

## PROCEDURE MANUAL

Lab Name:

Procedure #:

Procedure: CLIA Complexity: WAIVED ( Whole Blood)  
: MODERATE (Serum/Plasma)

| Prepared By | Date Adopted | Supersedes Procedure # |
|-------------|--------------|------------------------|
|             |              |                        |

| Review Date | Revision Date | Signature |
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This Procedural Bulletin is intended to provide a ready outline reference for performance of the assay. It is the obligation of every manufacturer of medical devices labeled FOR *IN VITRO* DIAGNOSTIC USE to provide a complete package insert in accordance with FDA labeling regulation (21 CFR 809.10). Prepared in accordance with the guidelines recommended by the Clinical and Laboratory Standards Institute, Wayne, PA 19087; CLSI Document GP2-A2.

**Clarity Diagnostics provides CLSI procedures for your use. The procedures are required to include the same information as listed in the package insert. Any modifications to this document are the sole responsibility of the Laboratory.**

## PROCEDURE MANUAL

Lab Name:

**CLIA Complexity: WAIVED****INTENDED USE**

The Clarity Mononucleosis Rapid Test Device (Whole Blood/Serum/Plasma) is an immunochemical device intended for the qualitative detection of Infectious Mononucleosis antibodies in human whole blood, Serum or plasma specimens by laboratories or physicians' offices. This test is intended for use as an aid in the diagnosis of infectious mononucleosis.

**SUMMARY AND EXPLANATION**

Infectious mononucleosis (IM) is an acute, self-limited, lymph proliferative disease caused by the Epstein-Barr virus (EBV). Infection with EBV usually occurs early in life with no recognizable disease. When primary infection is delayed until young adulthood and adolescence, however, there is about a 50% chance that it will occur with the classic clinical manifestations associated with IM (1, 2).

The diagnosis of IM is usually based on the evaluation of characteristic clinical, hematological, and serological changes. In most cases of IM, clinical diagnosis can be made from the characteristic triad of fever, pharyngitis, and cervical lymphadenopathy, lasting for 1 to 4 weeks. IM may be complicated by splenomegaly, hepatitis, pericarditis, or central nervous system involvement (3). Rare fatal primary infections occur in patients with histiocytic hemophagocytic syndrome (4) or with a genetic X-linked lympho proliferative syndrome (5). Hematologic features of IM include lymphocytosis with prominent atypical lymphocytes. Because other diseases may mimic the clinical and hematological symptoms of IM, serological testing is essential for the most accurate diagnosis. Serological diagnosis of IM is demonstrated by the presence of heterophile and EBV antibodies in the sera of patients (2, 6, and 7).

It has been well established that most individuals exposed to EBV develop a heterophile antibody response. Heterophile antibodies make up a broad class of antibodies which are characterized by the ability to react with surface antigens present on erythrocytes of different mammalian species. It is not known which specific antigen stimulates their production. It has been a common practice for physicians to use the detection of IM heterophile antibodies in the blood of patients as an aid in the diagnosis of IM. **Clarity** MONO Mononucleosis Rapid Test Device (Whole Blood/Serum/Plasma) utilizes an extract of bovine erythrocytes which gives a greater sensitivity and specificity than

## PROCEDURE MANUAL

### Lab Name:

Similar extracts prepared from sheep or horse erythrocytes. The Forssmann antibody interference has been known to be minimized by using the bovine erythrocyte extract (8, 9).

## PRINCIPLE OF THE TEST

**Clarity** Mononucleosis Rapid Test Device (Whole Blood/Serum/Plasma), one-step antibody test for IM, uses direct solid-phase immunoassay technology for the qualitative detection of IM heterophile antibodies in human serum, plasma or whole blood. In the test procedure, 10 µl serum or plasma are added in the **Sample Well (S)** located below the result window. For finger-tip or whole blood, 25 µl of blood is collected in a capillary tube and spotted in the **Sample Well (S)**. If any IM-specific heterophile antibody is present in the sample, it will be captured by the antigen band (bovine erythrocyte extracts) impregnated in the test membrane. The developer solution is then added in **Sample Well (S)**. As the specimen followed by the developer moves by capillary action to the antigen band, the solution mobilizes the dye conjugated to anti-human IgM antibodies. Visualization of the antigen band at the **Test position (T)** in the result window will occur only when the IM-specific heterophile antibody binds to the extracted antigen obtained from bovine erythrocytes. As the antibody-dye conjugate continues to move along the test membrane, it will bind to another band located at the **Control position (C)** to generate a colored band regardless of presence of IM heterophile antibodies in the sample. Therefore, the presence of two colored bands, one at the **Test position (T)** and the other at the **Control position (C)**, indicates a positive result, while the absence of a colored band at the **Test position (T)** indicates a negative result.

## REAGENTS AND MATERIALS SUPPLIED

- **Clarity** Mononucleosis Rapid Test Device (Whole Blood/Serum/Plasma) 15 test devices containing a membrane strip coated with bovine erythrocyte extract and a pad impregnated with the monoclonal mouse antihuman IgM antibody-dye conjugate in a protein matrix containing 0.1% sodium azide.
- Developer Solution: Phosphate saline buffer containing 0.1% sodium azide as preservative.
- Negative Control: Diluted serum containing 0.1% sodium azide as preservative.
- Positive Control: Diluted in serum containing 0.1% sodium azide as preservative.
- Package insert
- Sample transfer pipettes for whole blood and serum/plasma

### Lab Name:

## PROCEDURE MANUAL

## MATERIALS REQUIRED BUT NOT PROVIDED

- Centrifuge capable of separation of blood cells from plasma
- Micropipette (optional)
- Lancet

## WARNINGS AND PRECAUTIONS

- The reagents in this kit contain sodium azide. Sodium azide may react with lead and copper plumbing to form highly explosive metal azide. Upon disposal, flush with a large amount of water to prevent azide buildup.
- Human blood and its products are potentially infectious; handle with appropriate precautions.
- For *in vitro* diagnostic use
- Do not interchange reagents from different kit lots or use beyond the expiration date.
- The reagents in each kit are tested by Quality Control to function as a unit to assure proper sensitivity and maximum accuracy.
- Use **Clarity** Mononucleosis Rapid Test Device (Whole Blood/Serum/Plasma) test only in accordance with instructions supplied with the kit.

## KIT STORAGE AND STABILITY

Clarity Mononucleosis Rapid Test Device (Whole Blood/Serum/Plasma) test kit should be stored at 2°–30°C (36°–86°F) in its sealed pouch. Do not freeze.

## SPECIMEN COLLECTION AND STORAGE

**Whole Blood:**A). **Anticoagulated Blood:**

Whole blood collected over CPDA-1, heparin or EDTA can be used. Mix whole blood by inversion and use in the test as outlined in the Test Procedure. Whole blood can be stored at 2°–8°C for 24 hours. If testing is anticipated after 24 hours, separate plasma, as outlined below, and freeze at or below -20°C. Caution: Do not freeze & thaw whole blood; hemolyzed blood can not be used in this test.

B). **Fingertip Blood:**

For fingertip blood, prick the finger and collect blood in capillary tube up to the black line (25 µl). Follow the “Test Procedure”.

**Lab Name:**

**Serum or Plasma:**

## PROCEDURE MANUAL

Use serum or plasma obtained from blood collected aseptically by venipuncture into a clean tube. If serum or plasma filter isolates are used, follow the manufacturer's instructions. For serum, no anticoagulant should be used. For plasma, collect the whole blood specimen into a tube containing anticoagulant such as CPDA-1, heparin, or EDTA. For serum, blood should be allowed to clot at room temperature (18°- 24°C) and then centrifuged at 1500 x g for ten minutes at room temperature. Serum should be separated as soon as possible and may be tested immediately. Remove the serum or plasma from the clot or red cells as soon as possible to avoid hemolysis. When possible, clear, nonhemolyzed specimens should be used. Mildly hemolyzed specimens do not affect the test result, but may create an undesirable reddish background in the result window. Specimens containing any particulate matter may give inconsistent test results. Such specimens should be clarified by centrifugation prior to testing.

**Storage of specimens:** Refrigerate all specimens at 2°- 8°C until ready for testing. If serum or plasma specimens will not be tested within 48 hours of collection, they should be stored at or below -20°C. Specimens should not be repeatedly frozen and thawed. If specimens are to be mailed, they should be packed in appropriate shipping containers as currently described by the carrier services for handling of potentially infectious Materials.

## TEST PROCEDURE

*Put on gloves before performing the following steps.*

### *Procedural Notes*

- The test protocol must be followed in order to achieve optimal test reactivity with specimens. Follow the assay procedure and always perform the test under carefully controlled conditions.
- Allow **Clarity** MONO test devices, reagents and specimens to warm to room temperature before testing.
- **Clarity** MONO test device should remain in the sealed pouch prior to testing.
- Do not reuse a lancet.
- To avoid cross-contamination, use a new disposable capillary tube for each specimen.
- Label the device with the patient's name or control number.
- When collecting finger-tip blood, allow a free flow drop to form. Do not squeeze the finger too hard. Follow instructions under "Specimen Collection and Preparation."

### **Lab Name:**

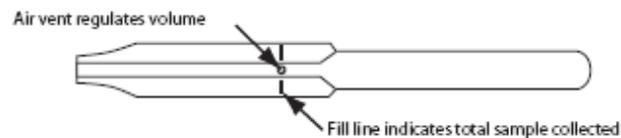
- To add the Developer Solution, hold the dropper bottle in a vertical position above the LOWER END of the **Sample Well (S)** and dispense 3 drops in the well.

**PROCEDURE MANUAL**

- Mildly hemolyzed whole blood specimens do not affect the test result, but may create an undesirable reddish background in the result window.
- To avoid contamination, do not touch the tip of the Developer Solution dropper bottle to skin or **Clarity** MONO test device.
- Use accepted microbiological practices for proper disposal of potentially infectious test materials and disinfection of contaminated equipment.
- After testing, dispose of **Clarity** MONO test devices, sample transfer pipettes and specimens in approved biohazard containers.

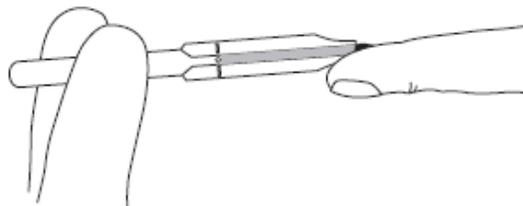
**Directions for use of Sample Transfer Pipette**

The sample transfer pipette has an air vent positioned on the sidewall of the pipette to provide automatic air venting and sample volume control.



**NOTE:** Once the specimen is drawn into the sample transfer pipette, the pipette will not leak; the pipette will hold the specimen until the bulb of the pipette is squeezed.

**CAUTION: Filling is automatic: Do not squeeze the sample transfer pipette while filling. Avoid air bubbles.**

**STEP 1**

Hold the sample transfer pipette horizontally and touch the tip of the pipette to the sample. The specimen can be obtained from vacutainer, test tube or finger stick. Capillary action will automatically draw up the correct volume to the fill line and stop.

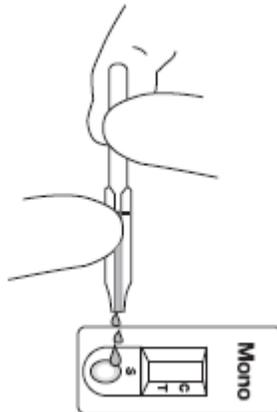
**Lab Name:**

**STEP 2**

**PROCEDURE MANUAL**

To expel sample, align the tip of the pipette over the upper area of the Sample Well (S) of the test device and squeeze the bulb.

**NOTE:** If a sample does not expel, hold the pipette vertically and place a finger over the vent hole. Then align the pipette tip over the upper area of the Sample Well (S) of the test device and squeeze the bulb.

**Test Procedure****STEP 1**

Remove a test device from its pouch and place on a flat surface.

**STEP 2**

Collect the sample using the appropriate sample transfer pipette according to the volume of sample required.

For whole blood samples, use the 25  $\mu$ L (red line) sample transfer pipette.

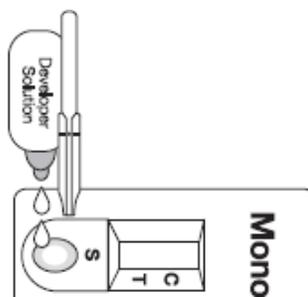
For serum/plasma samples, use the 10  $\mu$ L (black line) sample transfer pipette.

Follow the directions for sampling using the sample transfer pipette.

**Lab Name:**

**STEP 3**

Add 2-3 drops of Developer Solution into the lower area of the Sample Well (S).



## PROCEDURE MANUAL

**STEP 4**

Read the results at 8 minutes. Do not read test after 15 minutes.

**INTERPRETATION OF RESULTS****Positive Result:**

If both a C-line and a T-line are present, the result is positive. One Pink-Purple colored horizontal band each at the Test position (T) and at the Control position (C) indicates that IM specific heterophile antibodies have been detected

**Note:**

A positive test result may be read as soon as a distinct pink-purple colored band appears at the **Test position (T)** and at the **Control position (C)**. Any shade of pink-purple colored horizontal band at the **Test position (T)** should be reported as a positive result. The intensity of the colored band at the **Test position (T)** may be different from the intensity of the band at the **Control position (C)**.

**Negative Result:**

If only the C-line develops in the control region of the test strip, the result is negative. One pink-purple colored band at the **Control position (C)**, with no distinct colored horizontal band at the **Test position (T)** other than the normal faint background color, indicates the IM-specific heterophile antibodies have not been detected.



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**Lab Name:**

**Invalid Result:**

If no C-line appears within 5 minutes, the result is



## PROCEDURE MANUAL

Invalid and the assay should be repeated with a new device.  
A distinct colored horizontal band at the **Control position (C)** Should always appear. The test is invalid if no such band Forms at the **Control position (C)**.

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## QUALITY CONTROL

There are two internal control features in **Clarity** MONO Mononucleosis Rapid Test Device (Whole Blood/Serum/Plasma) test. A colored control band will always appear at the **Control position (C)** if the test has been performed correctly and if the device is working properly. This is considered an internal positive procedural control. A clear background in the result window is considered an internal negative procedural control. If the test has been performed correctly and **Clarity** MONO device is working properly, the background in the result window will be clear, providing a distinct result. Good laboratory

Practice recommends the periodic use of external control materials to ensure proper kit performance. The included positive and negative controls can be run in place of serum or plasma according to the test procedure for this purpose. If the controls do not perform as expected or the colored control band does not appear at the **Control position (C)**, contact Clarity Diagnostics' Technical Services immediately for assistance at 1-877-485-7877.

## LIMITATIONS

- The results obtained by this kit yield data which must be used only as adjunct to other information available to the physician.
- Although most patients will have a detectable heterophile antibody level within three weeks of infection, occasionally a patient with strong clinical signs of IM may take longer than three months to develop a detectable level (10). If further testing is desired, collect additional specimens every few days and retest.
- Some segments of the population who contract IM do not produce measurable levels of heterophile antibody. Approximately 50% of children under 4 years of age who have IM may test as IM heterophile antibody negative (11). EBV-specific laboratory Diagnosis may be helpful in these cases.
- Some individuals are reported to maintain a low but persistent level of heterophile antibodies long after their primary illness. Heterophile antibodies have been detected in blood specimens taken more than one year after the onset of the

### Lab Name:

- Illness (12). Such false positive test results occurring in 2- 3% of patients can be excluded by EBV-specific serology (3).
- The IM heterophile antibody has been associated with disease states other than IM, such as leukemia, cytomegalovirus, Burkitt's lymphoma, rheumatoid arthritis, adenovirus, viral

## PROCEDURE MANUAL

hepatitis, and *Toxoplasma Gondii* (13). In primary infections of adults with clinically atypical diseases, EBV-specific laboratory diagnosis may also be helpful.

- **Clarity** MONO for serum and plasma is classified as moderately complex under the CLIA '88 regulations. **Clarity** MONO for whole blood test is classified as waived under the CLIA '88 regulations.
- Open or broken/damaged pouches may produce erroneous results due to kit instability from exposure to moisture and should be discarded.

## EXPECTED VALUES

- In patients with symptoms indicating IM, a positive heterophile antibody result is diagnostic, and no further testing is necessary. During the acute phase of illness, IM-specific heterophile antibodies are detectable in 80-85% of IM cases. Humoral responses to primary infections appear to be quite rapid. Moderate to high levels of heterophile antibodies are seen during the first month of illness and decrease rapidly after week four (3).
- Positive test results may persist for months or even years due to the presence of persistent IM heterophile antibodies (14). This may occur with or without any clinical symptoms or hematological evidence of IM (12, 15-17). Conversely, a confirmed heterophile antibody test may indicate an occult infection (18, 19). In fact, detection of IM prior to onset of clinical symptoms has been reported (20, 21).
- Some patients remain persistently negative, even though there may exist hematological and clinical evidence of IM (13, 22). In some of these patients, serological evidence for a diagnosis of cytomegalovirus infection, toxoplasmosis, or viral hepatitis, as well as others, have been found (13, 23).

## PERFORMANCE CHARACTERISTICS

### Specificity

The following potentially interfering substances do not interfere with infectious mononucleosis heterophile antibody determinations in **Clarity** MONO Mononucleosis Rapid Test Device (Whole Blood/Serum/Plasma) Assay up to the levels shown below:

### Lab Name:

- Human Albumin 15 g/dL
- Bilirubin 60 mg/dL
- Hemoglobin 1 g/dL
- Triglycerides 1,300 mg/dL

**PROCEDURE MANUAL****Specificity and Sensitivity**

The Specificity of the Clarity Mono Mononucleosis test is 98.8% and the Sensitivity is 99.0%

**ASSISTANCE**

If you have any questions regarding the use of this product, please call Clarity Diagnostics' Technical Support number, (877) 485-7877, Monday through Friday, between 8:00 a.m. and 6:00 p.m. Eastern Standard Time, U.S.A.

**REFERENCES**

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**Lab Name:**

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## PROCEDURE MANUAL

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**Lab Name:**

## PROCEDURE MANUAL

### LOG SHEET



*Record Built-in Procedural Controls on the first patient tested each day.*

|    | Date | Patient Name | Positive Procedural Control (Pink-Purple Line) | Test Results At 8 minutes<br>Do not read the test results after fifteen (15) minutes | Lot Number and Exp. Date | Technician |
|----|------|--------------|--|--|--------------------------|------------|
| 1  |      |              |  |  |                          |            |
| 2  |      |              |  |  |                          |            |
| 3  |      |              |  |  |                          |            |
| 4  |      |              |  |  |                          |            |
| 5  |      |              |  |  |                          |            |
| 6  |      |              |  |  |                          |            |
| 7  |      |              |  |  |                          |            |
| 8  |      |              |  |  |                          |            |
| 9  |      |              |  |  |                          |            |
| 10 |      |              |  |  |                          |            |
| 11 |      |              |  |  |                          |            |
| 12 |      |              |  |  |                          |            |
| 13 |      |              |  |  |                          |            |
| 14 |      |              |  |  |                          |            |
| 15 |      |              |  |  |                          |            |

## PROCEDURE MANUAL

### LOG SHEET



|    | Date | External Positive Control Result | External Negative Control Result | Lot Number and Exp. Date | Technician |
|----|------|----------------------------------|----------------------------------|--------------------------|------------|
| 1  |      |                                  |                                  |                          |            |
| 2  |      |                                  |                                  |                          |            |
| 3  |      |                                  |                                  |                          |            |
| 4  |      |                                  |                                  |                          |            |
| 5  |      |                                  |                                  |                          |            |
| 6  |      |                                  |                                  |                          |            |
| 7  |      |                                  |                                  |                          |            |
| 8  |      |                                  |                                  |                          |            |
| 9  |      |                                  |                                  |                          |            |
| 10 |      |                                  |                                  |                          |            |
| 11 |      |                                  |                                  |                          |            |
| 12 |      |                                  |                                  |                          |            |
| 13 |      |                                  |                                  |                          |            |
| 14 |      |                                  |                                  |                          |            |
| 15 |      |                                  |                                  |                          |            |