# Aurora D-Dimer Assay

CARBONTECHNOLOGIES

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**Intended Use**

Aurora D-Dimer Assay is a chemiluminescent microparticle immunoassay (CMIA) for the quantitative determination of D-Dimer in human plasma. The assay kit is intended for in vitro diagnostic use.

**Summary**

D-Dimer is a fibrin degradation product, a small protein fragment present in the blood after a blood clot is degraded by fibrinolysis. It is so named because it contains two D fragments of the fibrin protein joined by a cross-link, hence forming a protein dimer. D-Dimer levels are used as a predictive biomarker for the blood disorder, disseminated intravascular coagulation and in the coagulation, disorders associated with COVID-19 infection. A four-fold increase in the protein is an indicator of poor prognosis in people hospitalized with COVID-19. Determination of D-Dimer is used for diagnosis of deep vein thrombosis (DVT), pulmonary embolism (PE), disseminated intravascular coagulation (DIC) and stroke.

**Test Principle**

The Aurora D-Dimer assay is a quantitative sandwich immunoassay to determine the presence of D-Dimer in human plasma and plasma using CMIA technology with flexible assay protocols.

1. Sample, assay diluent, paramagnetic anti-D-Dimer coated microparticles and a conjugate containing acridinium-labeled anti-D-Dimer are mixed, D-Dimer present in the sample binds to anti-D-Dimer coated microparticles and acridinium-labeled anti-D-Dimer, forming an antigen antibody complex.
2. After further incubation and washing, Pre-Trigger and Trigger Solutions are added to the reaction mixture.
3. The resulting chemiluminescent reaction is measured as relative light units (RLUs). There is a relationship between the amount of D-Dimer in the sample and the RLUs detected by the optical system. Results are calculated automatically based on the previously established calibration curve.

**Reagents**

| | |
|---|---|
| R1 | 3.0 mL |
| R2 | 3.0 mL |
| R3 | 5.0 mL |
| CAL | Contains 3 levels, Reconstitute each vial with 1 mL of double deionized water. |
| CON | Contains 2 levels, 1.0 mL each level |

R1: Microparticles. Anti-D-Dimer coated microparticles. Preservative: 0.05% ProClin 300.

R2: Conjugate. Acridinium-labeled anti-D-Dimer. Preservative: 0.05% ProClin 300.

R3: Assay diluent. Preservative: 0.05% ProClin 300.

CAL: Calibrator. Lyophilized of different concentrations of D-Dimer. Preservative: 0.05% ProClin 300.

CON: Control. Tris buffer solution for quality control of D-Dimer

**Required Materials**

- Pre-Trigger Solution: Hydrogen peroxide solution.
- Trigger Solution: Sodium hydroxide solution.
- Sample Diluent: Phosphate buffered saline solution with surfactant and ProClin 300.
- Wash Buffer: Phosphate buffered saline solution with 0.05% ProClin 300.

**Safety Precautions**

- Exercise the normal precautions required for handling all laboratory reagents.
- Disposal of all waste material should be in accordance with local guidelines.
- Wear gloves when handling specimens or reagents.
- Clean and disinfect all spills of specimens or reagents using a suitable disinfectant.
- Trigger solution contains sodium hydroxide (NaOH) and should be avoided contact with eyes.

**Warning**（Contains Proclin 300）

Hazardous Component: 0.05% Proclin 300

- Reaction mass of: 5-chloro-2-methyl-4-isothiazolin [EC no. 247-500-7] and 2-methyl-4-isothiazolin-3-one [EC no. 200-239-6] (3:1)

**Hazard Statement**

- H317: May cause an allergic skin reaction.
- H319: Causes serious eye irritation.
- H410: Very toxic to aquatic life with long-lasting effects.

**Precautionary Statement**

- P261: Avoid breathing dust/fume/gas/mist/vapors/spray.
- P264: Wash hands thoroughly after handling.
- P272: Contaminated work clothing should not be allowed out of the workplace.
- P280: Wear protective gloves/protective clothing/eye protection/face protection.
- P305+P351+P338: IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
- P337+P313: If eye irritation persists: Get medical advice/attention.
- P333+P313: If skin irritation or rash occurs: Get medical advice/attention.
- P302+P352: IF ON SKIN: Wash with plenty of soap and water.
- P321: Seek immediate care from a doctor.
- P363: Wash contaminated clothing before reuse.
- P273: Avoid release to the environment.
- P391: Collect spillage.
- P501: Dispose of contents/container in a safe way.

**Reagent Handling**

- Do not use reagent kits beyond the expiration date.
- Do not pool reagents within a kit or between kits.
- Before loading the reagent kit on the system for the first time, the microparticle bottle requires mixing to resuspend microparticles that may have settled during shipment.
- Septums MUST be used to prevent reagent evaporation and contamination and to ensure reagent integrity. Reliability of assay results cannot be guaranteed if septums are not used according to the instructions in this package insert.
- To avoid contamination, wear clean gloves when placing a septum on an uncapped reagent bottle.
- Once a septum has been placed on an open reagent bottle, do not invert the bottle as this will result in reagent leakage and may compromise assay results.

**Reagent Storage**

| REAGENT | Storage Temperature | Maximum Storage Time |
|---|---|---|
| Unopened | 2℃～8℃ Do not freeze. | 12 months |
| On board/ Opened | 2℃～8℃ Do not freeze. | 28 days |

- Reagents may be stored on or off the chemiluminescence immunoassay analyzer. If reagents are removed from the analyzer, store them at 2-8°C (with septums and replacement caps) in an upright position. For reagents stored off the system, it is recommended that they be stored in their original trays and boxes to ensure they remain upright. If the microparticle bottle does not remain upright (with a septum installed) while in refrigerated storage off the system, the reagent kit must be discarded.

**Calibrator & Control Storage**

| CAL | CON | Storage Temperature | Maximum Storage Time |
|---|---|---|---|
| Unopened | | 2℃～8℃ | 12 months |
| Opened | | 2℃～8℃ | 30 days |

**Applicable Analyzer**

Automatic Chemiluminescence Immunoassay Analyzer (model: Aurora S-01).

**Specimen Types**

Verified specimen types to be used with this assay:

| Specimen Types | Collection Tubes |
|---|---|
| Plasma | Dipotassium EDTA |
| | Tripotassium EDTA |
| | Sodium heparin<br>Lithium heparin powder<br>Plasma separator tubes (PST)<br>-lithium heparin gel |

- Other specimen collection tube types have not been tested with this assay.
- Liquid anticoagulants may have a dilution effect

resulting in lower concentrations for individual patient specimens.

- The instrument does not provide the capability to verify specimen type. It is the responsibility of the operator to verify that the correct specimen types are used in the assay.

**Specimen Conditions**

Do not use specimens with the following conditions:

- Heat-inactivated
- Pooled
- Grossly hemolyzed (> 500 mg/dl hemoglobin)
- Obvious microbial contamination
- Fungal growth
- For accurate results, plasma specimens should be free of fibrin, red blood cells, and other particulate matter.
- To prevent cross contamination, use of disposable pipettes or pipette tips is recommended.

**Preparation for Analysis**

- Follow the tube manufacturer's processing instructions for collection tubes. Gravity separation is not sufficient for specimen preparation.
- Mix thawed specimens thoroughly by low speed vortexing or by inverting 10 times. Visually inspect the specimens. If layering or stratification is observed, continue mixing until specimens are visibly homogeneous.
- Avoid more than 3 freeze/thaw cycles.
- To ensure consistency in results, specimens must be transferred to a centrifuge tube and centrifuged for a minimum of 30,000 g-minutes before testing if they contain fibrin, red blood cells, or other particulate matter, they were previously frozen.
- Examples of acceptable time and force ranges that meet this criterion are listed in the table below. Centrifugation time using alternate Relative Centrifugal Force values (RCF) can be calculated using the following formula:

| Centrifugation Time (Minutes) | RCF (×g) | g × minutes |
|---|---|---|
| 10 | 3,000 | 30,000 |
| 15 | 2,000 | 30,000 |
| 20 | 1,500 | 30,000 |

- 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.
- Inspect all specimens for bubbles. Remove bubbles with an applicator stick before analysis. Use a new applicator stick for each specimen to prevent cross contamination.

**Specimen Storage**

| Specimen Type | Storage Temperature | Maximum Storage Time |
|---|---|---|
| Plasma | Room temperature | ≤ 4 hours |
| | 2℃～8℃ | ≤24 hours |
| | -20℃ | ≤ 90 days |

- Remove plasma from the clot, red blood cells, or separator gel if stored longer than the maximum room temperature storage time.
- Remove plasma from the clot, red blood cells, or separator gel if stored longer than the maximum 2-8°C storage time and store frozen.
- Frozen specimens must be mixed thoroughly after thawing.
- Use caution in handling patient specimens to prevent cross-contamination.
- Do not exceed the storage limitations listed above.

**Assay Procedure**

- Refer to the system operating instruction or the online help system for detailed information on preparing the system.
- Before loading the reagent kit on the system for the first time, the microparticle bottle requires mixing to resuspend microparticles that may have settled during shipment. After the first time the microparticles have been loaded, no further mixing is required.
- Invert the microparticle bottle 30 times. Visually inspect the bottle to ensure microparticles are resuspended. If microparticles are still adhered to the bottle, continue to invert the bottle until the microparticles have been completely resuspended. If the microparticles do not resuspend, DO NOT USE. Once the microparticles have been resuspended,

place a septum on the bottle.

- Load the reagent kit on the chemiluminescence immunoassay analyzer.
- Verify that all necessary reagents are present.
- Verify adequate sample volume is present prior to running the test.
- Sample volume for first test: 250 µL
- Sample volume for each additional test from same sample cup: 20 µL
- The test-specific parameters stored in barcode on the reagent pack are read in. In cases the barcode cannot be read, enter the sequence numbers
- Order calibration, if necessary.
- Prepare D-Dimer Calibrators and Controls.
- Mix calibrator(s) and controls by gentle inversion before use.
- Hold bottles vertically and dispense recommended volumes into each respective sample cup.
- Place the calibrators in the calibrator rack in the sample zone.
- Calibration.
- Load samples. For information on loading samples, refer to the Analyzer's Operations Manual.
- Press RUN.
- The chemiluminescence immunoassay analyzer performs all the functions automatically and calculates the results.

For optimal performance, it is important to perform routine maintenance as described in the Analyzer's Operations Manual. Perform maintenance more frequently when required by laboratory procedures.

Sample Dilution Procedures

- Samples with a D-Dimer value exceeding 20 µg/mL（FEU） may be diluted using the Manual Dilution Procedure.

**Manual Dilution Procedure**

Suggested dilution: 1:10

- Add 100 µL of the sample to 900 µL of Stroke physiological saline solution or dilutions.
- The operator must enter the dilution factor in the Patient or Control order screen. The system will use this dilution factor to automatically calculate the concentration of the sample before dilution and report the result.

**Calibration**

- Traceability: This assay has been standardized against the Immunoassay D-Dimer Assay kit produced at Snibe.
- Every D-Dimer assay kit has a two-dimension code label containing the predefined master curve of the particular reagent lot.
- Test Calibrators in duplicate. The calibrators should be priority loaded. A replicate of each control level must be tested to evaluate the assay calibration. Ensure that assay control values are within the ranges specified in the respective control package insert.
- Once calibration is accepted and stored, all subsequent samples may be tested without further calibration unless:
- After 28 days when using the same lot reagent.
- A reagent kit with a new lot number is used.
- Controls are out of range.
- Required by pertinent regulations.
- Assay may also need to be recalibrated after specified service procedures have been performed or maintenance to critical part or subsystems that might influence the performance of the assay. For detailed information on how to perform an assay calibration, refer to the Analyzer's Operations Manual.
- Calibration Range: 0.22 µg/mL（FEU）～20 µg/mL（FEU.

**Quality Control Procedures**

- Order Control, if necessary.
- The recommended control requirement for the Aurora D-Dimer assay is that a single replicate of each control level be tested:
- Once every 24 hours or each day of use
- After performing calibration
- After instrument service procedures or maintenance that may affect assay performance have been performed.
- If the quality control procedures in your laboratory require more frequent use of controls to verify test results, follow your laboratory-specific procedures.
- Each laboratory should establish control ranges

to monitor the acceptable performance of the assay. If a control is out of its specified range, the associated sample results are invalid and the samples must be retested. Recalibration may be indicated.

• These results should be applied to your laboratory's quality control practices. In addition, the laboratory must ensure that the matrix of the control material is suitable for use in the assay per the assay package insert.

• Unless specified, target values and ranges provided with the commercial control product insert are guidelines only and should not be used for quality control purposes.

• Refer to Clinical and Laboratory Standards Institute (CLSI) Document C24-A3, or other published guidelines for general quality control recommendations.

**Results**

**Calculation**

• The analyzer automatically calculates the concentration of each sample. The results are given in µg/mL（FEU.

**Limits**

• Results should be used in conjunction with other data; e.g., symptoms, results of other tests, and clinical impressions.

• If the Aurora D-Dimer Assay results are inconsistent with clinical evidence, additional testing is recommended.

• 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 that employ mouse monoclonal antibodies. Additional information may be required for diagnosis.

• Heterophilic antibodies in human plasma can react with reagent immunoglobulins, interfering with in vitro immunoassays. Patients routinely exposed to animals or to animal plasma products can be prone to this interference, and anomalous values may be observed. Additional information may be required for diagnosis.

• Rheumatoid factor (RF) in human plasma can react with reagent immunoglobulins, interfering with in vitro immunoassays. Additional information may be required for diagnosis.

• The Aurora D-Dimer assay is susceptible to interference effects from triglycerides at > 1000 mg/dL.

• There is no high-dose HOOK effect at D-Dimer concentrations up to 500 µg/mL (FEU).

**Expected Values**

• It is recommended that each laboratory establish its own reference range, which may be unique to the population it serves depending upon geographical, season, patient, dietary, or environmental factors. A study was performed based on guidance from Clinical and Laboratory Standards Institute (CLSI) C28-A3c.

• Human plasma specimens from apparently healthy individuals were collected the 201 specimens, 101 were female and 100 were male, age between 21 and 90 years.

| The population | n | Reference range* |
|---|---|---|
| Apparently healthy individuals | 201 | ≤ 0.5 µg/mL（FEU） |

*According to the 95th percentile.

*Representative data; results in individual laboratories and in different geographical areas may vary from these data.

**Specific Performance Characteristics**

• Assay results obtained in individual laboratories may vary from data presented.

**Limit of Blank (LoB)**

• The Limit of Blank was determined in accordance with the CLSI (Clinical and Laboratory Standards Institute) EP17-A requirements.

• The Limit of Blank is the 95$^{th}$ percentile value from n ≥ 20 measurements of analyte-free samples over several independent series. The Limit of Blank corresponds to the concentration below which analyte-free samples are found with a probability of 95 %.

- The observed LoB value was ≤ 0.22 µg/mL (FEU).

**Accuracy**

**Intra Assay Variation**

- Within run variation was determined by replicate determination (n=10) of two different control sera in one assay. The within assay variability is ≤8.0%.

**Inter Assay Variation**

- Inter assay variation was determined by replicate measurements (n=10) of two different control sera in 3 different lots. The inter assay variation is ≤10.0%.

| Intra-Assay, n=10 | | | Inter-Assay, n=10×3 | | |
|---|---|---|---|---|---|
| Sample | Mean (µg/mL （FEU)) | CV | Sample | Mean (µg/mL （FEU)) | CV |
| 1 | 0.50 | 4.8% | 1 | 0.52 | 4.4% |
| 2 | 5.45 | 3.2% | 2 | 5.39 | 3.3% |

**Linearity**

- The linearity was determined in accordance with the CLSI (Clinical and Laboratory Standards Institute) EP6-A requirements.
- The linearity range was verified by more than 6 concentration levels which encompass or be equal to the minimum and the maximum values of linearity range and duplicate assays (n=3) at all levels.
- The Aurora D-Dimer assay has been demonstrated to be linear from 0.25 µg/mL（FEU） to 20 µg/mL（FEU）, regression ≥0.99 and max diff ≤ 15% in this interval.

**Specificity**

**Cross-Reactivity**

- A study was performed based on guidance from CLSI EP7-A2.
- The cross-reactants listed below were evaluated to determine whether D-Dimer concentrations were affected when using the Aurora D-Dimer assay.

| Cross-Reactant | Cross-Reactant Concentration | % Cross-Reactant Bias |
|---|---|---|
| Fibrinogen | 20 µg/mL | ≤ 10% |
| Fibrinogen fragment E | 20 µg/mL | ≤ 10% |

**Interference**

- A study was performed based on guidance from CLSI EP7-A2.
- Potentially interfering substances were evaluated to determine whether D-Dimer concentrations were affected when using the Aurora D-Dimer assay. Samples containing the potential interferents were prepared at two D-Dimer concentrations. The samples were assayed, and the D-Dimer concentrations of the spiked samples were compared to the reference samples.

| Potential Interferent | Interferent Concentration | % Interferent Bias |
|---|---|---|
| Bilirubin | 20 mg/dL | ≤ 10% |
| Hb | 500 mg/dL | ≤ 10% |
| Intralipid | 1000 mg/dL | ≤ 10% |
| Total protein | 10 g/dL | ≤ 10% |
| RF | 1000IU/mL | ≤ 10% |
| ANA | 400AU/mL | ≤ 10% |
| HAMA | 600ng/mL | ≤ 10% |

**Reference**

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4. Kogan AE, Mukharyamova KS, Bereznikova AV, Filatov VL, Koshkina EV, Bloshchitsyna MN, Katrukha AG. Monoclonal antibodies with equal specificity to D-dimer and high-molecular-weight fibrin degradation products. Blood Coagul Fibrinolysis.

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5. Rathbun SW, Whitsett TL, Vesely SK, Raskob GE. Clinical utility of D-dimer in patients with suspected pulmonary embolism and nondiagnostic lung scans or negative CT findings. Chest. 2004 Mar;125(3):851-5.

6. Schrecengost JE, LeGallo RD, Boyd JC, Moons KG, Gonias SL, Rose CE Jr, Bruns DE. Comparison of diagnostic accuracies in outpatients and hospitalized patients of D-dimer testing for the evaluation of suspected pulmonary embolism. Clin Chem. 2003 Sep;49(9):1483-90.

**Symbols**

| | |
|---|---|
|  | Manufacturer |
|  | Date of manufacture |
|  | Expiration date |
|  | Contains sufficient for <n> tests |
|  | Consult instructions for use |
|  | Biological risks |
|  | Temperature limit |
|  | CE Marking |
| EC REP | Authorized representative in the European Community |
| IVD | In Vitro Diagnostic Medical Device |
| LOT | Batch code |
| REAGENT | Reagent |
| CAL | Calibrator |

**Contact Information**

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CE
IVD

Release Date: … … … Date of Manufacture: … … …