

# Importance of nRBC Count in Small Animal Patients

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Nucleated red blood cells (nRBCs) are immature erythrocytes that are usually confined to the bone marrow. An occasional nRBC can be found in healthy dogs and cats and are usually the metarubricyte stage. Rubricytes may be present during certain disease processes. When present, nRBCs are counted as leukocytes with both manual methods and most automated analyzers. With analyzers that provide a differential blood cell count, most will include nRBCs in the lymphocyte category.

Traditionally, the presence of nRBCs required counting the number seen per 100 white blood cells on a differential blood smear. Identification of nucleated red blood cells on a differential blood smear is complicated by the fact that nRBCs appear morphologically similar to mature lymphocytes. Some automated analyzers can identify and count these cells.

When the number of nRBCs is increased, the total white blood cell counts are corrected for this error with the following calculation:

$$\text{Corrected WBC count} = (\text{measured WBC count} \times 100) \div (\text{nRBC} + 100)$$

This correction is not needed when the nRBC count on the differential blood smear is under 5/100WBC as it will have minimal impact on the total WBC count at that level.

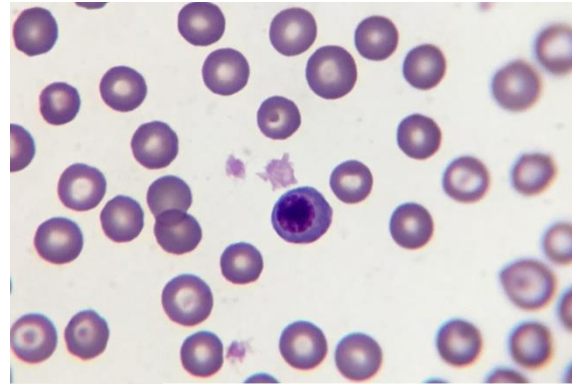
## *Significance of Increased nRBCs*

Increased numbers of nRBCs are seen with regenerative anemia, in conjunction with reticulocytosis. Nucleated red blood cells may also be seen in increased numbers in the presence of inflammatory conditions. Bone marrow insult, such as with sepsis, leukemia, or trauma, is often characterized by increased nRBCs in peripheral blood. Small animal patients with lead poisoning have increased nRBCs and polychromasia in the absence of any anemia. Basophilic stippling may also be seen in these patients. Nucleated red blood cells are recognized as abnormal by splenic macrophages and usually removed from circulation. Conditions that alter splenic function may be characterized by increased nRBCs in peripheral blood. While the exact mechanism is not known, dogs with heatstroke frequently have increased nRBCs in circulation. Very high nRBC counts are associated with greater mortality in dogs with heatstroke. Dogs undergoing chemotherapy may also have significant increases in nRBCs which may mask any potential neutropenia with routine CBC analysis.

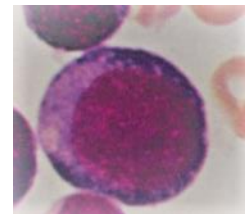
## *Summary*

Enumeration of nucleated red blood cells can provide valuable information in classifying anemia as regenerative or non-regenerative. In addition, a variety of other conditions may be characterized by increases in nRBCs. It is important to verify that automated analysis is properly quantifying these cells.

1. Müller M, Dörfelt R, Hamacher L, Wess G. Association of nucleated red blood cells with mortality in critically ill dogs. *Vet Rec.* 2014 Nov 22;175(20):508
2. <http://eclinpath.com/hematology/morphologic-features/red-blood-cells/nucleated-rbcs/>
3. Aroch I, Segev G, Loeb E, Bruchim Y. Peripheral nucleated red blood cells as a prognostic indicator in heatstroke in dogs. *J Vet Intern Med.* 2009 May-Jun;23(3):544-51
4. Moretti P, Giordano A, Stefanello D, Ferrari R, Castellano S, Paltrinieri S. Nucleated erythrocytes in blood smears of dogs undergoing chemotherapy. *Vet Comp Oncol.* 2017 Mar;15(1):215-225.



Metarubricyte in canine blood



Rubricyte in canine blood