Blood Hemoglobin Determination (HemoCue)

Purpose:

"Anemia is said to exist when the level of circulating hemoglobin in the patient is lower than that of healthy persons of the same age group and sex in the same environment"(WHO). The most common type of anemia is iron deficiency resulting from inadequate iron intake. The objective of this procedure is to measure the amount of Hemoglobin in peripheral whole blood.

Content:

Hemoglobin is the iron-containing pigment of red blood cells that carries oxygen from the lungs to the tissues. The measures of haemoglobin values vary between genders and infants, but normal ranges create the standards against which anemia (decreased numbers of red blood cells or haemoglobin) can be identified. In the lungs haemoglobin combines with essential oxygen, which is then carried to body tissues where the oxygen is subsequently released. Anemia is not a disease, but rather a symptom of other illnesses or dietary deficiencies. Therefore, determination of haemoglobin in the blood is an important screening procedure that directs therapeutic choices.

Hemoglobin Screening:

The prevalence of anemia is high among Aboriginal children 6-24 months of age. In addition to ethnic background, other risk factors for anemia are prematurity and low birth weight, breastfeeding beyond 6 months of age, lack of access to or inability to consume iron-fortified products, diet of cow' milk only in the first year of life, pregnancy and low socioeconomic status.

Children who are not exclusively fed with iron fortified formula according to the preparation and intake recommendations should be screened at least one time for hemoglobin between 6-12 months.

Taking the Blood Sample:

Procedure:

Capillary Sampling Heel – Infants (less than one year old) and premature infants over the age of 12 months who have not begun to walk
Capillary Sampling Finger – Children over one year of age

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1. Explain the procedure and rationale for the blood test.
2. Gather all necessary equipment. Create a clean area for the supplies by using a small drape.
3. Wash Hands.
4. The wearing of gloves is recommended for this procedure.

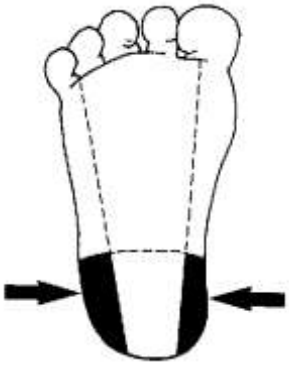
NOTE: Routine foot/finger warming prior to procedure is no longer recommended as it is not possible to conveniently measure the water temperature and the potential for overheating exists.

5. Clean the puncture site with 70% alcohol. Wipe dry with gauze. Failure to wipe off alcohol residue may dilute the specimen and adversely affect test results. Use a sterile, disposable lancet (<2.0mm depth) to puncture the infant's heel **< 1 year** or finger (middle or ring finger for sampling –take any rings off) **>1 year**. Place the blade slot securely against the heel/finger. Firmly and completely depress the trigger with your index finger.

6. After triggering the lancet, remove the lancet and immediately discard it into the "sharps container".

7. If unable to obtain a sufficient amount of blood with first puncture, choose another puncture site to complete sample collection. It is preferable to use the opposite foot/hand if a second puncture is necessary. If, for some reason, this is not possible, the same foot/hand may be used but the opposite side of the heel/finger should be used. Do not re-puncture on top of or beside the first puncture site.

8. See diagram for puncture site. Place infant's limb in a dependent position (leg lower than heart) to increase venous pressure and enhance blood flow. Massage foot gently to increase circulation/blood flow. The incision can be placed at a 90-degree angle to the length of the foot or parallel to the length of the foot.



NOTE: The outside of the heel (little toe side) is the primary choice in heel puncture.

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CORRECT LOCATION FOR CAPILLARY PUNCTURE IN THE FINGER. PUNCTURE ACROSS THE FINGERPRINTS NOT PARALLEL TO THEM. **Finger over one year**

9. Gently wipe away the first and second drop of blood with dry clean gauze. Collect the third drop of blood for analysis (first/second drop may contain tissue fluids and dilute the specimen). Allow blood to flow freely. Gently apply and release pressure around the heel/finger to increase blood flow. Avoid milking/squeezing the puncture site as this can cause haemolysis (breakdown of red blood cells and make the specimen unusable).
10. Make sure the third drop of blood is big enough to fill the microcuvette completely. Avoid touching the microcuvette to the skin. Keep the microcuvette in contact with the blood and fill in one continuous process. Do not refill a partially filled microcuvette.
11. Wipe any residual control material from the sides of the microcuvette with a piece of gauze, as if wiping excess butter from a knife. Do not touch the opened end of the microcuvette with the gauze since this will draw blood out of the microcuvette.
12. Visually inspect for air bubbles in the center of the microcuvette eye. If bubbles are present in the microcuvette eye, discard the microcuvette and obtain another specimen.
13. The filled (test) microcuvette should be analyzed within 10 minutes after being filled. Filled (test) microcuvettes are to be kept in the horizontal position. Place the filled (test) microcuvettes into the cuvette holder and gently slide the holder into measuring position.
14. During the measurement, the hourglass symbol and three fixed dashed will be shown on the display.
15. The Hgb value will be displayed in grams/dL within 15 to 60 seconds. The result will remain on the display as long as the cuvette is in the measuring position.
16. Record the result before removing the microcuvette from the instrument.
17. Pull the microcuvette holder out to the loading position. Remove the microcuvette and discard it into the biohazardous waste container.
18. When the display shows three flashing dashes and the HemoCue symbol, the analyzer is ready for the next measurement.
19. If an "ERROR" code is displayed, refer to the manufacturer's "Troubleshooting Guide" found in the Hemocue operating manual.
20. Once collection is completed, apply steady pressure to the puncture site. The foot should be elevated above the body, and a clean gauze pressed against the puncture until the bleeding stops. It is not recommended to apply a band aid over the puncture site. If bleeding is persistent, apply 2X2 gauze with paper tape.

NOTE: It is not recommended to apply a band aid over the puncture site. If bleeding is persistent, apply 2X2 gauze with paper tape.

21. Discard all other disposable items by grasping items in palm and pulling glove "inside-out". Dispose of the garbage.

22. Wash hands.

23. Children or adults with critically low initial hemoglobin results require retesting. Repuncture at a new site and recheck the hemoglobin immediately.

24. In most cases, if the first screening test is low but the second test result is within the normal range, the problem may usually be attributed to faulty technique of the test in collection of the first sample. A common problem is the introduction of air into the microcuvette. Excessive milking of the finger may lead to the introduction of air bubbles or dilution of blood with serous fluid.

25. Low readings that persist after the performance of the required re-test should be referred to the client's primary care provider for a confirmatory venous blood test and any needed follow-up. Chart referral in the client chart.

Results

Population	**Hemoglobin Range (Clinical Practice Guidelines FNIH)**		
Newborns<7 days	Normal Range:	170g/L – 220g/L	(17 – 22) g/dL
1 month	Normal Range:	115g/L – 180g/L	(11.5 – 18) g/dL
3-12 months	Normal Range:	100g/L – 140g/L	(10 – 14) g/dL
1-5 years	Normal Range:	110g/L – 140g/L	(11 – 14) g/dL
6-14 years	Normal Range:	120g/L – 160g/L	(12 – 16) g/dL
Women	Normal Range:	120g/L – 160g/L	(12 – 16) g/dL
Pregnant Women	Normal Range:	110g/L – 140g/L	(11 – 14) g/dL
Men	Normal Range:	130g/L – 180g/L	(12 – 18) g/dL

Quality Control:

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1. The individually wrapped microcuvettes (for use with HemoCue 201+ only) have an expiration date specified by the manufacture and printed on the outside of each individual packet

2. The bulk microcuvettes have an expiration date specified by the manufacturer and printed on the outside of the vial. Once opened, the microcuvettes are stable for three (3) months. Tightly reseal container immediately after use. Write both the date opened and the open vial expiration date on the container

3. Every time the analyzer is turned on, it will automatically verify the performance of the optronic unit of the analyzer (self test). This self test is performed every second hour if the analyzer remains switched on.

4. After 10 seconds, the display will show three flashing dashes and the HemoCue symbol. This indicated that the HemoCue Hb 201+ has passed the SELFTEST and is ready for use. If the SELFTEST fails, an error code will be displayed.

Infection Control

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1. Clean the exterior of the instrument on a daily basis with a disinfectant wipe.

2. The cuvette holder should be cleaned daily with alcohol. Check that the analyzer is turned off. The display should be blank. Pull the cuvette holder out by pressing the small catch positioned in the upper right corner of the cuvette holder. While pressing the catch, carefully rotate the cuvette holder towards the left as far as possible. Carefully pull the cuvette holder away from the analyzer.

3. Clean the interior of the optronic unit daily (or each day that the instrument is in operation). A dirty optronic unit may cause the analyzer to display an error code. To clean the optronic unit:

– push the HemoCue cleaner swab into the opening of the cuvette holder. Move from side-to-side 5-10 times. If the swab is stained, repeat with a new swab. No further cleaning is required if the swab remains clean. As an alternative to the HemoCue cleaner swab:

– push a long stem cotton-tipped applicator that has been saturated with alcohol (<70% without additives) into the opening of the cuvette holder. Move from side-to-side 5-10 times.

4. Wait 15 minutes before replacing the cuvette holder and using the analyzer.

Please see video at:

http://www.youtube.com/watch?v=GA_sbOo6aJU

Management & Follow-up

Community Health Nurse

1. If haemoglobin levels are below age specific ranges, assess for physical findings such as pallor of conjunctiva and palmar creases, tachycardia.
2. Inquire about diet; (6-24 month old children fed exclusively milk).

– *Children*: inquire about symptoms of; irritability, tiredness, ADHD, growth retardation, cognitive/intellectual impairment, previous history of anemia.

– *Adults*: hair loss, fatigue, cold intolerance, irritability, menstrual irregularities, recent birth history, history of bleeding and/or anemia and medications.

3. Refer all clients with anemia to their primary care provider. For children with obvious symptoms of anemia a timely referral is required.
4. Have discussion about iron rich foods, complications associated with iron deficiency, and side effects of iron therapy.
5. Encourage clients to take their iron supplements as directed by their primary care provider. (on an empty stomach; with acidic juice or vitamin C, not with multivitamins, calcium, or antacids).
6. After 1 month, check haemoglobin. When haemoglobin becomes normal, treatment must be continued for 2 – 3 months to replenish iron stores, then a maintenance dose may be required. (Ask primary care provider).
7. Refer to a primary care provider if there is no response to iron therapy after 1 month.
8. Monitor haemoglobin monthly if there are concerns about iron intake or bleeding tendencies.