

Elecsys EBV VCA IgG

REF			SYSTEM
08355312190	08355312500	100	cobas e 411 cobas e 601 cobas e 602

English

System information

For **cobas e 411** analyzer: test number 1220
 For **cobas e 601** and **cobas e 602** analyzers: Application Code Number 212

Please note

For the serological determination of the EBV infection stage, the Elecsys EBV VCA IgG assay should only be used in combination with the Elecsys EBV IgM assay and the Elecsys EBV EBNA IgG assay.

Intended use

Immunoassay for the in vitro qualitative detection of IgG antibodies to Epstein-Barr virus (EBV), including viral capsid antigens (VCA), in human serum and plasma. It is a first-line assay intended for use as an aid in the diagnosis of an infectious mononucleosis, to differentiate EBV infection from other infections with similar clinical signs and symptoms, and to determine the immune status in pre-transplant recipients and donors.

The electrochemiluminescence immunoassay "ECLIA" is intended for use on **cobas e** immunoassay analyzers.

Summary

Epstein-Barr virus, also known as human herpesvirus 4 (HHV4) is one of the 8 known human herpes viruses, infecting about 90 % of the world population already at young age and generally causing little complications. The majority of these infections are either asymptomatic or manifest with only minor unspecific symptoms.¹ The most common EBV-linked disease is the symptomatic acute primary infection called infectious mononucleosis (IM), mainly affecting adolescents and young adults. IM is characterized by the triad of fever, pharyngitis and cervical lymphadenopathy, and is generally a self-limiting disease with supportive therapy as the mainstay of treatment.² Yet, early and accurate diagnosis is valuable as EBV is highly communicable, and in rare cases complications may develop, posing serious health risks.¹ Following the lytic replication during primary infection, EBV remains latent for life, mainly in B-cells.³ EBV infection has been associated to various autoimmune diseases as well as several distinct malignant diseases including both lymphomas and carcinomas.⁴ Immunosuppression can result in post-transplant lymphoproliferative disorder (PTLD), a frequently fatal disorder of uncontrolled B-cell proliferation.⁵ EBV is mainly transmitted by saliva, but sexual transmission, and transmission via solid-organ and hematopoietic-stem-cell transplantation has been reported.⁶

Various viral, bacterial, and parasitic diseases can cause mononucleosis-like symptoms, especially in early infection.⁷ A combination of biomarkers is commonly used for differential diagnosis, to rule out other infections or conditions with similar symptoms, such as acute HIV or CMV infection or toxoplasmosis. EBV serology is also used for the determination of the immune status of transplant donors and recipients assessing the risk of a patient to develop PTLD, that can be caused by a reactivation or a new EBV infection in the previously EBV naive patient.^{8,9,10,11}

Serologic tests specific for EBV are routinely used to confirm the diagnosis of an acute EBV infection, as clinical signs and symptoms are not very sensitive or specific.² 3 different biomarkers are routinely used in combination to determine the stage of EBV infection: IgM antibodies to EBV antigens, IgG antibodies to EBV viral capsid antigens (VCA), and IgG antibodies to EBV nuclear antigen-1 (EBNA-1).^{12,13} Anti-EBV IgM and anti-EBV VCA IgG antibodies are typically detectable at the clinical onset of illness. IgM may remain positive until 2 to 6 months after primary infection, and VCA IgG antibodies typically show lifelong persistence. EBNA-1 IgG antibodies usually appear within 6-12 weeks after primary infection and persist lifelong. Therefore, the presence of IgM and VCA IgG antibodies, and the absence of EBNA-1 IgG, in combination with the typical clinical presentation are indicative for acute infection. The absence of IgM antibodies and presence of VCA IgG and EBNA-1 IgG antibodies are indicative for past infection and a state of latency.^{12,13} For EBV-monitoring

in cancer, transplantation, HIV/AIDS and autoimmune syndromes, specific rules may apply, that differ per disease condition.^{12,14,15}

Test principle

Sandwich principle. Total duration of assay: 18 minutes.

- 1st incubation: 35 µL of sample, biotinylated recombinant EBV-specific antigens and EBV-specific recombinant antigens labeled with a ruthenium complex^{a)} form a sandwich complex.
- 2nd incubation: After addition of streptavidin-coated microparticles, the complex becomes bound to the solid phase via interaction of biotin and streptavidin.
- The reaction mixture is aspirated into the measuring cell where the microparticles are magnetically captured onto the surface of the electrode. Unbound substances are then removed with ProCell/ProCell M. Application of a voltage to the electrode then induces chemiluminescent emission which is measured by a photomultiplier.
- Results are determined automatically by the software by comparing the electrochemiluminescence signal obtained from the reaction product of the sample with the signal of the cutoff value previously obtained by calibration.

a) Tris(2,2'-bipyridyl)ruthenium(II)-complex (Ru(bpy)₃²⁺)

Reagents - working solutions

The reagent rackpack (M, R1, R2) is labeled as EBVVCAG.

- M Streptavidin-coated microparticles (transparent cap), 1 bottle, 6.5 mL: Streptavidin-coated microparticles 0.72 mg/mL; preservative.
- R1 EBV-Ag-biotin (gray cap), 1 bottle, 7 mL: Biotinylated EBV-specific antigen (recombinant, E. coli) > 1000 µg/L; MES^{b)} buffer 50 mmol/L, pH 6.5; preservative.
- R2 EBV-Ag-Ru(bpy)₃²⁺ (black cap), 1 bottle, 8 mL: EBV-specific antigen (recombinant, E. coli) labeled with ruthenium complex > 1000 µg/L; MES buffer 50 mmol/L, pH 6.5; preservative.

b) MES = 2-morpholinoethane sulfonic acid

- EBVVCAG Cal1 Negative calibrator 1 (white cap; lyophilized), 1 bottle for 1.0 mL: Human serum, non-reactive for EBV VCA IgG; buffer; preservative.
- EBVVCAG Cal2 Positive calibrator 2 (black cap; lyophilized), 1 bottle for 1.0 mL: Human serum, reactive for EBV VCA IgG; 15000-120000 counts (**cobas e 411** analyzer); 12000-110000 counts (**cobas e 601** and **cobas e 602** analyzers); buffer; preservative.

Precautions and warnings

For in vitro diagnostic use for laboratory professionals. Exercise the normal precautions required for handling all laboratory reagents.

Infectious or microbial waste:

Warning: handle waste as potentially biohazardous material. Dispose of waste according to accepted laboratory instructions and procedures.

Environmental hazards:

Apply all relevant local disposal regulations to determine the safe disposal.

Safety data sheet available for professional user on request.

This kit contains components classified as follows in accordance with the Regulation (EC) No. 1272/2008:



Warning

- H317 May cause an allergic skin reaction.
- H412 Harmful to aquatic life with long lasting effects.

Prevention:

- P261 Avoid breathing mist or vapours.
- P273 Avoid release to the environment.
- P280 Wear protective gloves.

Response:

- P333 + P313 If skin irritation or rash occurs: Get medical advice/attention.
- P362 + P364 Take off contaminated clothing and wash it before reuse.

Disposal:

- P501 Dispose of contents/container to an approved waste disposal plant.

Hazardous components:

- 2-methyl-2H-isothiazol-3-one hydrochloride
- Product safety labeling follows EU GHS guidance.
Contact phone: all countries: +49-621-7590

All human material should be considered potentially infectious. All products derived from human blood are prepared exclusively from the blood of donors tested individually and shown to be free from HBsAg and antibodies to HCV and HIV. The testing methods use assays that have been approved or cleared by the FDA or that are in compliance with the legal rules of the European Union (IVDR 2017/746/EU, IVDD 98/79/EC, Annex II, List A). However, as no testing method can rule out the potential risk of infection with absolute certainty, the material should be handled with the same level of care as a patient specimen. In the event of exposure, the directives of the responsible health authorities should be followed.^{16,17}

Avoid foam formation in all reagents and sample types (specimens, calibrators and controls).

Reagent handling

The reagents (M, R1, R2) in the kit are ready-for-use and are supplied in bottles compatible with the system.

Calibrators:

Carefully dissolve the contents of 1 bottle by adding exactly 1.0 mL of distilled or deionized water and allow to stand closed for 15 minutes to reconstitute. Mix carefully, avoiding foam formation.

Transfer the reconstituted calibrators into the supplied empty labeled snap-cap bottles.

cobas e 411 analyzer: The reconstituted calibrators should only be left on the analyzer during calibration at 20-25 °C. After use, close the bottles as soon as possible and store upright at 2-8 °C.

Due to possible evaporation effects, not more than 3 calibration procedures per calibrator bottle set should be performed.

cobas e 601 and **cobas e 602** analyzers: Unless the entire volume is necessary for calibration on the analyzers, transfer aliquots of the freshly reconstituted calibrators into empty snap-cap bottles (CalSet Vials). Attach the supplied labels to these additional bottles. Store the aliquots at 2-8 °C or -20 °C (± 5 °C) for later use.

Perform **only one** calibration procedure per aliquot.

All information required for correct operation is read in from the respective reagent barcodes.

Please note for **cobas e 602** analyzers: Both the vial labels, and the additional labels (if available) contain 2 different barcodes. Please turn the vial cap 180° into the correct position so that the barcode between the

yellow markers can be read by the system. Place the vial on the analyzer as usual.

Storage and stability

Store at 2-8 °C.

Do not freeze.

Store the Elecsys reagent kit **upright** in order to ensure complete availability of the microparticles during automatic mixing prior to use.

Stability of the reagent rackpack	
unopened at 2-8 °C	up to the stated expiration date
after opening at 2-8 °C	8 weeks
on the analyzers	28 days

Stability of the calibrators	
unopened at 2-8 °C	up to the stated expiration date
reconstituted at 2-8 °C	4 weeks
reconstituted at -20 °C (± 5 °C)	16 weeks (freeze only once)
on cobas e 411 at 20-25 °C	up to 5 hours
on cobas e 601 and cobas e 602 at 20-25 °C	use only once

Store calibrators **upright** in order to prevent the calibrator solution from adhering to the snap-cap.

Specimen collection and preparation

Only the specimens listed below were tested and found acceptable.

Serum collected using standard sampling tubes or tubes containing separating gel.

Li-heparin, K₂-EDTA and K₃-EDTA plasma.

Plasma tubes containing separating gel can be used.

Criterion: Absolute deviation of negative samples ± 0.25 COI (cutoff index) from serum value; reactive samples: recovery within 75-125 % of serum value.

Stable for 5 days at 20-25 °C, 14 days at 2-8 °C, 3 months at -20 °C (± 5 °C). The samples may be frozen 3 times.

The sample types listed were tested with a selection of sample collection tubes or systems 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. When processing samples in primary tubes (sample collection systems), follow the instructions of the tube/collection system manufacturer.

Specimens should not be subsequently altered with additives (e.g. biocides, anti-oxidants or substances that could possibly change the pH or ionic strength of the sample) in order to avoid erroneous findings.

Pooled samples and other artificial material may have different effects on different assays and thus may lead to discrepant findings.

Centrifuge samples containing precipitates and thawed samples before performing the assay.

Do not use heat-inactivated samples.

Ensure the samples, calibrators and controls are at 20-25 °C prior to measurement.

Due to possible evaporation effects, samples, calibrators and controls on the analyzers should be analyzed/measured within 2 hours.

The performance of the Elecsys EBV VCA IgG assay has not been established with cadaveric samples or body fluids other than serum and plasma.

Materials provided

See "Reagents – working solutions" section for reagents.

- 2 x 4 bottle labels
- 2 empty labeled snap-cap bottles

Materials required (but not provided)

- [REF](#) 08355428190, PreciControl EBV IgM/VCA IgG, 6 x 2.0 mL

Elecsys EBV VCA IgG

- [REF] 11776576322, CalSet Vials, 2 x 56 empty snap-cap bottles
- General laboratory equipment
- **cobas e** analyzer
- Distilled or deionized water

Additional materials for the **cobas e** 411 analyzer:

- [REF] 11662988122, ProCell, 6 x 380 mL system buffer
- [REF] 11662970122, CleanCell, 6 x 380 mL measuring cell cleaning solution
- [REF] 11930346122, Elecsys SysWash, 1 x 500 mL washwater additive
- [REF] 11933159001, Adapter for SysClean
- [REF] 11706802001, AssayCup, 60 x 60 reaction cups
- [REF] 11706799001, AssayTip, 30 x 120 pipette tips
- [REF] 11800507001, Clean-Liner

Additional materials for **cobas e** 601 and **cobas e** 602 analyzers:

- [REF] 04880340190, ProCell M, 2 x 2 L system buffer
- [REF] 04880293190, CleanCell M, 2 x 2 L measuring cell cleaning solution
- [REF] 03023141001, PC/CC-Cups, 12 cups to prewarm ProCell M and CleanCell M before use
- [REF] 03005712190, ProbeWash M, 12 x 70 mL cleaning solution for run finalization and rinsing during reagent change
- [REF] 03004899190, PreClean M, 5 x 600 mL detection cleaning solution
- [REF] 12102137001, AssayTip/AssayCup, 48 magazines x 84 reaction cups or pipette tips, waste bags
- [REF] 03023150001, WasteLiner, waste bags
- [REF] 03027651001, SysClean Adapter M

Additional materials for all analyzers:

- [REF] 11298500316, ISE Cleaning Solution/Elecsys SysClean, 5 x 100 mL system cleaning solution

Assay

For optimum performance of the assay follow the directions given in this document for the analyzer concerned. Refer to the appropriate operator's manual for analyzer-specific assay instructions.

Resuspension of the microparticles takes place automatically prior to use. Read in the test-specific parameters via the reagent barcode. If in exceptional cases the barcode cannot be read, enter the 15-digit sequence of numbers.

Bring the cooled reagents to approximately 20 °C and place on the reagent disk (20 °C) of the analyzer. Avoid foam formation. The system automatically regulates the temperature of the reagents and the opening/closing of the bottles.

Calibrators:

Place the reconstituted calibrators in the sample zone.

All the information necessary for calibrating the assay is automatically read into the analyzer.

After calibration has been performed, store the calibrators at 2-8 °C or discard (**cobas e** 601 and **cobas e** 602 analyzers).

Calibration

No international standard is available for EBV VCA IgG.

Calibration frequency: Calibration must be performed once per reagent lot using EBVVCAG Cal1, EBVVCAG Cal2 and fresh reagent (i.e. not more than 24 hours since the reagent kit was registered on the analyzer).

Calibration interval may be extended based on acceptable verification of calibration by the laboratory.

Renewed calibration is recommended as follows:

- after 8 weeks when using the same reagent lot
- after 7 days when using the same reagent kit on the analyzer
- as required: e.g. quality control findings outside the defined limits

Quality control

Use PreciControl EBV IgM/VCA IgG or other suitable controls for routine quality control procedures.

Controls for the various concentration ranges should be run individually at least once every 24 hours when the test is in use, once per reagent kit, and following each calibration.

The control intervals and limits should be adapted to each laboratory's individual requirements. Values obtained should fall within the defined limits. Each laboratory should establish corrective measures to be taken if values fall outside the defined limits.

If necessary, repeat the measurement of the samples concerned.

Follow the applicable government regulations and local guidelines for quality control.

Calculation

The analyzer automatically calculates the cutoff based on the measurement of EBVVCAG Cal1 and EBVVCAG Cal2. The result of a sample is given either as reactive, borderline or non-reactive as well as in the form of a cutoff index (COI; signal sample/cutoff).

Interpretation of the results

Results obtained with the Elecsys EBV VCA IgG assay can be interpreted as follows:

Numeric result	Result message	Interpretation
COI < 0.7	Non-reactive	Negative for EBV-specific IgG
COI ≥ 0.7 to < 1.0	Borderline	Indeterminate for EBV-specific IgG ^{c)}
COI ≥ 1.0	Reactive	Positive for EBV-specific IgG

c) It is recommended to interpret this result in conjunction with the results obtained with the Elecsys EBV IgM assay and Elecsys EBV EBNA IgG assay (see table below on determination of EBV infection stage).

The magnitude of the measured result above the cutoff is not indicative of the total amount of antibody present in the sample.

Due to different calibration curves, the numeric COI values of the Elecsys EBV VCA IgG assay on the **cobas e** 411 analyzer differ from those obtained on the other **cobas e** analyzers. However, the qualitative interpretation of the results is the same across all analyzers, where the cutoff level at a COI of 1 is identical.

The EBV VCA IgG results in a given specimen, as determined by assays from different manufacturers, can vary due to differences in methods.

For the serological determination of the EBV infection stage, the Elecsys EBV VCA IgG assay should only be used in combination with the Elecsys EBV IgM assay and the Elecsys EBV EBNA IgG assay.

The following result interpretation table is proposed to determine the EBV infection stage when using Elecsys EBV assays, based on what has been described in the literature.^{12,18,19}

Result message of the Elecsys assay			Corresponds to the EBV infection stage
EBV IgM	EBV VCA IgG	EBV EBNA IgG	
non-reactive	non-reactive	non-reactive	Seronegative
non-reactive	<i>borderline</i>	non-reactive	
<i>borderline</i>	non-reactive	non-reactive	Presumed early phase of EBV infection*
reactive	non-reactive	non-reactive	
<i>borderline</i>	<i>borderline</i>	non-reactive	
reactive	<i>borderline</i>	non-reactive	Acute phase of EBV infection
reactive	reactive	non-reactive	
<i>borderline</i>	reactive	non-reactive	
reactive	reactive	reactive	Presumed transient phase of EBV infection*
reactive	<i>borderline</i>	reactive	

Elecsys EBV VCA IgG



Result message of the Elecsys assay			Corresponds to the EBV infection stage
EBV IgM	EBV VCA IgG	EBV EBNA IgG	
borderline	reactive	reactive	Past EBV infection
borderline	borderline	reactive	
non-reactive	reactive	reactive	
non-reactive	borderline	reactive	
non-reactive	reactive	non-reactive	Isolated VCA IgG reactivity*
non-reactive	non-reactive	reactive	Isolated EBNA IgG reactivity*

For infection stages marked with an asterisk (*) and any other combination of result messages that is not listed in the table above, the EBV infection stage is considered indeterminate. Additional and/or follow-up testing is recommended in those cases.¹²

The individual immune response following EBV infection varies considerably¹² and might give different results with assays from different manufacturers. Results of assays from different manufacturers should not be used interchangeably.

Limitations - interference

The effect of the following endogenous substances and pharmaceutical compounds on assay performance was tested. Interferences were tested up to the listed concentrations and no impact on results was observed.

Endogenous substances

Compound	Concentration tested
Bilirubin	≤ 1130 µmol/L or ≤ 66 mg/dL
Hemoglobin	≤ 0.621 mmol/L or ≤ 1000 mg/dL
Intralipid	≤ 2000 mg/dL
Biotin	≤ 4912 nmol/L or ≤ 1200 ng/mL
Rheumatoid factors	≤ 1200 IU/mL
Human serum albumin	≤ 7 g/dL

Criterion: For samples with a COI ≥ 1.0, the deviation is ≤ 20 %. For samples with a COI < 1.0, the deviation is ≤ 0.2 COI.

A non-reactive EBV VCA IgG test result does not completely rule out the possibility of an infection with EBV. Individuals may not exhibit detectable levels of IgG antibodies, e.g. at the early stage of acute infection. Negative results may also occur when the patient is EBV infected but does not raise IgG antibodies against those EBV antigens that are contained in the EBV VCA IgG assay.

A one-time detection of VCA IgG antibodies in a single sample can indicate an acute or a previous exposure to EBV. Therefore, a test result for EBV VCA IgG alone is not sufficient to allow for an interpretation of the stage of EBV infection.

The Elecsys EBV VCA IgG assay is a qualitative assay. The numeric result is not indicative of a specific stage of an EBV infection and should not be compared to the numeric result of EBV VCA IgG assays of other manufacturers.

No false negative results due to a high-dose hook effect were found with the Elecsys EBV VCA IgG assay but the occurrence of a high-dose hook effect cannot be completely excluded.

In HIV patients, in patients undergoing immunosuppressive therapy, or in patients with other disorders leading to immune suppression different interpretations of the serological profile might apply.^{12,15}

Pharmaceutical substances

In vitro tests were performed on 17 commonly used pharmaceuticals. No significant interference with the assay was found except for itraconazole. Itraconazole can lead to reduced COI values.

In rare cases, interference due to extremely high titers of antibodies to analyte-specific antibodies, streptavidin or ruthenium can occur. These effects are minimized by suitable test design.

For clarification of the EBV infection stage the combination of the 3 Elecsys tests should always be performed and results should be assessed in conjunction with the patient's medical history, clinical symptoms and other findings.

cobas e 601 and cobas e 602 analyzers: In case Elecsys EBV VCA IgG/Elecsys EBV IgM assay combinations are performed, make sure that these assays are entered in the "Special Wash" section of the system software and "Step1" (wash execute) is checked. Please refer to the operator's manual.

Specific performance data

Representative performance data on the analyzers are given below. Results obtained in individual laboratories may differ.

Precision

Precision was determined using Elecsys reagents, samples and controls in a protocol (EP05-A3) of the CLSI (Clinical and Laboratory Standards Institute): 2 runs per day in duplicate each for 21 days (n = 84). The following results were obtained:

cobas e 411 analyzer					
Sample	Mean COI	Repeatability		Intermediate precision	
		SD COI	CV %	SD COI	CV %
HS ^{d)} , negative	0.307	0.026	8.3	0.046	14.8
HS, near cutoff / negative	0.724	0.033	4.6	0.052	7.1
HS, near cutoff / positive	1.40	0.035	2.5	0.054	3.8
HS, medium positive	11.8	0.103	0.9	0.289	2.5
HS, high positive	48.9	0.729	1.5	1.30	2.7
PC ^{e)} EBV IgM/VCA IgG 1	0.349	0.020	5.8	0.037	10.7
PC EBV IgM/VCA IgG 3	4.57	0.059	1.3	0.108	2.4

d) HS = human serum

e) PC = PreciControl

cobas e 601 and cobas e 602 analyzers					
Sample	Mean COI	Repeatability		Intermediate precision	
		SD COI	CV %	SD COI	CV %
HS, negative	0.256	0.031	12.0	0.038	14.9
HS, near cutoff / negative	0.755	0.044	5.8	0.052	6.9
HS, near cutoff / positive	1.22	0.071	5.8	0.081	6.6
HS, medium positive	34.5	0.525	1.5	0.871	2.5
HS, high positive	152	1.82	1.2	3.69	2.4
PC EBV IgM/VCA IgG 1	0.345	0.026	7.4	0.041	11.8
PC EBV IgM/VCA IgG 3	12.9	0.186	1.4	0.310	2.4

Analytical specificity

Potentially cross-reacting samples (characterized positive for potentially cross-reacting analytes with commercially available assays) were tested with the Elecsys EBV VCA IgG assay and 2 comparator assays (Comp1 and Comp2). 110 samples were tested internally, another 50 samples were tested externally as a part of the multicenter evaluation study.

Due to the high prevalence of EBV IgG antibodies in the population, most samples tested for cross-reactivity were reactive with the Elecsys EBV VCA IgG assay. Reactive results with the Elecsys EBV VCA IgG assay were all concordant with at least 1 comparator assay with the exceptions discussed below. The following results were obtained:

	N	EBV VCA IgG assay result					
		Non-reactive			Reactive		
Containing potentially cross-reacting analytes		Elecsys	Comp1	Comp2	Elecsys	Comp1	Comp2
CMV	20	1	0	1	19	20	19
HSV-1	13	0	0	1*	13	13	12
VZV	10	1	1	1	9	9	9
Parvovirus B19	16	0	0	1	16	16	15
Toxoplasmosis	18	1	1	1	17	17	17
Rubella	12	2	2	4*	10	10	8
HIV	10	0	0	0	10	10	10
HAV	25	1	1	1	24	24	24
HBV	10	0	0	0	10	10	10
HEV	4	0	0	0	4	4	4
ANA	12	1	1	1	11	11	11
SLE/dsDNA	10	1	1	1	9	9	9

*1 out of 4 samples (Rubella cohort) and 1 out of 1 sample (HSV-1 cohort) were EBV EBNA IgG reactive in at least 2 out of 3 methods, indicating a past EBV infection stage. These 2 samples are likely to be EBV VCA IgG non-responders in the method of comparator 2. Unless indicated otherwise, positive and negative concordance was observed on individual sample level, although shown here as the sum of the respective cohort only. Borderline results did not occur.

No evidence for other cross-reactivities was observed, but a potential cross-reactivity cannot be ruled out.

Relative specificity and relative sensitivity

Relative sensitivity and specificity were assessed on a total of 1734 specimens (1068 specimens with request for EBV testing from daily laboratory routine, 467 presumed acute specimens and 199 presumed seronegative specimens). All specimens were tested with the Elecsys EBV IgM assay, the Elecsys EBV VCA IgG assay and the Elecsys EBV EBNA IgG assay (referred to as Elecsys EBV assay panel) as well as with 2 different comparator EBV assay panels. The EBV infection stage was determined with the Elecsys EBV assay panel (according to the table in the section "Interpretation of the results"), and with the comparator panels according to their respective instructions for use. The ultimately assigned stage of EBV infection of a specimen was defined by the concordant EBV infection stage of at least 2 out of the 3 EBV assay panels (majority approach). In case each of the 3 EBV assay panels suggested a different EBV infection stage for a sample, no EBV infection stage could be defined and the sample was excluded from the performance calculations shown below.

Relative sensitivity

1253 specimens with the assigned stage "acute phase of an EBV infection" (n = 397) or "past EBV infection" (n = 856) were included in the calculation. The results are shown in the table below:

Sample cohort	N	Elecsys EBV VCA IgG assay result		Relative sensitivity	95 % confidence interval	
		Concordant to stage	Discordant to stage		Lower limit	Upper limit
Acute phase and past EBV infection	1253	1233	20	98.40 %	97.55 %	98.96 %

Relative specificity

318 specimens with the assigned stage "seronegative for EBV" were included in the calculation. The results are shown in the table below:

Sample cohort	N	Elecsys EBV VCA IgG assay result		Relative specificity	95 % confidence interval	
		Concordant to stage	Discordant to stage		Lower limit	Upper limit
Seronegative for EBV	318	314	4	98.74 %	96.81 %	99.51 %

Determination of EBV infection stage

The EBV infection stage was determined with the Elecsys EBV assay panel (according to the table in the section "Interpretation of the results"), and with the 2 comparator EBV assay panels according to their respective instructions for use.

Using the majority approach, an EBV infection stage was assigned to each specimen. The table below shows the number of specimens classified into each EBV infection stage with the Elecsys EBV assay panel in relation to the majority approach.

EBV infection stage	Number of samples per EBV infection stage as classified with the Elecsys EBV assay panel in relation to the majority approach	% of concordantly classified samples by the Elecsys EBV assay panel
Seronegative	310/318	97.48 %
Acute infection	369/397	92.95 %
Past infection	826/856	96.50 %
Total	1505/1571	95.80 %

In addition, 145 specimens were classified according to the majority approach into one of the "indeterminate EBV infection stages" (presumed early phase, transient phase, isolated VCA IgG, or isolated EBNA IgG), and in 18 specimens no majority approach was possible (3 different EBV infection stages found by the 3 different EBV assay panels).

References

- 1 Odumade OA, Hogquist KA, Balfour HH Jr. Progress and Problems in Understanding and Managing Primary Epstein-Barr Virus Infections. *Clin Microbiol Rev* 2011;24(1):193-209.
- 2 Luzuriaga K, Sullivan JL. Infectious Mononucleosis. *N Engl J Med* 2010;362(21):1993-2000.
- 3 Kerr JR. Epstein-Barr virus (EBV) reactivation and therapeutic inhibitors. *J Clin Pathol* 2019;72(10):651-658.
- 4 Okano M, Gross TG. Acute or Chronic Life-Threatening Diseases Associated With Epstein-Barr Virus Infection. *Am J Med Sci* 2012;343(6):483-489.
- 5 Gulley ML, Tang W. Using Epstein-Barr Viral Load Assays To Diagnose, Monitor, and Prevent Posttransplant Lymphoproliferative Disorder. *Clin Microbiol Rev* 2010;23(2):350-366.
- 6 Dunmire SK, Verghese PS, Balfour HH Jr. Primary Epstein-Barr virus infection. *J Clin Virol* 2018;102:84-92.
- 7 Hurt C, Tammaro D. Diagnostic Evaluation of Mononucleosis-Like Illnesses. *Am J Med* 2007;120(10):911 e1-8.
- 8 Green M, Michaels MG. Epstein-Barr Virus Infection and Posttransplant Lymphoproliferative Disorder. *Am J Transplant* 2013;13:41-54.
- 9 Dudley C, Harden P. Renal Association Clinical Practice Guideline on the Assessment of the Potential Kidney Transplant Recipient. *Nephron Clin Pract* 2011;118 Suppl 1:c209-224.
- 10 Nowalk A, Green M. Epstein-Barr Virus. *Microbiol Spectr* 2016;4(3).
- 11 European Directorate for the Quality of Medicines & HealthCare (EDQM). Guide to the quality and safety of organs for transplantation. 7th ed: Council of Europe; 2018.
- 12 De Paschale M, Clerici P. Serological diagnosis of Epstein-Barr virus infection: Problems and solutions. *World J Virol* 2012;1(1):31-43.
- 13 Rea TD, Ashley RL, Russo JE, et al. A Systematic Study of Epstein-Barr Virus Serologic Assays Following Acute Infection. *Am J Clin Pathol* 2002;117(1):156-161.
- 14 Crowley A, Connell J, Schaffer K, et al. Is There Diagnostic Value in Detection of Immunoglobulin G Antibodies to the Epstein-Barr Virus Early Antigen? *Biores Open Access* 2012;1(6):291-296.

Elecsys EBV VCA IgG

- 15 Middeldorp JM. Epstein-Barr Virus-Specific Humoral Immune Responses in Health and Disease. In: Münz Ch, editor. Epstein Barr Virus Volume 2 One Herpes Virus: Many Diseases. Springer; 2015;289-324.
- 16 Occupational Safety and Health Standards: Bloodborne pathogens. (29 CFR Part 1910.1030). Fed. Register.
- 17 Directive 2000/54/EC of the European Parliament and Council of 18 September 2000 on the protection of workers from risks related to exposure to biological agents at work.
- 18 Hess RD. Routine Epstein-Barr Virus Diagnostics from the Laboratory Perspective: Still Challenging after 35 Years. J Clin Microbiol 2004;42(8):3381-3387.
- 19 Klutts JS, Ford BA, Perez NR, et al. Evidence-based Approach for interpretation of Epstein-Barr virus serological patterns. J Clin Microbiol 2009;47(10):3204-3210.

For further information, please refer to the appropriate user guide or operator's manual for the analyzer concerned, the respective application sheets and the Method Sheets of all necessary components (if available in your country).







A point (period/stop) is always used in this Method Sheet as the decimal separator to mark the border between the integral and the fractional parts of a decimal numeral. Separators for thousands are not used.

Any serious incident that has occurred in relation to the device shall be reported to the manufacturer and the competent authority of the Member State in which the user and/or the patient is established.

The Summary of Safety & Performance Report can be found here:
<https://ec.europa.eu/tools/eudamed>

Symbols

Roche Diagnostics uses the following symbols and signs in addition to those listed in the ISO 15223-1 standard (for USA: see navifyportal.roche.com for definition of symbols used):

	Contents of kit
	Analyzers/Instruments on which reagents can be used
	Reagent
	Calibrator
	Volume for reconstitution
	Global Trade Item Number

Rx only For USA: Caution: Federal law restricts this device to sale by or on the order of a physician.

COBAS, NAVIFY, ELECSYS and PRECICONTROL are trademarks of Roche. INTRALIPID is a trademark of Fresenius Kabi AB.

All other product names and trademarks are the property of their respective owners.

Additions, deletions or changes are indicated by a change bar in the margin.

© 2024, Roche Diagnostics



 Roche Diagnostics GmbH
 Sandhofer Strasse 116
 68305 Mannheim, Germany
www.roche.com

 +800 5505 6606

