

7 Summary

Anemia in cats: Incidence, differential diagnoses, diagnostic approach and diagnostic value of Coombs' test and erythrocytic osmotic fragility.

Anemia is a common laboratory test result in the cat. A classification of different categories of anemia is essential to ensure the correct prognostical evaluation combined with the appropriate treatment. This study presents an extensive diagnostic approach to 100 feline patients with anemia (hematocrit (hct) below 0,25 l/l) at the Small Animal Clinic, Free University of Berlin. On the basis of those results, different kinds of anemia were classified. In addition to a thorough clinical examination all patients underwent haematological and biochemical blood analysis. In most cases, further tests and examinations were carried out, e.g. a Coombs' test, determination of the osmotic fragility of erythrocytes, testing for feline leukemia virus (FeLV) as well as feline immunodeficiency virus (FIV), radiographic and ultrasonographic, cytological and histopathological examination.

29 % of the cats were anemic because of an anemia of inflammatory/neoplastic disease (AID). 24 % of the cats suffered from hemolytic or blood loss anemia (22 % acute and 2 % chronic blood loss). 9 % of the cats had a nonregenerative anemia due to chronic renal disease (ENR) and another 9 % a non regenerative anemia due to bone marrow disease (INR). 5 % of the cats could not be classified (anemia of unknown origin). In some of the cases, the anemia was caused by more than one pathogenic factor, e.g. in patients with nonregenerative anemia caused by intramedullary disease or in cats with AID, whose increased osmotic fragility of erythrocytes (OF) in addition to hyperbilirubinemia suggested a hemolytic component involved. In these cases, the classification was based on the presumed main cause.

In order to differentiate between regenerative or nonregenerative anemia, the reticulocyte counts were taken into account, but this parameter was not useful for an initial classification. 67 % of the cats diagnosed with hemolysis and 83 % of the cats diagnosed with blood loss anemia showed reticulocyte counts below 40.000/ μ l (within 3 or 4 days after the first examination).

The MCV was useful for distinguishing between acute and chronic blood loss anemia. Two cats with chronic blood loss anemia had the lowest MCV of all patients; 13 of 100 patients had an increased MCV, 8 of them because of autoagglutination of erythrocytes.

The other 5 cats without autoagglutination suffered from non regenerative anemia and had an increased OF, two of these cats were infected with FeLV.

In total 33 cats showed agglutination of erythrocytes in our study: 79% of the cats with hemolytic anemia, 22 % of the cats with INR or ENR, 17 % with AID, 13 % of the cats with blood loss anemia, and two cats with anemia of unknown origin. In a control group of non-anemic cats suffering from different diseases, two patients (14 %) showed agglutination. Erythrocytic agglutination did not occur in a control group of healthy cats. Only three cats suffering from primary immune hemolytic anemia (piHA) and one cat with FeLV associated secondary immune hemolytic anemia (siHA) had a persisting agglutination. Only one patient with a positive Coombs' test result showed no slide-agglutination. Erythrocytic agglutination is not specific for immune mediated hemolytic anemia (IHA), but it occurs in most of the cases.

An useful factor for the distinction between hemorrhage and hemolysis was the plasma protein value. The group of patients with hemolytic anemia showed the highest median value with 71 g/l, and the patients with acute and chronic blood loss anemia had the lowest median value (56 or 45 g/l).

79 % of the cats with hemolytic anemia had a hyperbilirubinemia, an elevated plasma bilirubin was also found in 56 % of the patients with INR, 44 % of the cats with chronic renal disease (ENR), 32 % of the cats with blood loss anemia and 31 % of the patients with AID. Therefore, hyperbilirubinemia in the absence of a hepatopathy is an indication for hemolysis, although it is not pathognomonic.

A Coombs' test was performed in 77 % of the anemic patients, which was positive in 16 % (n=12). Eleven of these cats suffered from immune-mediated hemolytic anemia (IMHA). Two of these eleven cats suffered from FeLV associated siMHA. For the other nine cats neither underlying diseases nor causing factors for the hemolysis were identified, they showed an increased OF, agglutination of erythrocytes and they responded to immunosuppressive treatment. These cats were diagnosed with primary IMHA. In order to evaluate the diagnostic value of the Coombs' test, five healthy cats and nine non anemic cats suffering from different diseases were tested: in all cases the test results were negative. Likewise, the Coombs' test showed negative results for all 18 cats with hemorrhage, all 7 cats with INR, all cats with ENR (4), for 20 of 21 cats with AID, and for all 3 cats with anemia of unknown origin.

Apart from the 11 cats suffering from IMHA, one other patient had a positive Coombs' test result: the cat was classified as having AID and suffered from a hepatopathy.

IgG-antibodies were detected in 67 % of the cats with a positive Coombs' test result, IgM-antibodies in 58 % of those cats and binding of complement could be detected in 33 % of them. Antibodies were detected both in tests at 37°C and 4°C but in three cases a slightly higher antibody titer for IgM was found at 4°C. The Coombs' test is a very useful means of diagnosing IMHA, but it does not help to distinguish between primary and secondary forms.

The mean osmotic fragility of erythrocytes (OF) was determined in 56 healthy and 82 anemic cats. In 95 % of the healthy animals the mean OF ranged from 0.45 % to 0.54 % (median 0.48 %). Of the groups with anemia, those cats with a hemolytic anemia showed the highest results (median 0.72 %). The lowest results were found in two patients suffering from chronic blood loss anemia (median 0.39 %). Results higher than 0.54 % (highest OF result in healthy animals) were found in seven cats (42 %) with blood loss anemia: four patients of the INR group (67 %), seven of the ENR group (78 %) and 21 of the AID group (75 %). The determination of the OF is especially useful in cases with non regenerative forms of hemolytic anemias and chronic blood loss anemia.

In only 10 % of the anemic cats a retrovirus-infection was diagnosed: six cats were FeLV positive, one cat was infected with FeLV and FIV, two cats were FIV positive. These cats were classified in the following categories: two FeLV-positive cats suffered from secondary immune mediated hemolytic anemia (sIMHA); four FeLV positive cats, the one FeLV and FIV positive cat, and one of the FIV positive cats suffered from non regenerative anemia due to bone marrow suppression (INR); one FIV positive cat suffered from acute blood loss anemia (thrombocytopenia); the other FIV positive cat from anemia of inflammatory disease (AID). An infection with FIP was diagnosed in 5 % of the animals: two of them suffered from anemia of chronic disease (AID), three others were classified as having a hemolytic anemia.