

7 SUMMARY

„Anemia of inflammatory disease“ in the cat – a clinical study

Anemia of inflammatory disease (AID) is the most common anemia in humans and animals but has been investigated in the cat only in a few, mainly experimentally studies. The pathogenesis in AID is multifactorial, resulting from decreased iron availability, a decline in erythrocyte survival time and a decreased response to anemia. The aim of this clinical study was to describe the course of AID, laboratory parameters important for the diagnosis and pathogenesis of AID and the therapy of 26 cats with inflammatory diseases (abscess [a] n=13, pyothorax [pt] n=7, pyometra [pyo] n=1, mycobacterial infection n=1, fat necrosis [fn] n=4). Cats with a positive FeLV/FIV test result, with a neoplasia, nephro- or hepatopathy as well as animals with blood loss anemia were excluded from the study. A complete blood cell count, clinical chemistry, serum concentrations of erythropoietin (EPO), iron and ferritin, the total iron binding capacity (TIBC), the acute-phase-proteins α_1 -AGP and haptoglobin, the osmotic fragility (OF) of erythrocytes as well as a direct Coombs' test were performed.

The hct was monitored over 3-51 days (mean 15.5, median 11). Eleven of 26 cats were anemic on presentation, whereas 12 cats developed anemia during hospitalization. Three other cats did not develop anemia; the hematocrit (Hct) of 2 cats decreased within the reference range (pt, fn) and an increase was noted in one cat (a). The anemia was predominantly mild (47.9%) to moderate (39.1%), but in some cases (13%) also severe. The Hct decreased – depending on the timepoint of measurement – from the 2nd to 7th day after hospitalization and decreased further throughout a period of 3-16 days. In 6 cats the Hct values were within the reference range 2-18 days after surgery (a), 18 days after start of the therapy (pt) and 10-19 days after surgery (fn). On the other hand 17 of the cats remained anemic over various timespans: up to 29 days (a), up to 16 days (pt), up to 40 days (pyo) or 51 days (mycobacterial infection) and 15 days (fn). In 95.6% of patients the anemia was mainly normocytic, whereas a constant microcytic anemia was present in one cat (4,4%). A temporary mild macrocytosis occurred in 3 cats (13%). In all patients, anemia was predominantly normochromic with only a few measurements of hypo- or hyperchromic anemia (26.1% and 21.7%). In 73.9% of cases the anemia was non-regenerative, whereas in 6 cats (26.1%) a mild regeneration (43,200-84,450 aggregated reticulocytes/ μ l) was noticed. Leukocytosis (18.9 - $150.0 \times 10^9/l$) was observed in 22 of 26 and a left shift in 12 of 19 patients, however the cats without leukocytosis also developed an AID. The acute-phase-protein α_1 -AGP was elevated in all examined 19 patients over a period of 7 days prior to 14 days after surgery. Haptoglobin however was elevated in 16 of 19 cats and within the reference range in 3 animals 5, 7 and 14 days after beginning of the therapy. Neither the Hct value nor the number of aggregated reticulocytes showed an inverse correlation with the number of leukocytes, the α_1 -AGP or haptoglobin concentration. Conspicuous results were a lowered albumin/globulin-ratio in 92.3% of the patients as well as hypoalbuminemia (84.6%) and hyperglobulinemia (76.9%). These results agree with abnormalities seen in the acute-phase-reaction.

As opposed to documentations on serum iron levels for humans and dogs cats rarely (13%) had lowered serum iron levels. However 47.8% of the cats had levels within the lower third of the reference range. As TIBC was often (39.1%) lowered or within the lower third of the

reference range (47.8%) and was never elevated and the ferritin concentration was predominantly (60.9%) elevated and never lowered, it seems that these parameters are helpful for the diagnosis of the AID and for the differentiation from an iron deficiency anemia. The positive Coombs' test in 2 of 10 examined cats (pt: IgG positive, mycobacterial infection: C3b positive), a mild hyperbilirubinemia in 6 of 26 cats (23.1%) and an elevated OF of erythrocytes in 2 of 17 animals (11.8%) led to the assumption of a shortening of the erythrocyte survival time.

In spite of a mild to moderate anemia, EPO concentrations of 30.8% of the cats were within the reference range and only slightly elevated in 61.5% of the animals. There was no inverse correlation between the EPO concentrations and the parameters of anemia (hct, hemoglobin concentration, number of erythrocytes). Therefore an inadequate EPO production is an important pathomechanism of AID in the cat. Furthermore the bone marrow regeneration response to produced EPO seems to be insufficient, because anemia was non-regenerative in 6 of 8 cats with slightly elevated EPO concentrations. Only one cat (7.7%) had high EPO concentrations and had to be euthanized because of its poor condition. A high EPO, as with AID in humans, may be associated with a negative prognosis.

A specific therapy of the anemia is usually not necessary because AID in humans and dogs is normally mild. In most animals it was possible to resolve the anemia by treating the underlying disease. However, 3 cats needed 2-4 blood transfusions either because of the severity of anemia or for stabilisation before anesthesia.

In this study it was shown that feline anemia of inflammatory disease is usually mild to moderate, non-regenerative and normocytic, normochromic. An inflammation, however, may also result in a severe, transfusion-dependent anemia, so that frequent Hct controls are indicated in feline patients with AID. As in humans the pathogenesis of AID seemed to be multifactorial, due to evidence of a shortened erythrocyte survival time, an iron sequestration and an inadequate production of EPO. To this point in time it has not been studied whether EPO, which is used to treat human AID, might be useful in cats with AID.