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Blood count in dogs with mammary gland carcinoma

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Abstract. Haematological studies were conducted in 19 dogs (8 from small and 8 from medium-size breeds, 15 of which over 8 years of age) with mammary gland carcinoma at different stages of development. Blood samples were collected after a single venipuncture of v. cephalica antebrachii in tubes with EDTA as anticoagulant. Complete blood count parameters: haemoglobin (g/L), haematocrit (%), erythrocytes (T/L), mean corpuscular volume (MCV, fl), mean corpuscular haemoglobin (MCH, pg), mean corpuscular haemoglobin concentration (MCHC, g/L), red cell distribution width (RDW, %), leukocytes (G/L), thrombocytes (G/L) were determined. Differential white blood cell counts were evaluated on blood smears stained with Hemacolor. The results showed anemia with erythropaenia, without significant changes in erythrocyte indices, thrombocytopenia and leukocytosis, and slight variations in differential white blood cell count.

Keywords: dogs, blood test, mammary gland tumours

Introduction

Mammary gland tumours are the commonest neoplasms in female dogs comprising from 2% to 20% of all malignancies. In male dogs, the risk of mammary gland tumor occurrence is under 1%. The share of mammary tumours in bitches is about 52% of all tumours in females, and in 41% to 53% of cases they are malignant (Perez-Alenza et al., 2000). According to different studies, the annual incidence of mammary tumours ranges from 111 per 10 000 dogs (Egenvall et al., 2005) and 205 per 100 000 dogs (Dobson et al., 2002). Spaying of female dogs before the onset of first estrus results in significantly lower prevalence of mammary gland neoplasms (Egenvall et al., 2005).

Secondary changes in blood cells (haematological paraneoplastic syndrome) are among the commonest syndromes seen in oncological patients. The changes are various depending on the types of tumors, the tendencies are inconsistent, although anaemia is the most typical sign in neoplasms (Gould, 2003).

The diagnostics of mammary gland tumors includes a detailed physical examination, routine morphological and blood biochemical analysis for evaluation of the general health status. Radiography and ultrasonography are necessary to exclude the presence of internal organs metastases. If involvement of regional or distant lymph nodes is suspected, fine-needle biopsy is advised (Clemente et al., 2010).

The present investigation is a part from a large-scale research aimed at determination of occurring haematological changes (including red and white blood cells) in some canine malignant neoplasms.

Material and methods

The studies were carried out with 19 dogs referred to the Small Animal Clinic of the Faculty of Veterinary Medicine, Trakia University, Stara Zagora, between 2007 and 2016. Sixteen were from small and medium-size breeds (8 small and 8 medium-sized), and 15 dogs were over 8 years of age. Mammary carcinoma was histopathologically confirmed in all animals.

Blood samples were collected by venipuncture of v. cephalica antebrachii in tubes with EDTA and heparin as anticoagulants. Samples were assayed immediately. Complete blood count parameters: haemoglobin (g/L), haematocrit (%), erythrocytes (T/L), mean corpuscular volume (MCV, fl), mean corpuscular haemoglobin (MCH, pg), mean corpuscular haemoglobin concentration (MCHC, g/L), red cell distribution width (RDW, %), leukocytes (G/L), thrombocytes (G/L) were determined on an automated haematology analyser Mindray BC-2800VET (China). Differential white blood cell counts were evaluated on blood smears stained with Hemacolor® (rapid staining kit, Merck).

The control group comprised 10 clinically healthy dogs from both genders, weighing 8–24 kg, aged 4–11 years. Data were submitted to statistical analysis (Statistica v. 6.1; StatSoft Inc., 2002). Descriptive statistical methods were used to calculate means and standard errors of means (±SEM). Results were considered statistically significantly different at P<0.05.

Results

The results from the CBC analysis in dogs with mammary gland carcinoma are presented in Tables 1 and 2.

The microscopic evaluation of blood smears did not reveal any
Table 1. Changes in red blood cell count at investigated dogs

<table>
<thead>
<tr>
<th>No.</th>
<th>Breed of dogs</th>
<th>Age of dogs (Years)</th>
<th>Hb (g/L)</th>
<th>Er (T/L)</th>
<th>Hc (%)</th>
<th>MCV (fl)</th>
<th>MCH (pg)</th>
<th>MCHC (g/L)</th>
<th>RDW (%)</th>
<th>PLT (G/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Rottweiler</td>
<td>8</td>
<td>97</td>
<td>4.49</td>
<td>28.9</td>
<td>64.5</td>
<td>21.6</td>
<td>335</td>
<td>14.2</td>
<td>228</td>
</tr>
<tr>
<td>2</td>
<td>Samoyed</td>
<td>8</td>
<td>154</td>
<td>6.61</td>
<td>47.0</td>
<td>71.2</td>
<td>23.8</td>
<td>356</td>
<td>17.2</td>
<td>329</td>
</tr>
<tr>
<td>3</td>
<td>Bolognese</td>
<td>12.5</td>
<td>98</td>
<td>9.61</td>
<td>48.6</td>
<td>50.6</td>
<td>10.1</td>
<td>201</td>
<td>18.0</td>
<td>-</td>
</tr>
<tr>
<td>4</td>
<td>Dachshund</td>
<td>12</td>
<td>130</td>
<td>6.03</td>
<td>36.6</td>
<td>60.8</td>
<td>21.6</td>
<td>356</td>
<td>21.0</td>
<td>98</td>
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<tr>
<td>5</td>
<td>Mix breed</td>
<td>8</td>
<td>143</td>
<td>5.27</td>
<td>39.3</td>
<td>63.2</td>
<td>23.1</td>
<td>343</td>
<td>16.1</td>
<td>230</td>
</tr>
<tr>
<td>6</td>
<td>G. Shorthaired Pointer</td>
<td>14</td>
<td>126</td>
<td>4.8</td>
<td>36.8</td>
<td>76.0</td>
<td>20.1</td>
<td>306</td>
<td>14.7</td>
<td>261</td>
</tr>
<tr>
<td>7</td>
<td>Mix breed</td>
<td>12</td>
<td>106</td>
<td>4.5</td>
<td>25.6</td>
<td>62.2</td>
<td>23.0</td>
<td>320</td>
<td>17.6</td>
<td>163</td>
</tr>
<tr>
<td>8</td>
<td>St. Bull Terrier</td>
<td>8.5</td>
<td>112</td>
<td>5.03</td>
<td>36.2</td>
<td>78.0</td>
<td>31.4</td>
<td>342</td>
<td>18.1</td>
<td>178</td>
</tr>
<tr>
<td>9</td>
<td>Bolognese</td>
<td>8.5</td>
<td>96</td>
<td>4.22</td>
<td>28.2</td>
<td>76.0</td>
<td>20.8</td>
<td>310</td>
<td>19.3</td>
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<td>10</td>
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<td>146</td>
<td>5.86</td>
<td>36.2</td>
<td>66.9</td>
<td>29.3</td>
<td>280</td>
<td>13.2</td>
<td>318</td>
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<tr>
<td>11</td>
<td>Mix breed</td>
<td>8</td>
<td>103</td>
<td>5.21</td>
<td>30.8</td>
<td>76.5</td>
<td>26.1</td>
<td>277</td>
<td>16.1</td>
<td>180</td>
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<tr>
<td>12</td>
<td>Cocker Spaniel</td>
<td>7</td>
<td>136</td>
<td>5.28</td>
<td>38.9</td>
<td>66.0</td>
<td>27.0</td>
<td>342</td>
<td>15.8</td>
<td>198</td>
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<tr>
<td>13</td>
<td>G. Shorthaired Pointer</td>
<td>11</td>
<td>129</td>
<td>5.82</td>
<td>42.3</td>
<td>66.1</td>
<td>18.2</td>
<td>266</td>
<td>16.7</td>
<td>212</td>
</tr>
<tr>
<td>14</td>
<td>Yorkshire Terrier</td>
<td>4</td>
<td>78</td>
<td>4.06</td>
<td>36.3</td>
<td>83.0</td>
<td>17.4</td>
<td>286</td>
<td>20.6</td>
<td>118</td>
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<tr>
<td>15</td>
<td>Mix breed</td>
<td>8</td>
<td>86</td>
<td>4.12</td>
<td>22.9</td>
<td>86.1</td>
<td>17.4</td>
<td>305</td>
<td>19.3</td>
<td>144</td>
</tr>
<tr>
<td>16</td>
<td>Bolognese</td>
<td>10</td>
<td>111</td>
<td>5.08</td>
<td>30.6</td>
<td>79.0</td>
<td>20.1</td>
<td>286</td>
<td>13.8</td>
<td>226</td>
</tr>
<tr>
<td>17</td>
<td>G. Shepherd dog</td>
<td>7</td>
<td>67</td>
<td>3.92</td>
<td>23.8</td>
<td>85.0</td>
<td>16.8</td>
<td>248</td>
<td>12.8</td>
<td>103</td>
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<tr>
<td>18</td>
<td>Bolognese</td>
<td>10</td>
<td>138</td>
<td>6.02</td>
<td>38.3</td>
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<td>19</td>
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<td>168</td>
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<td>38.9</td>
<td>68.3</td>
<td>24.1</td>
<td>365</td>
<td>12.5</td>
<td>188</td>
</tr>
<tr>
<td></td>
<td>Mean ±SEM</td>
<td>117.05 ± 5.40 ±</td>
<td>35.06 ± 70.68 ± 21.74 ± 308.73 ± 16.17 ± 184.95 ± 27.13** 1.32** 7.2** 9.39* 4.99* 42.79** 2.91** 78.52**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Control group: Mean ±SEM</td>
<td>174.2 ±23.56  7.44±1.13</td>
<td>52.62±9.38 14.46±302.5</td>
<td>23.56±1.13</td>
<td>9.38±4.06</td>
<td>14.46±3.23</td>
<td>3.23±75.77</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*p<0.05, **p<0.01

significant alterations in the size, shape and haemoglobinisation of erythrocytes.

Mean haematocrit values also tended to decline (p<0.01), and individual values in 36.8% of dogs (n=7) were below the physiological range (as per Merck Hematologic Reference Ranges).

Erythrocyte indices did not undergo substantial changes. Mean corpuscular volume (MCV, fl), mean corpuscular haemoglobin (MCH, pg) and mean corpuscular haemoglobin concentration (MCHC, g/L) varied within narrow limits.

Red cell distribution width (RDW) was higher than 20% only in two of patients (No. 4 and 14).

Total thrombocyte counts were far below normal (p<0.01), and 11 dogs or 57.86% exhibited marked thrombocytopaenia (as per Merck Hematologic Reference Ranges). In dog No. 3, the haematology analyser did not detect any thrombocytes.

Leukocyte counts were markedly increased (p<0.01). Their values varied within a very broad range from leukaemia (No. 16) to hyperleukocytosis (No. 3, 17). In 31.56% of dogs (n=6) total leukocytes were higher than 20 G/L.

The main change on differential white blood cell counts was neutrophilia with or without left shift. Five dogs (26.3%) demonstrated regenerative left shift to metamyelocytes. The counts of neutrophils (band and segmented) and lymphocytes were statistically significantly changed vs healthy controls (p<0.01).

Discussion

The observed changes in the red blood picture (mild hypochromasia, erythrocyte counts close to the lower limit of the range and reduced haematocrit) were indicative for mild anaemia. This is anaemia of chronic disease (ACD) that is usually attributed to reduced erythropoiesis, decreased survival of red blood cells, impaired metabolism of iron, and sometimes is associated with occasional haemorrhages from the tumour mass in some animals (Ogilvie and Moore, 2006). The reduced haematocrit is consequent to marker erythropoiesis.

As the mean values of red blood cell indices (MCV, MCH, MCHC) were within the reference range with MCHC close to the lower limit and the red cell distribution width (RDW) was slightly higher, the anaemia could be interpreted as non-regenerative, normocytic and normochromic, as also described by others (Finora, 2003). This hypothesis is supported by the absence of morphological alterations in erythrocytes.

The development of thrombocytopaenia in cancer patients (animals and humans) is often triggered by the cytostatic drug therapy. On the other hand, thrombocytopaenia has been established in more than one-third of dogs with newly diagnosed neoplasms (Grindem et al., 1994). Our results are very similar to those of the cited study. About 50% of studied animals had low- to medium-grade thrombocytopaenia. It was caused by the combined effect of secondarily reduced thrombocytes production due to direct damage of bone marrow and its lower production capacity (Morrison, 2005). Some autoimmune reactions (immune-mediated thrombocytopaenia - ITP) could also lead to decreased thrombocyte counts (Rozanski et al., 2002).
neoplastic growths. The usual cause of leukocytosis is inflammation and tissue degradation (Vail and Young, 2007). In more than 25% of studied animals, leukocytosis was marked (> 20 G/L) as did neutrophilia (about and over 90%). Although neutrophilia is a common finding in veterinary oncology, the true leukocytosis (due to inflammation and necrosis) and paraneoplastic leukocytosis resulting from the production of specific cytokines could be hardly distinguished. The assay of some tumour-associated tissue factors (GM-CSF, G-CSF) or cytokines (IL-1, IL-6) could indentify properly whether leukocytosis in a given case is true or paraneoplastic (Peeters et al., 2011).

Conclusion

Haematological paraneoplastic alterations are often encountered in different types of neoplasms, including mammary gland carcinoma. Anaemia (hypoproteinaemia with erythropaenia) is outlined as the primary change associated to mammary gland cancer. An important feature is that anaemia accompanying this type of neoplasms is normocytic and normochromic. Leukocytosis and thrombocytopenia are also specific findings in canine mammary gland carcinoma.

Conflict of interest

The authors declare that they have no conflict of interest.

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References


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