| **C-Reactive Protein** |
| --- |
| **Purpose** | This procedure provides instructions for C-REACTIVE PROTEIN (CRP) ON ABBOTT INSTRUMENTATION. The CRP method is an *in vitro* diagnostic test for the quantitative measurement of C-Reactive (CRP) in human serum and plasma on the Abbott Architect c4000 and Alinity c automated chemistry analyzers. |
| **Policy Statements** | This procedure applies to all personnel responsible for operating the Abbott Architect c4000 or Alinity c at Children’s Minnesota Laboratory.  |
| **Principle** | MULTIGENT CRP Vario is a latex immunoassay developed to accurately and reproducibly measure blood CRP levels in serum and plasma. When an antigen-antibody reaction occurs between CRP in a sample and anti‑CRP antibody, which has been adsorbed to latex particles, agglutination results. This agglutination is detected as an absorbance change (572 nm), with the rate of change being proportional to the quantity of CRP in the sample. Three different methods (High Sensitivity [CRP16], Standard [CRP32], and Wide Range [CRP48]) are available to cover a wide analytical measurement range.Methodology: Turbidimetric/Immunoturbidimetric |
| **Clinical Significance** | C-reactive protein (CRP) is an acute phase protein whose concentration rises non-specifically in response to inflammation. CRP is seen to increase as a result of the inflammatory process, most notably in response to pneumococcal (bacterial) infection, histolytic disease, and a variety of other disease states. Intraindividual variation is a major limitation of the assay when the assay is used for directing therapies. Intraindividual variations of the CRP levels are from 30% to 60%. Serial measurement may be required to estimate true mean of CRP depending on the intended use in any specific individual. CRP is used as a marker or general diagnostic indicator of infections and inflammation, in addition to serving as a monitor of patient response to pharmacological therapy and surgery. |
| **Analyzer** | **St. Paul: Abbott Architect c4000 (Sunquest method code: ARCH4), Abbott Alinity c (Sunquest method code: SALIC)****Minneapolis: Abbott Alinity c (Sunquest method code: MALIC), Abbott Alinity ci (Sunquest test code: MACC)** |
| **Sunquest Test Codes** | **CRP:** C-Reactive Protein on serum or plasma |
| **Specimen** | Sample: Plasma (lithium heparin with or without gel) preferred. Sodium heparin plasma or serum (with or without gel) are also acceptable. Refer to specimen collection procedures.**Minimum sample volume:** 200 µL preferred, 150 µL minimum**Stability when separated from cells/gel:** RT / 15 days, 2-8 °C / 2 months, < -20°C / 3 years**Rejection criteria:** Unlabeled tube, sample type other than serum or acceptable plasma**Preparation:** 1. Whole blood specimens should be centrifuged following complete clot formation, according to Specimen Processing procedures prior to analysis.
2. Serum or plasma should be physically separated from cells as soon as possible with a maximum limit of two hours from the time of collection.
3. Specimens should be free of particulate matter.
4. Transfer serum or plasma to a properly labeled sendout tube. Short samples should be pipetted into an Abbott sample cup and nested on a sendout tube; any amount remaining after sampling should be pipetted into the sendout tube and tightly capped.
5. Architect and Alinity systems utilize a specimen level detect mechanism, so special racks specific to tube-type are not required.
6. Minimum labeling includes sample accession ID, and/ or patient name, medical record number, collection date and time.
 |
| **Reagents** | **Reagent Handling** **Architect c4000:**Upon receipt, place reagent cartridges in an upright position for 1 hour before use to allow bubbles that may have formed to dissipate. If a reagent cartridge is dropped, place in an upright position for 1 hour before use to allow bubbles that may have formed to dissipate. Reagents are susceptible to the formation of foam and bubbles. Bubbles may interfere with the detection of the reagent level in the cartridge and cause insufficient reagent aspiration that may adversely affect results. Use a pipette to remove all bubbles prior to loading on the Alinity or Architect system.* Do not use reagents beyond the expiration date.
* Do not pool reagents within a kit or between kits.
* Do not use components from one lot with components from another lot.

**Alinity c:**Upon receipt, gently invert cartridges 5 times, then place reagent cartridges in an upright position for 1 hour before use to allow bubbles that may have formed to dissipate. If a reagent cartridge is dropped, place in an upright position for 1 hour before use to allow bubbles that may have formed to dissipate. Reagents are susceptible to the formation of foam and bubbles. Bubbles may interfere with the detection of the reagent level in the cartridge and cause insufficient reagent aspiration that may adversely affect results. Use a pipette to remove all bubbles prior to loading on the Alinity or Architect system.* Do not use reagents beyond the expiration date.
* Do not pool reagents within a kit or between kits.
* Do not use components from one lot with components from another lot.
 |
|  | **Alinity c:**

|  |  |  |
| --- | --- | --- |
| ***Product Description*** | ***Product Code*** | ***Stability*** |
| Abbott Alinity CRP Vario Reagent | 07P56-21 | **Store at:** 2 – 8 °C**Unopened:** Manufacturer’s printed expiration date**On-board**: 60 days**Opened, off the analyzer (with clean caps):** Manufacturer’s printed expiration date. (Reagents may be stored on or off the system. The system tracks time onboard.) |
| Abbott Alinity CRP Vario Calibrator | 07P56-03 | **Store at:** 2 – 8 °C**Unopened:** Manufacturer’s printed expiration date**Opened expiration: 3 months** when opened and stored off the system. |

**Architect c4000:**

|  |  |  |
| --- | --- | --- |
| ***Product Description*** | ***Product Code*** | ***Stability*** |
| Abbott Architect CRP Vario ReagentCHC# 32547 | 06K26-30 | **Store at:** 2 – 8°C**Unopened:** Manufacturer’s printed expiration date.**On-board:** 60 Days |
| Abbott Architect CRP CalibratorCHC# 32560 | 06K26-10 | **Store at:** 2 – 8°C**Unopened:** Manufacturer’s printed expiration date**Opened:** 90 Days**DO NOT USE THE PINK-CAPPED VIAL (8.0mg/dL)** |

 |
| **Risk and Safety** |

|  |
| --- |
| **CAUTION:** For in vitro diagnostic use. This product requires the handling of human specimens. It is recommended that all human sourced materials be considered potentially infectious and be handled in accordance with the OSHA Standard on Bloodborne Pathogens. Appropriate Personal Protective Equipment (PPE) must be worn according to Children’s Minnesota Laboratory policies. Current SDSs are kept on the [Children’s StarNet](https://msdsmanagement.msdsonline.com/a07dc954-23d8-42a9-b591-ef5763cdfd33/ebinder/?nas=True) page.R1 and R2 Reagents: Contain sodium azide. Contact with acids liberates very toxic gas. Amount of sodium azide does not require the reagent to be specially discarded. Dispose of in regulated medical waste if unused.CRP Calibrator should be disposed of in Regulated Medical Waste (red trash). |

 |
| **Calibration** | **Alinity c:**

|  |  |
| --- | --- |
| Assay Range: | 0.04 – 48.00 mg/dL |
| Reference Material: | Abbott Architect CRP Calibrator |
| Suggested Calibration Levels: | CRP05: White Cap: 0.50 mg/dLCRP10: Light yellow cap: 1.00 mg/dLCRP20: Light green cap: 2.00 mg/dLCRP40: Light blue cap: 4.00 mg/dLCRP160: Magenta cap: 16.00 mg/dLCRPWR: Brown cap: 48.00 mg/dL |
| Calibration Scheme: | 6 levels, Spline |
| Calibration Frequency: | 15 Days |
| AMR | AMR is verified with every calibration. |

**Architect c4000:**

|  |  |
| --- | --- |
| Assay Range: | 0.02 – 32.00 mg/dL |
| Reference Material: | Abbott Architect CRP Calibrator |
| Suggested Calibration Levels: | CRP05: White Cap: 0.50 mg/dLCRP10: Light yellow cap: 1.00 mg/dLCRP20: Light green cap: 2.00 mg/dLCRP40: Light blue cap: 4.00 mg/dLCRP160: Magenta cap: 16.00 mg/dLCRP320: Brown cap: 32.00 mg/dLNOTE: discard the pink-capped vial (8.0 mg/dL) to avoid confusion.  |
| Calibration Scheme: | 6 levels, Spline |
| Calibration Frequency: | 15 Days |
| AMR | AMR is verified with every calibration. |

 |
| **Quality Control** | **Alinity c and Architect c4000:** Bio-Rad Liquichek™ Immunology Control Levels 1 & 3**Frequency:** Two levels each day of use**Stability:** Stable until the expiration date when stored frozen between -20 and -40°C. Once thawed, opened, and stored tightly capped at 2 to 8°C, this product is stable for 30 days. **Preparation**: This product should be treated the same as patient specimens and run in accordance with the instructions accompanying the instrument, kit, or reagent being used. * To thaw the product, allow it to stand at room temperature (18° to 25°C) until completely thawed but no longer than one (1) hour.
* After thawing, the product **MUST** be gently swirled and inverted several times to ensure homogeneity.
* For optimal analyte stability in the thawed state, promptly return to 2 to 8°C storage after each use and minimize the time at room temperature to no more than 20 minutes daily.
* **Before each use**, gently swirl the contents until homogeneous with no visible signs of precipitate.

**Acceptable ranges:** * Non-Bio-Rad controls will utilize manufacturer ranges and 2 SD Westgard rules.
* New lots of Bio-Rad controls should be run for 20 days in parallel with the current lot whenever possible prior to switching to the new lot.
* Refer to the Westgard Rules in Chemistry procedure (insert hyperlink) for current Westgard rules in place for each analyte.
* **Acceptable ranges are current in Unity Real Time only.** Quality Control results must be rejected in Sunquest when the results cross the interface.
* In the event of a QC failure, refer to the [Unity Real Time QC Review, General User](https://starnet.childrenshc.org/References/labsop/chem/quality/ch-2.17-unity-real-time-qc-review-general-user.pdf) and navigate to the QC Troubleshooting section.
* Do not load or release patients until QC is acceptable in Unity Real Time.
 |
| **Interferences** | **Alinity c and Architect c4000:** **Hemolysis, Icterus & Lipemia (HIL) Index Values:**

|  |  |  |
| --- | --- | --- |
| **H** | **I** | **L** |
| **-** | **-** | **-** |

At HIL levels at or above the specified cutoff value, append the appropriate comment AFTER visually confirming presence of interferent: -HP for “Hemolysis present, may affect results.” -BIN for “Bilirubin Interference”-LINT for “Lipid Interference” Interference studies were conducted by Abbott Diagnostics Division and effects were assessed by Dose Response and Paired Difference methods at the medical decision levels of the analyte. Interference is less than 5% for:* Hemoglobin: up to 500 mg/dL
* Bilirubin: up to 66 mg/dL
* Triglycerides (Intralipid): up to 1500 mg/dL
* Rheumatoid Factor up to 550 IU/mL

Interferences from medication or endogenous substances may affect results.For accurate results, serum and plasma specimens should be free of fibrin, red blood cells, and other particulate matter. Serum specimens from patients receiving anticoagulant or thrombolytic therapy may contain fibrin due to incomplete clot formation.  |
|  |  |
| **Reference Intervals** | All ages: Less than or equal to 0.5 mg/dL |
| **Critical Values** | None |
| **Limitations** | The instrument reporting system contains flags and comments to provide the user with information regarding instrument processing errors, instrument status information and potential errors in glucose results. Refer to the [Abbott Architect](https://starnet.childrenshc.org/References/labsop/chem/operator/abbott-architect-operations-manual.pdf) or [Alinity](https://starnet.childrenshc.org/References/labsop/chem/operator/alinity-ci-series-operations-manual.pdf) Operator’s Guides for the meaning of report flags and comments, and instructions for addressing them. Do not report results until a report containing flags and/or comments is resolved.In very rare cases, gammopathy, particularly of the monoclonal IgM type (e.g., Waldenstrom’s macroglobulinemia), may cause unreliable results.Specimens collected in EDTA collection tubes are not acceptable for use.For accurate results, serum and plasma specimens should be free of fibrin, red blood cells, and other particulate matter. Serum specimens from patients receiving anticoagulant or thrombolytic therapy may contain fibrin due to incomplete clot formation.  |
| **Dilutions** |

|  |
| --- |
| **Architect c4000:**  |
| Max Auto Dilution: | 1:5 |
| Maximum Manual Dilution: | Do not manually dilute |
| Diluent: | Onboard Saline |
| Manual Dilution: | Follow Abbott [Architect Operator’s Manual](https://starnet.childrenshc.org/References/labsop/chem/operator/abbott-architect-operations-manual.pdf) instructions for programming automated dilutions. The system will automatically calculate the concentration of the sample and report the result. If a diluted sample result is less than the lower value of the measuring interval of 0.02 mg/dL, do not report the result. Rerun and/or investigate for other possible causes of error. |

 |
| **Result Reporting** |

|  |
| --- |
| **Alinity c:**  |
| Max Auto Dilution: | 1:5 |
| Maximum Manual Dilution: | Do not manually dilute |
| Diluent: | Onboard Saline |
| Manual Dilution: | Follow Abbott [Alinity Operator’s Manual](https://starnet.childrenshc.org/References/labsop/chem/operator/alinity-ci-series-operations-manual.pdf) instructions for programming automated dilutions. The system will automatically calculate the concentration of the sample and report the result. If a diluted sample result is less than the lower value of the measuring interval of 0.04 mg/dL, do not report the result. Rerun and/or investigate for other possible causes of error. |

**Architect c4000:** * Results between 0.4 and 32.00 mg/dL without error messages are released
* Results below 0.4 mg/dL without error messages are reported as < 0.02 mg/dL.
* Results >32.00 mg/dL should be diluted using the onboard automated 1:5 dilution. Release results without error messages following this dilution.
* Results > 160.00 mg/dL following automated dilution are reported as > 160.00 mg/dL.

**Alinity c:*** Results between 0.4 and 48.00 mg/dL without error messages are released
* Results below 0.4 mg/dL without error messages are reported as < 0.04 mg/dL.
* Results >48.00 mg/dL should be diluted using the onboard automated 1:5 dilution. Release results without error messages following this dilution.
* Results > 240.00 mg/dL following automated dilution are reported as > 240.00 mg/dL.
 |
| **Specimen Storage** | Promptly stopper tested specimen and store upright in a specimen rack. Every 8 hours remove specimens to refrigerator/freezer storage. Samples are retained 7 days in specimen storage freezer. |
| **References** | 1. Jacobs & DeMott Laboratory Test Handbook, Lexi-Comp, Inc., Hudson, OH, 5th Edition, 2001
2. Architect CRP Vario Package Insert, Abbott Laboratories Diagnostics Division, Abbott Park, IL 60064, August 2015.
3. Architect CRP Calibrator Package Insert, Abbott Laboratories Diagnostics Division, Abbott Park, IL 60064, August 2018.
4. Alinity c CRP Vario Reagent Kit Package Insert, Abbott Laboratories Diagnostics Division, Abbott Park, IL 60064, November 2019.
5. Alinity c CRP Vario Wide Range Calibrator Kit Package Insert, Abbott Laboratories Diagnostics Division, Abbott Park, IL 60064, January 2017.
6. Bio-Rad Liquichek Immunology Control Product Insert, Bio-Rad Laboratories, Irvine, CA 92618
 |
| **Historical Record** | **Version** | **Written/Revised by:** | **Effective Date:** | **Summary of Revisions** |
| 1 | Erin Bartos | 10/15/2019 | New Procedure for Abbott analyzers |
| 2 | Erin Bartos | 3/24/2020 | Added Alinity c |
| 3 | Elauteria Earnhardt | April 23, 2020 | Added St Paul Alinity c as an analyzer |
| 4 | Elauteria Earnhardt | June 11, 2020 | Fixed typo |
| 5 | Erin Bartos | 10/28/2020 | Changed AMRs, added Mpls alin ci, added HIL box. |