SOP on Packed Cell Volume (PCV) Measurement Using the Microhaematocrit Method

Department of Medicine

Faculty of Medicine

UWUSL

Standard Operating Procedure for Packed Cell Volume (PCV) Measurement Using the Microhaematocrit Method

(1) Title
Packed Cell Volume (PCV) Measurement Using the Microhaematocrit Method

(2) Issued By
Department of Medicine, Faculty of Medicine, Uva Wellassa University of Sri Lanka

(3) Purpose & Scope
To ensure the safe, accurate, and standardised measurement of Packed Cell Volume (PCV), also known as haematocrit, using the microhaematocrit centrifuge method while maintaining biosafety and quality assurance standards in ward settings. This Standard Operating Procedure (SOP) applies to medical students and healthcare staff performing PCV measurement under supervision during clinical training and bedside procedures.

(4) Principle
Whole blood is centrifuged in a capillary tube at high speed, causing red blood cells to pack at the bottom, plasma to remain above, and a thin buffy coat to form in between. The Packed Cell Volume (PCV) is calculated as the percentage or decimal fraction (L/L) of the packed red cell volume relative to the total blood volume. Note that centrifuged PCV results may be slightly higher (by approximately 2%) than those from automated electronic counters due to a small amount of plasma trapped between the packed red cells.

(5) Responsibilities

(5.1) Medical Officers
(5.1.1) Supervise and ensure adherence to SOP.
(5.1.2) Review abnormal PCV results and initiate clinical action.

(5.2) Medical Students
(5.2.1) Perform the procedure under the supervision of a trained professional.

(5.3) Healthcare Staff
(5.3.1) Perform the procedure according to the guidelines.

(6) Indications

(6.1) Monitoring haemoconcentration in suspected or confirmed dengue to detect plasma leakage, assess severity, and guide fluid therapy.

(6.2) Screening for anaemia in low-resource settings where automated haematology analysers are unavailable.

(6.3) Detection of polycythaemia in low-resource settings when rapid bedside haematology assessment is required.

(6.4) Assessing dehydration or other haematological changes when laboratory facilities are limited.

(7) Contraindications

(7.1) Presence of infection, inflammation, oedema, burns, or damaged skin at the puncture site.

(7.2) Poor peripheral circulation or use of a limb with intravenous infusion or arteriovenous fistula.

(8) Procedure

(8.1) Assemble Equipment

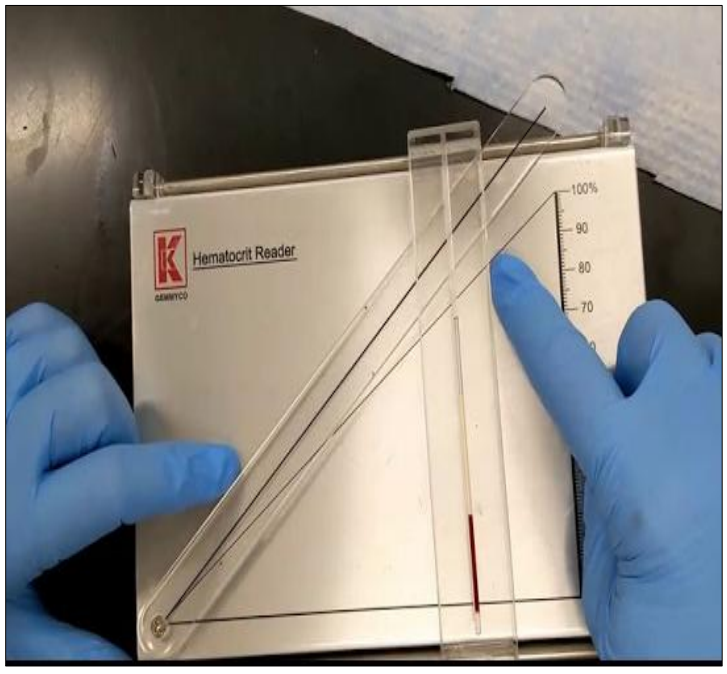
(8.1.1) Microhaematocrit centrifuge

(8.1.2) Heparinised capillary tubes (red band for capillary pricks)

(8.1.3) Disposable lancet

(8.1.4) Plasticine/clay tray

(8.1.5) Microhaematocrit reader card



(8.1.6) 70% alcohol swabs (for skin disinfection)

(8.1.7) Non-sterile gloves

(8.1.8) Alcohol hand rub

(8.1.9) Gauze or cotton wool balls (to apply after puncture)

(8.1.10) Puncture-resistant sharps container

(8.2) Pre-procedure steps

(8.2.1) Verify the patient's identity using appropriate identifiers (e.g. full name and BHT number).
(8.2.2) Explain the procedure to the patient, including the purpose of the test and the method of blood collection.
(8.2.3) Request informed verbal consent from the patient before proceeding.

(8.3) Blood Collection

(8.3.1) Perform hand hygiene according to standard infection control guidelines.

(8.3.2) Before blood collection, wear appropriate Personal Protective Equipment (PPE), including disposable gloves.

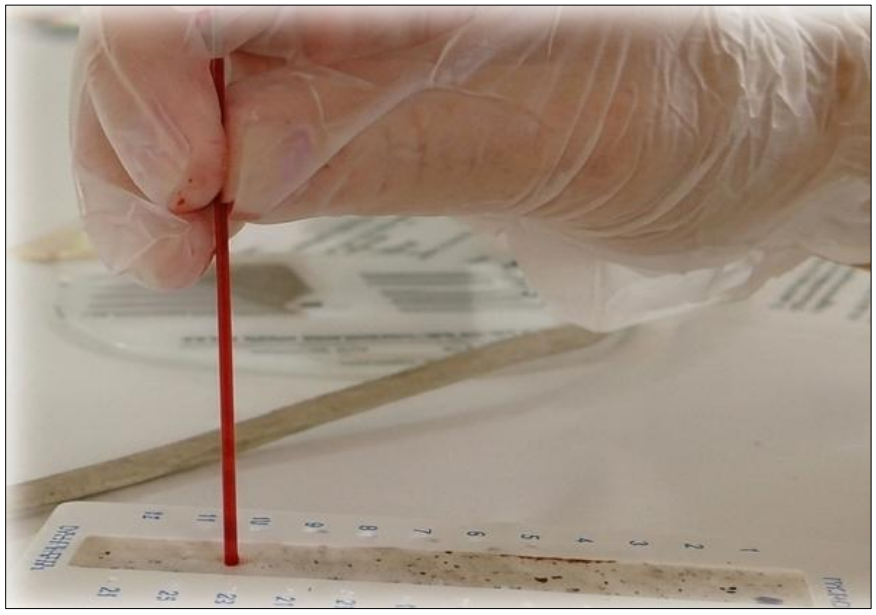
(8.3.3) Select the middle or ring finger for sample collection and clean the selected fingertip using a 70% alcohol swab and allow it to air dry completely.

(8.3.4) Use a sterile disposable lancet to puncture the side of the fingertip and wipe away the first drop of blood using sterile gauze or cotton wool.

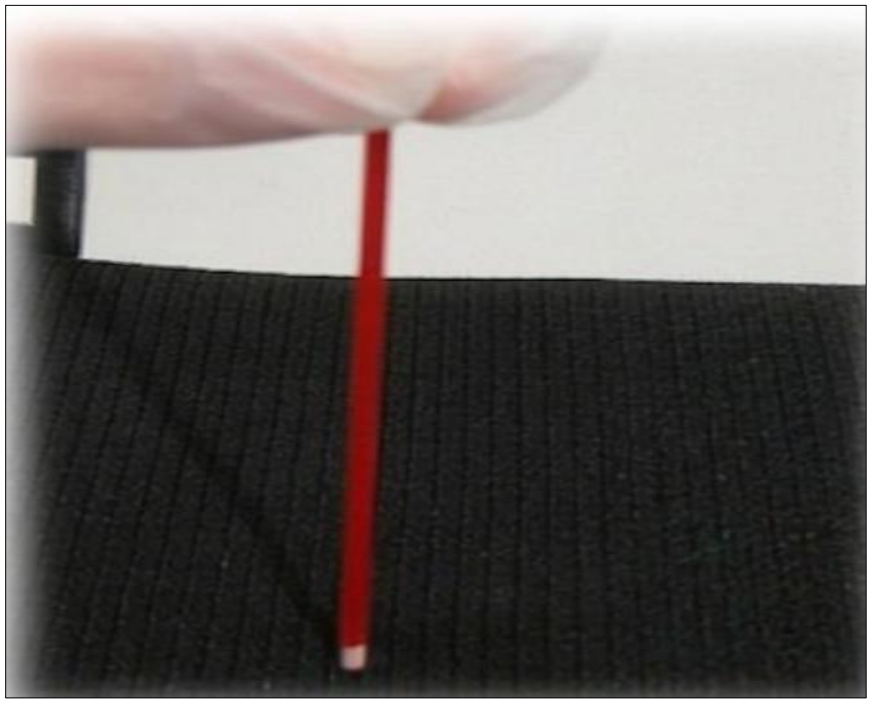
(8.3.5) Allow a large drop of blood to form without excessive squeezing of the finger.

(8.3.6) Hold the capillary tube horizontally or slightly inclined, and allow blood to enter the tube by capillary action until approximately two-thirds (⅔) to three-quarters (¾) of its total length is filled (approximately 40–50 mm of a standard 75 mm tube).

(8.3.7) Carefully wipe any excess blood from the outside of the tube using clean gauze, ensuring the gauze does not touch the open tip of the tube. Seal the dry end firmly with 4 to 5 mm of plasticine/clay sealant.



(8.3.8) Check that the sealed end of the capillary tube contains sufficient plasticine sealant. If the seal is inadequate, discard the tube safely and prepare a new sample. To avoid clotting or evaporation, the capillary tube must be centrifuged immediately.



(8.4) Centrifugation

(8.4.1) Switch on the microhaematocrit centrifuge at the power source and open the centrifuge lid.

(8.4.2) Remove or unscrew the metal cover (plate) inside the centrifuge. Ensure that the centrifuge chamber is clean and free from dust, debris, or previous samples.

(8.4.3) Place the capillary tubes opposite each other in the centrifuge to maintain balance. Ensure that the sealed ends face outward and touch the shock-absorbing rubber edge of the centrifuge chamber.

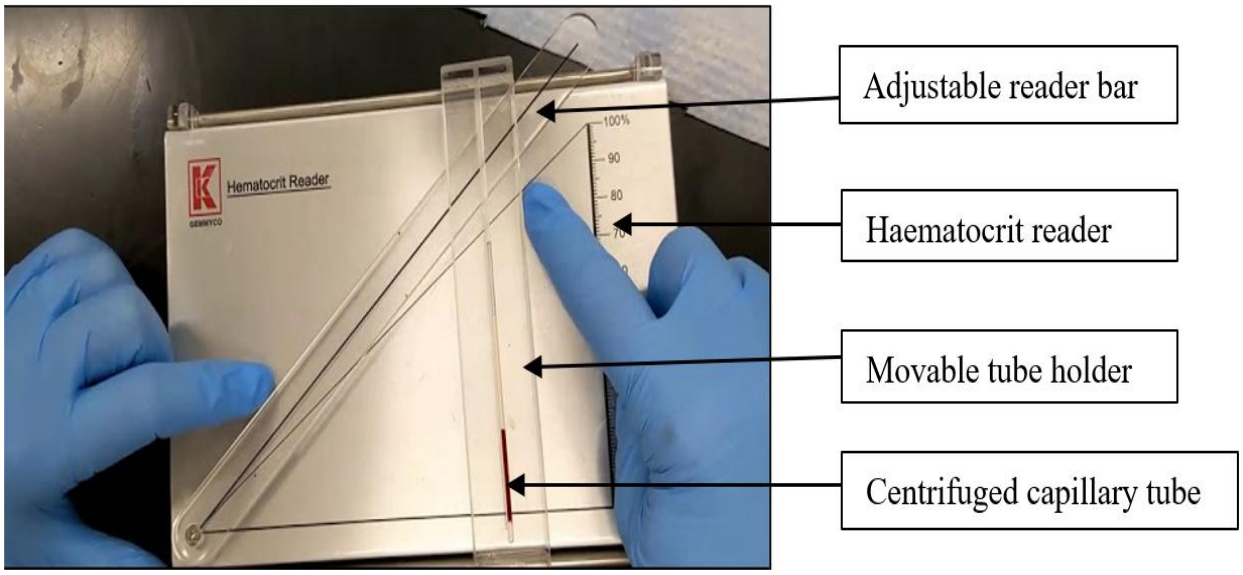
(8.4.4) Replace and secure the metal cover (plate) firmly and close the centrifuge lid securely.

(8.4.5) Set the centrifuge to spin for 4 to 5 minutes at a speed of 11,000 to 12,000 rpm to ensure complete packing of the red blood cells. Ensure the rotor temperature does not exceed 45°C during consecutive runs to prevent specimen heating or haemolysis.

(8.4.6) Allow the centrifuge to stop completely before opening the lid. Once the centrifuge has come to a complete stop, open the lid and remove the metal cover carefully.

(8.5) Reading the PCV Value

(8.5.1) Carefully remove the centrifuged capillary tube from the rotor head and place it into the groove of the movable tube holder on the reader platform.



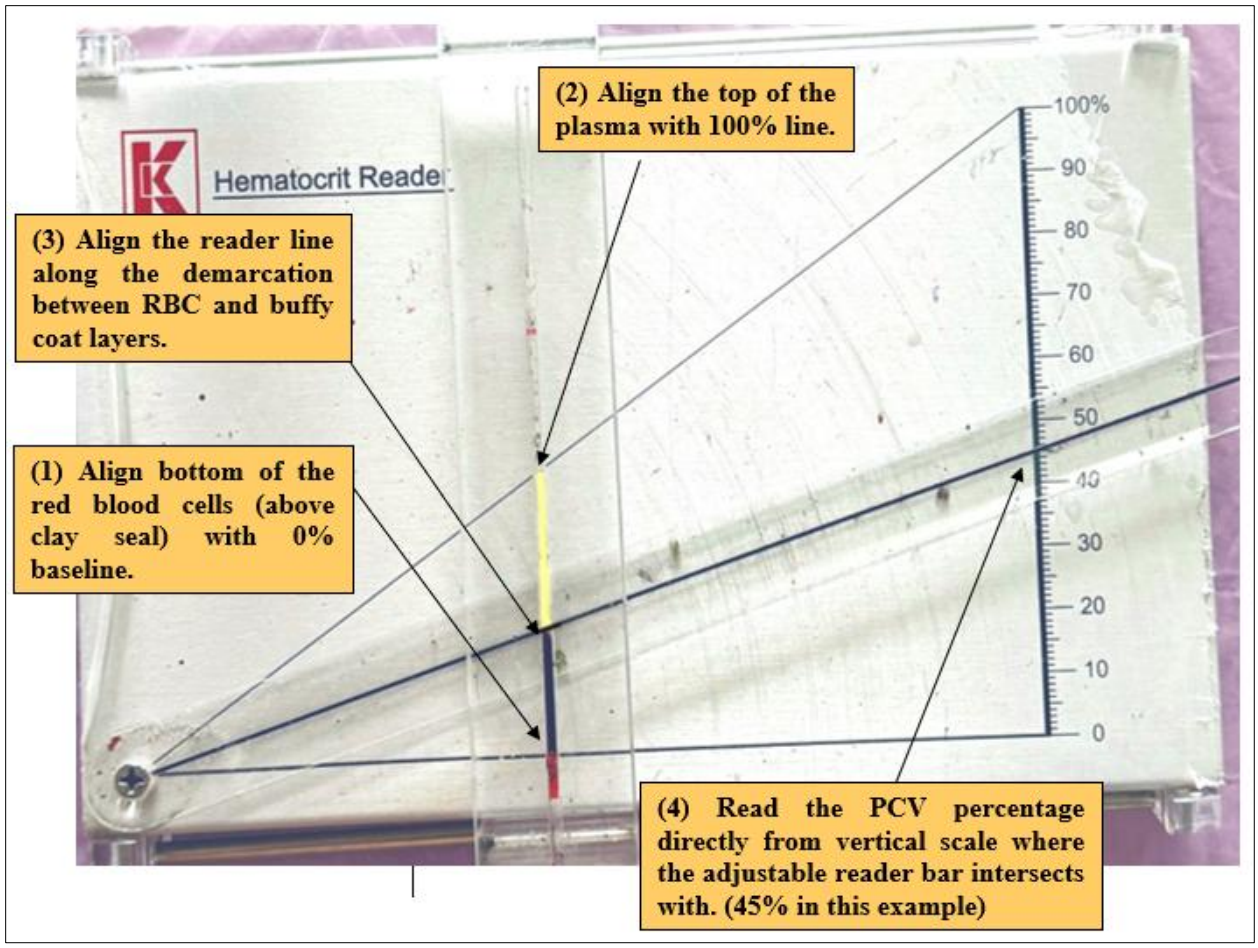
(8.5.2) Align the bottom interface of the packed red blood cells (just above the clay seal) exactly with the lower straight baseline (1) on the platform.

(8.5.3) Slide the movable tube holder horizontally until the top extreme edge of the plasma column intersects exactly with the upper diagonal line (2) on the platform.

(8.5.4) Pivot the adjustable reader bar so that its centre line meets the precise demarcation line (3) separating the packed red blood cells from the white blood cell/leucocyte buffy coat layer.

(8.5.5) Read and record the Packed Cell Volume (PCV) value as a percentage directly from the vertical scale (4) on the right-hand side of the reader board. For healthy adults, haematocrit ranges from 40% to 52% in males and 37% to 47% in females.

(8.5.6) In **Dengue Haemorrhagic Fever**, progressively rising haematocrit (Hct) towards 20% from the baseline suggests that the patient may have entered the critical phase. For example, if the initial Haematocrit is 35%, an increase up to 42% indicates a 20% increase.



(8.6) Post-procedure Steps

(8.6.1) Apply gentle pressure to the puncture site with sterile gauze or cotton wool if blood was collected by finger prick. Apply an adhesive plaster if required.

(8.6.2) Dispose of used lancets and capillary tubes in a puncture-resistant sharps container and dispose of gauze and other contaminated materials in biohazard waste containers.

(8.6.3) Remove gloves and other personal protective equipment (PPE) appropriately and perform hand hygiene after completion of the procedure.

(8.6.4) Thank the patient for their cooperation.

(9) References

(1) World Health Organization. (2000). Determination of packed red cell volume (PCV) (WHO/DIL/00.2).
(2) StatPearls Bookshelf. (2023). Haematocrit. National Centre for Biotechnology Information (NCBI).
(3) University of Bristol Clinical Skills Lab PCV guideline (2017)

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(11) Date of Implementation

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