Basic laboratory techniques safety and hematocrit

The hematocrit is normally ordered as a part of the complete blood count. It is important in evaluating anemia and polycythemia, monitoring the recovery from dehydration, the effectiveness of treatment for anemia, the ongoing bleeding to check its severity, etc. In this practical, hematocrit is used to determine if the patient has anemia by means of red cell indices MCV, MCH and MCHC. For red blood cell count, it is used to evaluate any type of decrease or increase in the number of red blood cells as measured per liter of blood. It is a parameter interprets in conjunction with hematocrit. Both decreased hematocrit and decreased RBC count indicate anemia.

(D) Results

Hematocrit (HCT)

Record the red blood cell indices in the table below.

Reading

SI Unit

RBC

8. 55 Ã- 1012

RBC/L

Hemoglobin

11. 0

g/dL

Your HCT value

26

%

The red blood cell indices are used to classify anemias. Find out their formulae and calculate the MCV, MCH & MCHC. Compare them to the reference values of a normal adult female.

Red cell indices

Formula

Calculation (units)

Reference range

Mean cell volume (MCV)

Hematocrit (%) Ã- 10

RBC

_26 Ã- 10

8. 55

MCV= 30. 4 fL

86 – 98 fL

Mean cell hemoglobin (MCH)

Hemoglobin(grams) Ã- 10

RBC

__11__ Ã- 10

8. 55

MCH= 12. 87 pg

27 – 32 pg

Mean cell hemoglobin concentration

(MCHC)

Hemoglobin(grams) Ã- 100

Hematocrit (%)

__11__ Ã- 100

26

MCHC= 42. 3 %

32 – 37 %

(*delete as appropriate and suggest whether blood smear A or B provided in the lab would belong to this sample)

As your calculated MCV suggest, the RBCs are macrocytic / normocytic / microcytic *.

As your calculated MCH suggest, the hemoglobin in the RBCs are within / below / above* the average weight.

As your calculated MCHC suggest, the RBCs are normochromic / hypochromic / hyperchromic*.

Blood smear A / B* belongs to this patient.

Cell count and hemacytometer

RBC Counts

Averaging no. of RBCs in 2

one square millimeter

Square

No. of RBC counted

1

178

2

164

Total RBCs counted

342

Averaged RBC counted

171

Calculate the RBC count in the sample:

= Average no. RBCs counted in 1 big square Ã- Dilution factor

Area counted (mm2) Ã- Depth (mm)

RBC count = 171 Ã- 1000 ikikikiiiiiiu

0. 2 (mm2) Ã- 0. 1 (mm)

RBC count = 8. 55 Ã- 1012 (units= /L)

(E) Quality Assessment

Obtain results from the class and do the statistics.(Refer to Basic Clinical Lab Techniques pp. 79 – 81)

Î£X_

n

(117+160+174+142+166+161+181+183+166+143+164+159+148+162+225+135+165+120+

168+128+271+104+171+168+171+182+170+176+181+116+172) ÷ 31

RBC counts is 162. 87 .

n

Test Value

(mg/dL)

X

Deviation Squared

(– x)2

1

117

2104. 15

2

160

8. 24

3

174

123. 86

4

142

435. 60

5

166

9. 79

6

161

3. 50

7

181

328. 66

8

183

405. 18

9

166

9. 79

10

143

394. 86

11

164

1. 27

12

159

14. 98

13

148

221. 15

14

162

0. 76

15

225

3860. 01

16

135

776. 79

17

165

4. 53

18

120

1837. 92

19

168

26. 31

20

128

1215. 98

21

271

11691. 89

22

104

3465. 79

23

171

66. 08

24

168

26. 31

25

171

66. 08

26

182

365. 92

27

170

50. 82

28

176

172. 37

29

181

328. 66

30

116

2196. 89

31

172

83. 34

Î£(– x)2__

n – 1

30297. 48__

30

= 1009. 916

âˆšVariance

âˆš1009. 916

31. 78

2s = 63. 56

+2s = 226. 43

-2s = 99. 31

3s = 95. 34

+3s = 258. 21

-3s = 67. 53

10. Construction of a Levey-Jenning s Chart using the mean and standard deviation(s) from above. Indicate the mean value, +/- 1s, +/-2s, +/-3s on the appropriate lines. Using the RBC data from the class, plot the values from all students.

Levey-Jennings Chart of RBC counts in class

SD of RBC counts

(G) Practical & Review Questions

Label the hemacytometer diagram below with its parts. (p208) Indicate the areas usually used for

WBC count with “ W”

RBC count with “ R” and

Platelet count.” p”

1. What does the hematocrit measure?

The hematocrit is a test determining the patients' red cell volume found in whole blood and, thus, the blood's oxygen carrying capacity. It is expressed as a percentage by volume.

2. Give the hematocrit reference values for males, females, and newborns.

Males: 42 – 52 %

Females: 36 – 48 %

Newborns: 51 – 61 %

3. Name a condition that could cause a decreased hematocrit value.

Anemias

4. Explain the hematocrit procedure

1. Obtain patients' blood and prepare the specimen.

Gently mix the capillary blood by inverting the tube until all sediments disappear.

Blood sample is drawn into a heparinixed microhematocrit tube by capillary action. Load the microhematocrit tube by holding it end downward to allow gravity to facilitate loading of the tube. The tube should be filled to about 3/4 full.

Seal one end of the tube with a small amount of clay material at a 90° angle.

2. Centrifuge the samples.

Please the sealed microhematocrit tube into the rotor of the microhematocrit centrifuge, with the sealed end against the rubber gasket.

Duplicate samples should be placed opposite each other in order to balance the centrifuge.

Securely fasten the flat lid on top of the capillary tubes.

Spin the tubes for 2 to 4 minutes at 10000 rpm.

After the centrifuge has stopped, open the top and remove the cover plate.

3. Reading and reporting the Hematocrit value.

Inspect the tube to see if there is any leakage after centrifugation.

Place the tube on the hematocrit reader.

Place tube in the groove with the top of the seal-ease (bottom of the packed cells) lined up with the bottom line of the reader.

Move the slider bar to the border between the packed red cells and the plasma.

Read the percentage reading beside the slide bar.

5. Blood enters the capillary tube by what action?

Blood enters by capillary action.

6. Why must the capillary tube be sealed securely?

In the process of spinning, RBCs and a small amount of plasma will be forced from the tube, a false result may be resulted because of incomplete sealing of tube. Therefore, sealing the tube securely can create a pressure inside the tube which prevents the content from forcing out during centrifugation.

7. What is the usual length of time for centrifugation of the hematocrit tubes?

The hematocrit tubes are usually centrifugated for 2 to 4 minutes at 10000rpm.

8. What safety precautions should be observed when performing a hematocrit?

Standard precaution should be observed.

9. What technical factors can affect the quality of hematocrit results?

– Blood sample should be well-mixed before microhematocrit tubes are filled.

– Avoid bubbles when filling blood sample into the microhematocrit tube.

– Microhematocrit tubes should be filled at least three-fourths full.

– The microhematocrit tubes should be completely sealed before centrifugation.

– Read the hematocrit value at the top of the red cell layer, not at the top of buffy coat.

10. Case Study 1

A hemoglobin and hematocrit test performed in a pediatric clinic on a 2-year-old boy gave results of 110 g/L hemoglobin and 0. 33 L/L hematocrit. Do these results agree? What is the boy’s general health status based on the hematology results?

From the data provided by the case, the mean cell hemoglobin concentration (MCHC) of the child:

__11__ Ã- 100

33

= 33%

The MCHC is within the normal range, showing the child is free from anemia.

However, according to World Health Organization, a hemoglobin concentration of less than 110 g/L and a hematocrit value of less than 33% were used as a cut-off for anemia for children aged 0. 5 to 5[1].

Therefore, for the above case, although the child does not have anemia at this moment, his marginal hemoglobin and hematocrit values agree and both show that he has a high risk of suffering anemia.

Age or gender group

Hemoglobin (g/dL)

Hematocrit (%)

Children (0. 5-4)

< 11. 0

< 33

Children (5-12)

< 11. 5

< 35

Children (12-15)

< 12. 0

< 36

Adult Men

< 13. 0

< 39

Non-pregnant Women

< 12. 0

< 36

Pregnant Women

< 11. 0