used for the assay should be considered potentially infectious and should be disposed of in accordance with local guidelines.
- This product contains sodium azide. Sodium azide may react with lead or copper plumbing to form highly explosive metal azides. Immediately after disposal, flush with a large volume of water to prevent azide build-up. For additional information, see Safety Data Sheets available for professional user on request.

Note: If any serious incident has occurred in relation to the device, please report to Shenzhen New Industries Biomedical Engineering Co., Ltd. (Snibe) or our authorized representative and the competent authority of the Member State in which you are established.

Reagent Handling

- To avoid contamination, wear clean gloves when operating with a reagent kit and sample. When handling reagent kit, replace the gloves that have been in contact with samples, since introduction of samples will result in unreliable results.
- Do not use kit in malfunction conditions; e.g., the kit leaking at the sealing film or elsewhere, obviously turbid or precipitation is found in reagents (except for Magnetic Microbeads) or control value is out of the specified range repeatedly. When kit in malfunction conditions, please contact Snibe or our authorized distributor.
- To avoid evaporation of the liquid in the opened reagent kits in refrigerator, it is recommended that the opened reagent kits to be sealed with reagent seals contained within the packaging. The reagent seals are single use, and if more seals are needed, please contact Snibe or our authorized distributor.
- Over time, residual liquids may dry on the septum surface. These are typically dried salts and have no effect on assay efficacy.
- Use always the same analyzer for an opened reagent integral.
- For magnetic microbeads mixing instructions, refer to the Preparation of the Reagent section of this package insert.
- For further information about the reagent handing during system operation, please refer to Analyzer Operating Instructions.

Storage and Stability

- Do not freeze the integral reagents.
- Store the reagent kit upright to ensure complete availability of the magnetic microbeads.
- Protect from direct sunlight.

Stability of the Reagents	
Unopened at 2-8°C	until the stated expiration date
Opened at 2-8°C	6 weeks
On-board	4 weeks

Stability of Controls	
Unopened at 2-8°C	until the stated expiration date
Opened at 10-30°C	6 hours
Opened at 2-8°C	6 weeks
Frozen at -20°C	3 months
Frozen and thawed cycles	no more than 3 times

SPECIMEN COLLECTION AND PREPARATION

Specimen Types

Only the specimens listed below were tested and found acceptable.

Specimen Types	Collection Tubes
Serum	Tubes without additive/accessory, or tubes containing clot activator or clot activator with gel.
Plasma	K2-EDTA, Na-heparin or Li-heparin

- The sample types listed were tested with a selection of sample collection tubes that were commercially available at the time of testing, i.e. not all available tubes of all manufacturers were tested. Sample collection systems from various manufacturers may contain differing materials which could affect the test results in some cases. Follow tube manufacturers' instructions carefully when using collection tubes.

Specimen Conditions

- Do not use heat-inactivated samples or grossly hemolyzed/hyperlipidaemia specimens and specimens with obvious microbial contamination.
- Ensure that complete clot formation in serum specimens has taken place prior to centrifugation. Some serum specimens, especially those from patients receiving anticoagulant or thrombolytic therapy, may exhibit increased clotting time. If the serum specimen is centrifuged before a complete clotting, the presence of fibrin may cause erroneous results.
- Samples must be free of fibrin and other particulate matter.
- To prevent cross contamination, use of disposable pipettes or pipette tips are recommended.

Preparation for Analysis

- Inspect all specimens for foam. Remove foam with an applicator stick before analysis. Use a new applicator stick for each specimen to prevent cross contamination.
- Frozen specimens must be completely thawed before mixing. Mix thawed specimens thoroughly by low speed vortexing or by gently inverting. Visually inspect the specimens. If layering or stratification is observed, mix until specimens are visibly homogeneous. If specimens are not mixed thoroughly, inconsistent results may be obtained.
- Specimens should be free of fibrin, red blood cells, or other particulate matter. Such specimens may give reliable results and must be centrifuged prior to testing. Transfer clarified specimen to a sample cup or secondary tube for testing. For centrifuged specimens with a lipid layer, transfer only the clarified specimen and not the lipemic material.
- The sample volume required for a single determination of this assay is 20 μL.

Specimen Storage

Specimens removed from the separator, red blood cells or clot may be stored up to 7 days at 10-30°C or 4 weeks at 2-8°C, or 6 months frozen at -20°C. Frozen specimens subjected to up to 5 freeze/thaw cycles have been evaluated.

Specimen Shipping

- Package and label specimens in compliance with applicable local regulations covering the transport of clinical specimens and infectious substances.
- Do not exceed the storage limitations listed above.

PROCEDURE

Materials Provided

CMV IgM (CLIA) assay, control barcode labels.

Materials Required (But Not Provided)

- General laboratory equipment.
- Fully-auto chemiluminescence immunoassay analyzer Maglumi 600, Maglumi 800, Maglumi 1000, Maglumi 2000, Maglumi 2000 Plus, Maglumi 4000, Maglumi 4000 Plus, MAGLUMI X8, MAGLUMI X3, MAGLUMI X6 or Integrated System Biolumi 8000, Biolumi CX8.
- Additional accessories of test required for the above analyzers include Reaction Module, Starter 1+2, Wash Concentrate, Light Check, Tip, and Reaction Cup. Specific accessories and accessories' specification for each model refer to corresponding Analyzer Operating Instructions.
- Please use accessories specified by Snibe to ensure the reliability of the test results.

Assay Procedure

Preparation of the Reagent

- Take the reagent kit out of the box and visually inspect the integral vials for leaking at the sealing film or elsewhere. If there is no leakage, please tear off the sealing film carefully.
- Open the reagent area door; hold the reagent handle to get the RFID label close to the RFID reader (for about 2s); the buzzer will beep; one beep sound indicates successful sensing.
- Keeping the reagent straight insert to the bottom along the blank reagent track.
- Observe whether the reagent information is displayed successfully in the software interface, otherwise repeat the above two steps.
- Resuspension of the magnetic microbeads takes place automatically when the kit is loaded successfully, ensuring the magnetic microbeads are totally resuspended homogenous prior to use.

Assay Calibration

- Select the assay to be calibrated and execute calibration operation in reagent area interface. For specific information on ordering calibrations, refer to the calibration section of Analyzer Operating Instructions.
- Execute recalibration according to the calibration interval required in this package insert.

Quality Control

- When new lot used, check or edit the quality control information.
- Scan the control barcode, choose corresponding quality control information and execute testing. For specific information on ordering quality controls, refer to the quality control section of the Analyzer Operating Instructions.

Sample Testing

- After successfully loading the sample, select the sample in interface and edit the assay for the sample to be tested and execute testing. For specific information on ordering patient specimens, refer to the sample ordering section of the Analyzer Operating Instructions.

To ensure proper test performance, strictly adhere to Analyzer Operating Instructions.

Calibration

Traceability: This method has been standardized against the Snibe internal reference standard.

Test of assay specific calibrators allows the detected relative light unit (RLU) values to adjust the master curve.

Recalibration is recommended as follows:

- Whenever a new lot of Reagent or Starter 1+2 is used.
- Every 28 days.
- The analyzer has been serviced.
- Control values lie outside the specified range.

Quality Control

Controls are recommended for the determination of quality control requirements for this assay and should be run in singlicate to monitor the assay performance. Refer to published guidelines for general quality control recommendations, for example Clinical and Laboratory Standards Institute (CLSI) Guideline C24 or other

published guidelines[15].

Quality control is recommended once per day of use, or in accordance with local regulations or accreditation requirements and your laboratory's quality control procedures, quality control could be performed by running the CMV IgM assay:

- Whenever the kit is calibrated.
- Whenever a new lot of Starter 1+2 or Wash Concentrate is used.

Controls are only applicable with MAGLUMI and Biolumi systems and only used matching with the same top seven LOT numbers of corresponding reagents. For each target value and range refer to the label.

The performance of other controls should be evaluated for compatibility with this assay before they are used. Appropriate value ranges should be established for all quality control materials used.

Control values must lie within the specified range, whenever one of the controls lies outside the specified range, calibration should be repeated and controls retested. If control values lie repeatedly outside the predefined ranges after successful calibration, patient results must not be reported and take the following actions:

- Verify that the materials are not expired.
- Verify that required maintenance was performed.
- Verify that the assay was performed according to the package insert.
- If necessary, contact Snibe or our authorized distributors for assistance.

If the controls in kit are not enough for use, please order CMV IgM (CLIA) Controls (REF: 160201482MT) from Snibe or our authorized distributors for more.

RESULTS

Calculation

The analyzer automatically calculates the CMV IgM concentration in each sample by means of a calibration curve which is generated by a 2-point calibration master curve procedure. The results are expressed in AU/mL. For further information please refer to the Analyzer Operating Instructions.

Interpretation of Results

The expected results for the CMV IgM assay was obtained by testing 286 CMV IgM positive patients and 794 CMV IgM negative people in China, gave the following expected value by ROC curve:

- Non-reactive: A result less than 2.00 AU/mL (<2.00 AU/mL) is considered to be negative.
- Grayzone: A result with in the interval between 2.00 and 4.20 (2.00≤x<4.20 AU/mL) is considered to be equivocal.
- Reactive: A result greater than or equal to 4.20 AU/mL (≥4.20 AU/mL) is considered to be positive.

It is recommended to retest the samples in the greyzone. If the results continue to be unclear, consider taking a second sample within an appropriate period of time (e.g. 2 weeks) and repeating testing.

Results may differ between laboratories due to variations in population and test method. It is recommended that each laboratory establish its own reference interval.

LIMITATIONS

- The assay is mainly used to prenatal screening and physical examination.
- Results should be used in conjunction with patient's medical history, clinical examination and other findings.
- If the CMV IgM results are inconsistent with clinical evidence, additional testing is needed to confirm the result.
- Specimens from patients who have received preparations of mouse monoclonal antibodies for diagnosis or therapy may contain human anti-mouse antibodies (HAMA). Such specimens may show either falsely elevated or depressed values when tested with assay kits which employ mouse monoclonal antibodies[16,17]. Additional information may be required for diagnosis.
- Heterophilic antibodies in human serum can react with reagent immunoglobulins, interfering with *in vitro* immunoassays. Patients routinely exposed to animals or animal serum products can be prone to this interference and anomalous values may be observed[18].
- Bacterial contamination or heat inactivation of the specimens may affect the test results.
- A negative CMV IgM test result, also in combination with a positive CMV IgG result, does not completely rule out the possibility of an acute infection with cytomegalovirus.
- The detection of IgM antibodies against CMV in a single sample is not sufficient to prove an acute CMV infection. In single cases elevated IgM antibody levels may persist even for years after initial infection.
- The results in HIV patients, in patients undergoing immunosuppressive therapy, or in patients with other disorders leading to immune suppression, should be interpreted with caution.
- Specimens from neonates, cord blood, pretransplant patients or body fluids other than serum and plasma, such as urine, saliva or amniotic fluid have not been tested.

SPECIFIC PERFORMANCE CHARACTERISTICS

Representative performance data are provided in this section. Results obtained in individual laboratories may vary.

Precision

Precision was determined using the assay, samples and controls in a protocol (EP05-A3) of the CLSI (Clinical and Laboratory Standards Institute): duplicates at two independent runs per day for 5 days at three different sites using three lots of reagent kits (n = 180). The following results were obtained:

Sample	Mean (AU/mL) (n=180)	Within-Run		Between-Run		Reproducibility	
		SD (AU/mL)	%CV	SD (AU/mL)	%CV	SD (AU/mL)	%CV
Serum Pool 1	1.002	N/A	N/A	N/A	N/A	N/A	N/A
Serum Pool 2	7.027	0.236	3.36	0.125	1.78	0.358	5.09
Serum Pool 3	14.066	0.445	3.16	0.228	1.62	1.010	7.18
Plasma Pool 1	1.021	N/A	N/A	N/A	N/A	N/A	N/A
Plasma Pool 2	7.058	0.225	3.19	0.117	1.66	0.365	5.17
Plasma Pool 3	14.131	0.375	2.65	0.293	2.07	0.592	4.19
Negative Control	0.501	N/A	N/A	N/A	N/A	N/A	N/A
Positive Control	6.953	0.223	3.21	0.148	2.13	0.284	4.08

Analytical Specificity

Interference

Interference was determined using the assay, three samples containing different concentrations of analyte were spiked with potential endogenous and exogenous interferents in a protocol (EP7-A2) of the CLSI. The measurement deviation of the interference substance is within ±10%. The following results were obtained:

Interference	No interference up to	Interference	No interference up to
Hemoglobin	2400 mg/dL	Interferon α	15000 IU/mL
Intralipid	3000 mg/dL	Levamisole	1.5 mg/mL
Bilirubin	50 mg/dL	Acetylsalicylic acid	0.65 mg/mL
ANA	40 ng/mL	Tazobactam	0.1 mg/L
ANA	398 AU/mL	Methylcobalamin	50 μg/mL
Rheumatoid factor	2000 IU/mL	Rifampicin	48 μg/mL
Total protein	12 g/dL	Doxycycline	18 μg/mL
Anti-Mitochondrial Antibody	398 RU/mL	Cefoxitin	6600 μg/mL
Total IgG	8000 mg/dL	Cyclosporine	2 μg/mL
Total IgM	2500 mg/dL	Metronidazole	125 μg/mL
K2-EDTA	22.75 μmol/mL	Ascorbic acid	60 μg/mL
Heparin sodium salt	80 IU/mL	Phenylbutazone	330 μg/mL
Heparin lithium salt	80 IU/mL	Vidarabine	1000 μg/mL
Biotin	0.5 mg/dL	Acetaminophen	400 μg/mL
Ribavirin	2 mg/mL	Sodium salicylate	500 μg/mL
Acyclovir	6.6 mg/dL	Systemic Lupus Erythematosus Plasma	/

Cross-Reactivity

The assay is highly specific for CMV IgM antibodies, with no observed cross reactivity to Toxo IgM, CMV IgG, HSV-1 IgM, HSV-2 IgM, Rubella IgM, Anti-HAV IgM, Anti-HBs, Anti-HBe, HBcAb IgM, Anti-HCV, Anti-HIV, Anti-Treponema pallidum, EBV VCA IgM, *M.Pneumoniae* IgM, *C.Pneumoniae* IgM, Parvovirus B19 IgM, VZV IgM, Influenza A virus IgM, Influenza B virus IgM, Parainfluenza virus IgM, Adenovirus IgM and CVB IgM.

High-Dose Hook

No high-dose hook effect was seen for CMV IgM concentrations up to 600 AU/mL.

Clinical Sensitivity

The clinical sensitivity of the CMV IgM assay was determined in China by testing 101 samples collected from pregnant women, women of childbearing age, newborn and random individuals with commercial assay confirmation of CMV IgM positive result.

N of samples	Reactive	Sensitivity	95% CI
101	99	98.02%	93.07%-99.46%

Clinical Specificity

The clinical specificity of the CMV IgM assay was determined in China by testing 769 samples collected from pregnant women, women of childbearing age, newborn and random individuals with commercial assay confirmation of CMV IgM negative result.

N of samples	Non-reactive	Specificity	95% CI
769	767	99.74%	99.06%-99.93%

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SYMBOLS EXPLANATIONS

	Consult instructions for use		Manufacturer
2°C 8°C	Temperature limit (Store at 2-8°C)		Use-by date
Σ	Contains sufficient for<n> tests		Keep away from sunlight
	This way up	EC REP	Authorized representative in the European Community
IVD	*In vitro* diagnostic medical device	CONTENTS	Kit component
REF	Catalogue number	LOT	Batch code
CE 0123	CE marking with notified body ID number		

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Summary of safety and performance is available at Eudamed.

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