References:


2. Blomback M, Kankie RA, Manco-Johnson MJ, Bremke K, Hellgren M, Kaaja R; ISTH SSC Subcommittee on Women’s Health Issues. Preanalytical conditions that affect coagulation testing, including hormonal status and therapy.


15. Gosselin RC, University of California, Davis Health System, Sacramento, California, U.S. Gosselin RC, University of New Mexico Health Sciences Center Albuquerque, New Mexico, U.S.

Pre-analytical Variables In Routine Coagulation Testing: Setting the Stage for Accurate Results

Gosselin RC, University of California, Davis Health System, Sacramento, California, U.S.

Published by Siemens Healthcare Diagnostics Products GmbH

Laboratory Diagnostics

Emil-von-Behring-Strasse 76
35041 Marburg, Germany
### Section: Patient Selection

**Recommendation**

- The laboratory must obtain the proper reference interval for the populations being assessed (accreditation requirements).
- Patients should be relaxed prior to phlebotomy to avoid physiological and psychological stress that may artefactually alter the laboratory must obtain the proper reference interval for the populations being assessed (accreditation requirements).

### Section: Specimen Collection

**Recommendation**

- There are significant differences between reported PT and APTT results using collection tubes with the same citrate concentration from different manufacturers. The laboratory must validate these systems prior to implementation.
- If the syringe technique is required, use a syringe less than 25 cc (preferably 10 cc) with a "butterfly" needle apparatus.
- Needle gauges for coagulation testing should range from 22 to 19 gauge, with higher gauges (23–25 gauge) for pediatric or difficult venous-access patients.
- For syringe collections of blood over 30 mL, an 18 gauge needle is recommended.
- Tourniquet time should not exceed 1 minute.
- For syringe collections, blood should be carefully introduced into appropriate blood collection tubes within 1 minute of collection.
- For arterial-line collections, a two-syringe technique is required, with the first 10 mL used to clear the line and the second syringe used for blood collection.
- For intravenous (IV)-line collections, turn off the IV line for 5 minutes. Then use the two-syringe technique, with the first 10 mL to clear the line and the second syringe used for blood collection.
- Follow manufacturer recommendations for under- or overfilling blood collection tubes. Generally both should be avoided, unless the laboratory can establish (demonstrated with supporting data) its own criteria for acceptance.
- Gentle inversion (mixing) of sodium citrate tubes approximately 5–6 times is recommended. Avoid rigorous shaking or agitation.
- 3.2% sodium citrate is the citrate concentration of choice.
- For patients with elevated hematocrits (>55%) require reduced volume of citrate prior to collection.
- Patients with elevated hematocrits (>55%) require reduced volume of citrate prior to collection.

### Section: Transportation and Stability Before Processing

**Recommendation**

- Coagulation samples should not be transported or stored on ice.
- Coagulation samples for platelet-function studies must be maintained at room temperature.
- Whole-blood samples for PT testing are stable for 24 hours at room temperature.
- Whole-blood samples for APTT testing are stable for 4 hours at room temperature, unless used for UFH monitoring, in which case the room temperature stability of whole blood is 1 hour.
- For other tests, unless otherwise indicated by the manufacturer, stability of whole blood is 4 hours.
- Pneumatic transport systems should not be used for samples that require platelet-function testing.
- Samples collected outside the confines of the hospital (e.g., home health and remote facilities) should be transported in containers (e.g., insulated STYROFOAM) that ensure ambient room temperature.
- For whole-blood samples being transported distances (e.g., via automobile), the tubes should be racked and positioned upright.

### Section: Specimen Processing

**Recommendation**

- Except for whole-blood testing and platelet-function studies, platelet-poor plasma (PPP) is the sample of choice.
- PPP is defined as <10,000 platelets/µL.
- Internal temperature for centrifuges for processing PPP must be room temperature (15–25°C).
- Although the recommended centrifuge force to obtain PPP is 1500 g for 10 minutes, the laboratory must verify its centrifugation speed (rpm) or force (g) to ensure PPP.
- All coagulation samples must be double centrifuged prior to freezing.
- Platelet counts from PPP processing must be verified at least annually (depending on the accreditation standard).
- Multiple tubes collected from a single patient should not be pooled prior to storage or testing.
- All primary and secondary tubes and tubes to be frozen must have multiple patient identifiers and date and time of collection.

### Section: Sample Storage

**Recommendation**

- For samples not tested within the recommended room-temperature stability limits, PPP should be stored frozen in 0.5–1.0 mL aliquots in appropriately labeled polypropylene vials.
- Optimal freezing method is −70°C or colder; non-frost-free freezer, which provides PPP sample stability of 6 months.
- PPP samples can be stored at −20°C in a non-frost-free freezer for 2 weeks.
- Sample vials (with caps on) should be rapidly thawed in a 37°C water bath.
- Thawed PPP aliquots must be mixed prior to analysis.
- Hemolysis, icterus, lipemia
  - HIL may affect the ability of optical-reading instruments to accurately assess PPP samples.
  - Lipemic samples may be processed using ultracentrifugation methods, but a parallel, nonlipemic sample should be processed concomitantly to assure the processing method is acceptable.
  - Lipemic samples may interfere with accurate assessment of chromogenic methods.
  - Infusion of HBOC (hemoglobin-based oxygen carrier) products creates a pseudo-hemolysis appearance in the plasma and may interfere with clot- and chromogenic-based assays.

### Section: Specimen shipping and processing

**Recommendation**

- All primary and secondary tubes and tubes to be frozen must have multiple patient identifiers and date and time of collection.
- Platelet counts from PPP processing must be verified at least annually (depending on the accreditation standard).
- Multiple tubes collected from a single patient should not be pooled prior to storage or testing.
- Optimal freezing method is −70°C or colder; non-frost-free freezer, which provides PPP sample stability of 6 months.
- PPP samples can be stored at −20°C in a non-frost-free freezer for 2 weeks.
- Sample vials (with caps on) should be rapidly thawed in a 37°C water bath.
- Thawed PPP aliquots must be mixed prior to analysis.
- Hemolysis, icterus, lipemia
  - HIL may affect the ability of optical-reading instruments to accurately assess PPP samples.
  - Lipemic samples may be processed using ultracentrifugation methods, but a parallel, nonlipemic sample should be processed concomitantly to assure the processing method is acceptable.
  - Lipemic samples may interfere with accurate assessment of chromogenic methods.
  - Infusion of HBOC (hemoglobin-based oxygen carrier) products creates a pseudo-hemolysis appearance in the plasma and may interfere with clot- and chromogenic-based assays.