Understanding Your Complete Blood Count

This information was developed by your nursing staff to help you understand your complete blood count.

Part 1: The measurements in a complete blood count

What is a complete blood count?
A complete blood count, often referred to as a CBC, is a common blood test. A CBC provides detailed information about three types of cells in your blood: red blood cells, white blood cells, and platelets. These blood cells are made in the bone marrow, the spongy tissue filling the center of your bones. Bone marrow in the skull, sternum (breast bone), ribs, vertebral column (backbone), and pelvis produces these blood cells.

Each type of blood cell plays an important role in your body’s normal function.

What does a complete blood count measure?
A complete blood count includes five major measurements:

• white blood cell (WBC) count
  White blood cells fight infections. They are measured in thousands per cubic milliliter (K/mm³) of blood.

• red blood cell (RBC) count
  Red blood cells carry oxygen to and remove waste products from the body’s tissues. These cells also contain hemoglobin. Red blood cells are measured in millions per cubic millimeter (mil/mm³) of blood.

• hemoglobin (HGB) value
  Hemoglobin gives red blood cells their color. Hemoglobin carries oxygen from the lungs to the tissues and takes carbon dioxide (the waste products) from the tissues to the lungs. From the lungs, carbon dioxide is exhaled. Hemoglobin is measured in grams per deciliter (g/dL) of blood.

• hematocrit (HCT) value
  The hematocrit is the percentage of red blood cells in relation to your total blood volume.

• platelet count
  Platelets help to stop bleeding by forming blood clots. They are measured in thousands per cubic millimeter (K/mm³) of blood.

What are the normal ranges of these measurements?
Each measurement in a complete blood count has a normal range:

• WBC: 3.4-9.6 K/mm³
• RBC: 3.58-4.99 mil/mm³
• HGB: 11.1-15.0 g/dL
• HCT: 31.8-43.2%
• Platelets: 162-380 K/mm³.

You will see these ranges on your complete blood count.
Part 2: A more detailed look at what the complete blood count measures

White blood cells
These cells are the mobile units of the body’s infection-fighting system. White blood cells travel in the bloodstream to areas of infection and destroy the responsible bacteria. However, the WBC lab value is not meaningful unless the “differential” is also known.

The differential
The differential measures each of the five types of white blood cells:
- neutrophils (polys and bands)
- basophils
- eosinophils
- lymphocytes
- monocytes.

The differential is usually based on 100 cells counted in a laboratory sample.

What are neutrophils?
Neutrophils are the most numerous white blood cells. They make up about 56 percent of white blood cells. Neutrophils are the “soldiers” that fight infections. They eat or gobble up the infectious particles (bacteria) in your body.

On your lab sheet, you will see the words “polys” and “bands.” Polys are mature neutrophils; bands are young polys, which also fight infections.

What is the ANC or AGC?
The absolute neutrophil count (ANC), also called absolute granulocyte count (AGC), is the measure of the number of infection-fighting white blood cells in your blood.

How is the ANC calculated?
To calculate the ANC, the number of white blood cells and the percentage of polys and bands must be known. Then, the number of white blood cells is multiplied by the percentage of polys and bands.

For example, let the number of white blood cells be 300. (This number would be 0.3 on the lab sheet. To get this number, move the decimal three places to the right.) Let the number of polys be 10 percent (0.10), and bands 5 percent (0.05). The ANC is found by doing the following:

\[
300 \times (0.10 + 0.05) = 300 \times 0.15 = 45
\]

The ANC is 45.

Three more examples of these calculations are at the end of this information. The normal ranges shown are based on adult women; adult men’s and children’s ranges will be slightly different.
Part 3: Low blood counts—neutropenia

*What does it mean to have a low ANC or an ANC lower than 500?*

The normal neutrophil count is 2,500-6,000. When you have 1,000 or fewer neutrophils, your risk of infection is increased. When your ANC is lower than 500, you are at risk for getting a serious infection. This condition is called “neutropenia.”

If you are neutropenic and develop a fever or signs of infection, contact your doctor immediately. You may be given antibiotics to fight the infection.

*If I am neutropenic, should I take special care of myself?*

If your ANC is low, be alert for the following signs and symptoms of infection:

- fever (temperature higher than 100.4 degrees Fahrenheit)
- shaking chills
- flushed skin
- sweating
- frequent urination or burning when urinating
- redness, tenderness, or pain anywhere on the body
- general feeling of tiredness or flu-like symptoms (sore throat, sneezing, runny nose, coughing, nausea, vomiting, diarrhea, shortness of breath, chest discomfort).

If you are neutropenic and have any of these signs or symptoms, contact your doctor immediately.

*If I am neutropenic, how can I prevent myself from getting infections?*

The following list contains information to help you care for yourself while you are neutropenic.

**Neutropenia precautions list**

To prevent or detect infections, follow these precautions.

**General precautions**

- Check your temperature three times a day when you are neutropenic. If your temperature is 101.3 °F* or greater once, or if your temperature is 100.4 °F or greater two times in 24 hours, notify your nurse or doctor. Take Tylenol only on your doctor’s advice. Do not take aspirin.

- Check for signs of infection in such areas as the site of a Hickman catheter or Port-a-Cath, or any tube or catheter site. Also check the mouth, groin, and perineum (the area between the penis and the rectum in men, and between the vagina and rectum in women). Signs of infection include redness, swelling, tenderness, drainage, or odor. If you have any signs of infection, notify your nurse or doctor.

**Personal hygiene**

- Shower or bathe daily. Give extra attention to washing the underarms, groin, and perineum. These areas are moist and may harbor germs. If your skin becomes dry, use lotion or oils to soften it and prevent cracking.

*°F means degrees Fahrenheit.*
• Perform mouth care every 4 hours, especially before and after meals.

  **Mouth care checklist**
  - Rinse with a baking soda mouth rinse (1 teaspoon of baking soda in an 8-ounce glass of water).
  - Use a soft toothbrush and floss gently. Floss only if your platelet count is greater than 50,000.
  - Use a lubricant (such as A & D ointment) on the lips to prevent chapping.
  - Wear well-fitting dentures.
  - Have dental work done only if you first consult your NIH doctor.

• Wash your hands before eating and after using the toilet, blowing your nose, coughing, or sneezing.
• Wear shoes in the hospital and at home.
• Do not have manicures or pedicures.
• Do not have nail tips or false nails applied.

**Precautions to take during daily activities**
• Avoid having contact with crowds, and people with infections.
• Use gloves when you do gardening.
• Avoid cleaning bird cages, cat litter boxes, and fish tanks.
• To promote hygiene during sexual activity, avoid excessive friction during intercourse by using a water-based lubricant. Avoid rectal intercourse. Use a birth control method recommended by your nurse or doctor.
• Avoid hot tubs and Jacuzzis. Swim only in chlorinated swimming pools.

**Other ways to prevent infection**
• Avoid immunizations.
• Limit your exposure to pet excrement, fresh flowers, house plants, and stagnant water. Wash your hands after touching any of these items.
• If you cut or scrape your skin, clean the area immediately with soap and warm water. Then apply a bandage.
• Use an electric shaver rather than a razor.
• Avoid using enemas, rectal thermometers, and suppositories. Women should not douche or use tampons or vaginal suppositories.

**Anemia**

*What happens when I don’t have enough red blood cells?*

When you do not have enough red blood cells, you develop a condition called “anemia.” When you are anemic, your hematocrit and hemoglobin levels will be below normal. You may feel weak and tired, and you may also have these symptoms:
• dizziness
• shortness of breath
• heart palpitations (racing heartbeat)
• pounding in your head
• ringing in your ears.
Anemia precautions list
By following these suggestions, you can lessen or prevent some of the symptoms of anemia.
- Rest often during the day and sleep enough at night.
- Rest between activities.
- Get up slowly from a sitting or reclining position. This will lessen dizziness.

You may need blood transfusions if your hematocrit or hemoglobin is too low.

Thrombocytopenia

What happens when I don’t have enough platelets?
When you do not have enough platelets, you have a condition called “thrombocytopenia.” You may bruise easily, and you may also have some of the following signs:
- tiny, pinpoint-sized red or purple spots on your skin (petechiae)
- nose bleeds
- bleeding gums
- prolonged bleeding from a cut
- black or bloody stool
- brown or red urine
- increased vaginal bleeding.

Thrombocytopenia precautions list
Many over-the-counter drugs contain aspirin, and aspirin prevents platelets from working as they should. Avoid taking any drug that contains aspirin. (The table included in this information lists common aspirin-containing products.) Speak with your doctor before taking medication.

You can also observe the following precautions to prevent bleeding when your platelets are low:

Personal hygiene
- Use a soft toothbrush. If your gums bleed during brushing, use Toothettes instead of a toothbrush. Do not floss.
- Use an electric shaver rather than a razor, especially if your platelet count is lower than 20,000.
- Wear shoes in the hospital and at home.
- When you blow your nose, do it gently.
- Avoid using enemas, rectal thermometers, and suppositories. Women should not douche or use tampons or vaginal suppositories.
- Eat properly so that you do not become constipated.
- Avoid eating irritating foods such as popcorn or apple peels.

Precautions to take during daily activities
- Avoid wearing tight-fitting clothing. For example, do not wear shirts with elastic wristbands, or skirts or slacks with tight waist-bands.
- Avoid cutting with sharp knives or working with sharp blades. Wear gloves when gardening.
- Avoid contact sports such as football and hockey.
- Speak with your doctor about sexual intercourse. If your platelet count is too low, sexual intercourse may not be advisable.
If you have sexual intercourse, use water-based lubricants as needed.

**Other ways to prevent bleeding**

- Notify your nurse or doctor if you notice new petechiae or bruises.
- Notify your nurse or doctor immediately if you have a nosebleed, bleeding gums, bleeding from a procedure or incision site, or blood in your urine or stool.
- Notify your nurse or doctor if you have headaches, extreme drowsiness (unrelated to medication), confusion, or falls.

### Sample complete blood counts

#### Example 1: CBC WHL BLD*

(Complete Blood Count Whole Blood)

<table>
<thead>
<tr>
<th>Lab Value</th>
<th>Normal Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>WBC 2.2 K/mm³</td>
<td>3.4-9.6</td>
</tr>
<tr>
<td>RBC 3.6 m/mm³</td>
<td>3.58-4.99</td>
</tr>
<tr>
<td>HGB 11.1 g/dL</td>
<td>11.1-15</td>
</tr>
<tr>
<td>HCT 32.6%</td>
<td>31.8-43.2</td>
</tr>
<tr>
<td>MCV 91 CU MICR</td>
<td>77-99</td>
</tr>
<tr>
<td>MCH 30.8 UUG</td>
<td>26-35</td>
</tr>
<tr>
<td>MCHC 34.0 g/dL</td>
<td>34-36</td>
</tr>
<tr>
<td>Platelets 8 K/mm³</td>
<td>162-380</td>
</tr>
</tbody>
</table>

**Differential**

<table>
<thead>
<tr>
<th>Lab Value</th>
<th>Normal Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>cell count</td>
<td>100</td>
</tr>
<tr>
<td>NUC RBC</td>
<td>0</td>
</tr>
<tr>
<td>polys</td>
<td>14%</td>
</tr>
<tr>
<td>bands</td>
<td>0 (0.14+0 = 0.14)</td>
</tr>
<tr>
<td>lymphocytes</td>
<td>79</td>
</tr>
<tr>
<td>monocytes</td>
<td>7</td>
</tr>
<tr>
<td>eosinophils</td>
<td>0</td>
</tr>
<tr>
<td>basophils</td>
<td>0</td>
</tr>
<tr>
<td>atyp lymph</td>
<td></td>
</tr>
</tbody>
</table>

**How to figure out the ANC**

2200 (WBCs) x 0.14 (polys plus bands) = 308.00 = ANC

*The abbreviations used are the ones you will see on your CBC lab report.*

#### Example 2: CBC WHL BLD*

(Complete Blood Count Whole Blood)

<table>
<thead>
<tr>
<th>Lab Value</th>
<th>Normal Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>WBC 1.1 K/mm³</td>
<td>3.4-9.6</td>
</tr>
<tr>
<td>RBC 2.41 m/mm³</td>
<td>3.58-4.99</td>
</tr>
<tr>
<td>HGB 7.9 g/dL</td>
<td>11.1-15</td>
</tr>
<tr>
<td>HCT 23%</td>
<td>31.8-43.2</td>
</tr>
<tr>
<td>MCV 97 CU MICR</td>
<td>77-99</td>
</tr>
<tr>
<td>MCH 32.8 UUG</td>
<td>26-35</td>
</tr>
<tr>
<td>MCHC 33.8 g/dL</td>
<td>34-36</td>
</tr>
<tr>
<td>Platelets 16 K/mm³</td>
<td>162-380</td>
</tr>
</tbody>
</table>

**Differential**

<table>
<thead>
<tr>
<th>Lab Value</th>
<th>Normal Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>cell count</td>
<td>50</td>
</tr>
<tr>
<td>NUC RBC</td>
<td>0</td>
</tr>
<tr>
<td>polys</td>
<td>84%</td>
</tr>
<tr>
<td>bands</td>
<td>10% (0.84+0.10 = 0.94)</td>
</tr>
<tr>
<td>lymphocytes</td>
<td>6</td>
</tr>
<tr>
<td>monocytes</td>
<td>0</td>
</tr>
<tr>
<td>eosinophils</td>
<td>0</td>
</tr>
<tr>
<td>basophils</td>
<td>0</td>
</tr>
<tr>
<td>atyp lymph</td>
<td></td>
</tr>
</tbody>
</table>

**How to figure out the ANC**

1100 (WBCs) x 0.94 (polys plus bands) = 1034.00 = ANC

*The abbreviations used are the ones you will see on your CBC lab report.*

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* WHT BLD*

Example 1:** CBC WHL BLD* (Complete Blood Count Whole Blood)
### Example 3: CBC WHL BLD*
(Complete Blood Count Whole Blood)

<table>
<thead>
<tr>
<th>Lab Value</th>
<th>Normal Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>WBC 3.2 K/mm³</td>
<td>3.4-9.6</td>
</tr>
<tr>
<td>RBC 2.56 m/mm³</td>
<td>3.58-4.99</td>
</tr>
<tr>
<td>HGB 8.4 g/dL</td>
<td>11.1-15.0</td>
</tr>
<tr>
<td>HCT 25%</td>
<td>31.8-43.2</td>
</tr>
<tr>
<td>MCV 98 CU MICR</td>
<td>77-99</td>
</tr>
<tr>
<td>MCH 32.8 UUG</td>
<td>26-35</td>
</tr>
<tr>
<td>MCHC 33.66 g/dL</td>
<td>34-36</td>
</tr>
<tr>
<td>Platelets 16 K/mm³</td>
<td>162-380</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Differential</th>
<th>Normal Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>cell count</td>
<td>100</td>
</tr>
<tr>
<td>NUC RBC</td>
<td>0</td>
</tr>
<tr>
<td>polys 16%</td>
<td>38-78</td>
</tr>
<tr>
<td>bands 1%</td>
<td>0-4</td>
</tr>
<tr>
<td>lymphocytes</td>
<td>78</td>
</tr>
<tr>
<td>monocytes</td>
<td>4</td>
</tr>
<tr>
<td>eosinophils</td>
<td>1</td>
</tr>
<tr>
<td>basophils</td>
<td>0</td>
</tr>
<tr>
<td>atyp lymph</td>
<td>0</td>
</tr>
</tbody>
</table>

How to figure out the ANC

3200 (WBCs) x 0.17 (polys plus bands) = 544.00 = ANC

*The abbreviations used are the ones you will see on your CBC lab report.

### Common Aspirin-Containing Products
- Acetylsalicylic acid
- A.P.C. tablets and capsules
- ASA
- A.S.A. compounds
- A.S.A. tablets and capsules
- Adult Analgesic Pain Reliever
- Alka Seltzer products
- Anacin
- Anacin Maximum Strength
- Analgestine Forte
- Anodynos
- Arthritis Bayer
- Arthritis Foundation Pain Reliever
- Arthritis Pain Formula
- ASA Enseals
- Ascriptin
- Ascriptin A/D
- Ascriptin Extra Strength
- Ascriptin with codeine
- Aspercin
- Aspercin Extra
- Asperein
- Aspergum
- aspirin
- Aspermin
- Aspirin
- Asprimox
- Azdone
- Back-Quell
- Bayer products
- BC Powder
- Bexophene
- Buf-Tabs
- Buff-A
- Buffaprin
- Buffaprin Extra
- Buffasal
- Buffasal Max
- Bufferin
- Buffets
- Buffex
- Buffinol
- Cama
Capron
Congespirin
Cope
Coralsone Modified
Coricidin
Cospirin
Counterpain
Damason Prep
Dasin
Derfort
Dermule
Dolcin
Dolor
Duradyne
Dynosal
Easprin
Ecotrin
Emagrin Forte
Emagrin
Empirin
Empirin with codeine
Equagesic
Excedrin
Excedrin P.M.
Excedrin tablets and capsules
Fiorinal tablets and capsules
Four, 4-Way
Gemnisyn
Gensprin
Gensan
Goody’s Extra Strength
Goody’s Headache Powder
Halfrin
Heartline
Liquidprin tablets
Lortab ASA
Magnaprin
McNess Pain
Measurin Time Release
Midol tablets or capsules
Momentum
Norgesic
Norgesic Forte
Norwich Extra Strength
PAC Analgesic
PAC tablets and capsules
Pain Reliever
Panodynes Analgesic
Pap capsules
Pepto-Bismol
Percodan
Persistin
Phencaps
Phensal
Presalin
Quiet World
Robaxinal
Salatin
Saleto
Salocol
Scrip-Dyne Compound
Sine-Off
Soma Compound
Soma Compound with codein
St. Joseph Children’s Aspirin
St. Joseph Cold tablets for children
St. Joseph Low Dose Adult Aspirin
Stanback powder and tablets
Supac
Synalgos-DC
Talwin compound
Triaminicin
Trigesic
Tri-Pain
Ursinus Inlay Tabs
Valesin
Vanquish
Verin
Wesprin
Zorprin

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