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Article

Results of Treatment of Pulmonary Metastatic Disease in Cats With Mammary Carcinoma

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Abstract: Mammary gland cancer (MGC) is one of the most common malignant neoplasms in cats and is frequently associated with metastatic involvement of the lungs. The study included cats with stage III–IV mammary carcinoma that underwent surgical treatment combined with chemotherapy: doxorubicin (1 mg/kg) was administered in the first group, and carboplatin (260 mg/m²) in the second group. The time to onset of clinical signs of metastasis, mean survival time after detection of metastases, and the efficacy of palliative chemotherapy were evaluated. It was established that palliative chemotherapy for metastatic lesions of the lungs and pleura prolonged survival compared to animals receiving only symptomatic therapy; the mean survival time after detection of metastases ranged from 63 to 128 days, with no statistically significant differences between the two drugs. Palliative chemotherapy contributed to improved quality of life; however, the development of new therapeutic strategies, including targeted therapy and the use of early biomarkers of metastasis, remains a relevant objective.

Keywords: mammary gland cancer, metastases, lungs, cats, chemotherapy, doxorubicin, carboplatin, mastectomy, palliative treatment.

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1. Introduction

Mammary gland cancer (MGC) is one of the most common malignant neoplasms in cats, accounting for approximately 17% of all tumors in this animal species [1]. The disease is most often diagnosed in middle-aged and older cats, usually at the age of 10–12 years, although in some cases it may also occur in younger animals. Studies show that the risk of developing mammary gland cancer increases significantly with age. The highest predisposition has been observed in Siamese and domestic shorthair cats.

Most mammary gland tumors in cats are malignant in nature (85–95%) and are characterized by an aggressive clinical course [2]. One of the key features of this disease is the high risk of metastasis, which ranges from 50% to 90%. Metastases most commonly affect the lungs and pleural cavity, which significantly worsens the prognosis of the disease. In addition to the lungs, tumor cells may spread to the regional lymph nodes, liver, kidneys, bones, and other organs. Metastasis occurs mainly through two routes: lymphogenous spread through the lymphatic system and hematogenous spread through the bloodstream.

Metastatic lung involvement is accompanied by pronounced clinical signs, including dyspnea, coughing, anorexia, and progressive weight loss. These symptoms require timely diagnosis and comprehensive treatment [3].

At present, the optimal treatment strategy for cats with pulmonary metastases associated with mammary gland cancer remains a subject of ongoing research. In clinical practice, surgical intervention, such as mastectomy, chemotherapy, and palliative therapy are used. However, surgical treatment is usually not performed at the metastatic stage, since it does not significantly affect the prognosis; therefore, systemic chemotherapy becomes the main treatment approach [4].

Chemotherapy for mammary gland cancer in cats may be used in two forms:

– Adjuvant chemotherapy — postoperative chemotherapy that reduces the risk of metastasis and increases overall survival by more than twofold compared with surgery alone.

– Neoadjuvant chemotherapy — preoperative chemotherapy used in cases of locally advanced tumors to reduce tumor size before surgery.

Doxorubicin and carboplatin are the most commonly used drugs in treatment; however, combined chemotherapy regimens including cyclophosphamide, 5-fluorouracil, methotrexate, and Taxotere remain a promising approach that may increase treatment efficacy [5].

The aim of this study is to evaluate the efficacy of different chemotherapy regimens in cats with pulmonary metastatic lesions associated with mammary gland cancer, as well as to analyze the effect of palliative treatment on patient survival [6].

2. Materials and Methods

The study included cats with a confirmed diagnosis of stage III–IV mammary gland cancer (MGC) that underwent combined treatment. The animals were divided into two groups depending on the chemotherapy regimen.

Before the start of treatment, all cats underwent a comprehensive examination, which included:

– Chest radiography — to detect pulmonary metastatic lesions, assess their extent, and monitor disease progression dynamically.

– Abdominal ultrasound examination — to exclude distant metastasis to the liver, kidneys, spleen, and other organs.

– Clinical and biochemical blood tests — to assess the general condition of the body, leukocyte count, liver enzyme levels (ALT, AST), and renal function, which are critical before chemotherapy.

– Cytological examination of the tumor — performed in cases of accessible tumor nodules to clarify the morphological type of the tumor, its degree of differentiation, and the extent of invasion.

– Aspiration and cytological examination of pleural fluid when effusion was present — to confirm metastatic involvement of the pleura and exclude secondary inflammatory processes.

3. Results and Discussion

Study Groups

1. **Group I** — cats that received surgical treatment (ST) and chemotherapy (CT) with doxorubicin (see Figures 1 and 2).

2. **Group II** — cats that received surgical treatment and chemotherapy with carboplatin [7].

Treatment of cats with pulmonary metastatic lesions associated with mammary gland cancer included a combined approach consisting of systemic chemotherapy and, where possible, surgical intervention [8].

Surgical treatment was performed as unilateral or bilateral mastectomy with lymph node dissection in cases of enlarged regional lymph nodes (see Figures 3 and 4). Removal of the primary tumor focus made it possible to reduce the burden on the body and, in some cases, slow further progression of the disease [9]. However, surgery did not

применялась у животных с обширным метастатическим поражением лёгких.

Figure 1. Administration of doxorubicin solution via an infusion pump

– **Chemotherapy** was the main treatment method in cases of metastasis. The drugs were administered by intravenous drip infusion, diluted in 50 ml of physiological saline, at 21-day intervals [10].

– **– Group I** — doxorubicin at a dose of 1 mg/kg, 4–5 courses.

– **– Group II** — carboplatin at a dose of **260 mg/m²**, 4–5 courses.

Figure 3. Drugs used in chemotherapy of cats with pulmonary metastatic lesions: doxorubicin on the left and carboplatin on the right

– **Symptomatic therapy** was prescribed during the intervals between chemotherapy courses and included:

– **– Antiemetic drugs** such as maropitant and ondansetron — to control nausea [11].

– **– Hepatoprotective and nephroprotective agents** — to minimize the toxic effects of chemotherapeutic drugs.

– **– Corticosteroids** — to reduce the inflammatory response and tissue edema [12].

– **Thoracocentesis** — performed in cases of pleural effusion to improve breathing (see Figure 5).

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Figure 3. Unilateral mastectomy

The treatment outcomes were evaluated based on the following criteria:

– **Life expectancy after the detection of metastases.**

– **Time to the development of pronounced clinical signs of metastasis**, including progressive dyspnea and severe weight loss.

– **Tumor response to chemotherapy**, assessed by the dynamics of changes observed on radiographic images.

– – **General condition of the animals** — assessment of improvement or deterioration in quality of life after treatment.

Figure 4. Bilateral mastectomy

As the disease progressed, cats developed the main clinical signs of metastatic involvement of the lungs and pleura:

– **Dyspnea** — respiratory rate (RR) ≥30 breaths per minute at rest or during sleep.

– **Coughing** of varying intensity.

– **Fluid accumulation in the pleural cavities**, known as hydrothorax (see Figure 6).

– **Decreased appetite and refusal to eat.**

– **Progressive weight loss.**

The diagnosis was confirmed by chest radiography (see Figure 7), which made it possible to detect metastatic lesions of the lung tissue, as well as by cytological examination of pleural effusion after thoracocentesis, which was necessary to clarify the nature of the lesion and exclude infectious and inflammatory processes [13].

Figure 5. Thoracocentesis

The results of the study showed that palliative chemotherapy is the main treatment method for cats with pulmonary metastatic lesions associated with mammary gland cancer, since surgical intervention at this stage is not advisable. In the present analysis, doxorubicin and carboplatin were used, as they are among the most commonly applied cytostatic drugs in veterinary oncology. Both drugs demonstrated comparable efficacy in

increasing the life expectancy of the animals, which is consistent with the findings of other studies [14].

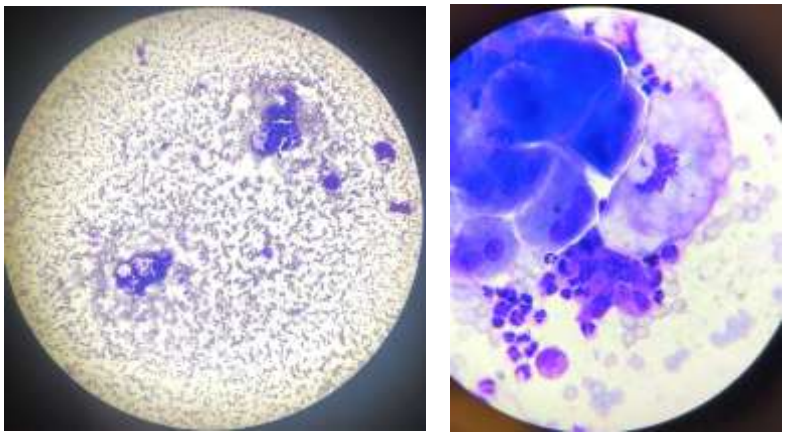

Figure 6. Cytological picture of pleural effusion in metastatic involvement of the lungs and pleura in cats

The literature indicates that pulmonary metastatic involvement is the most common type of dissemination of the tumor process in cats with mammary gland cancer. According to various sources, the risk of metastasis ranges from 50% to 90%, and the average life expectancy of animals after the detection of metastases without treatment varies from 1 to 3 months. In our study, combined treatment increased the average life expectancy to 63–128 days, confirming the effectiveness of systemic chemotherapy in prolonging the survival of animals.

Previously published studies confirm that adjuvant chemotherapy after mastectomy can reduce the risk of distant metastasis and increase overall survival by more than twofold. However, at advanced stages, when the tumor process has already spread to the lungs, surgical treatment does not provide a significant effect, which is consistent with our findings. In such cases, the main goal of therapy is to slow disease progression and improve quality of life..

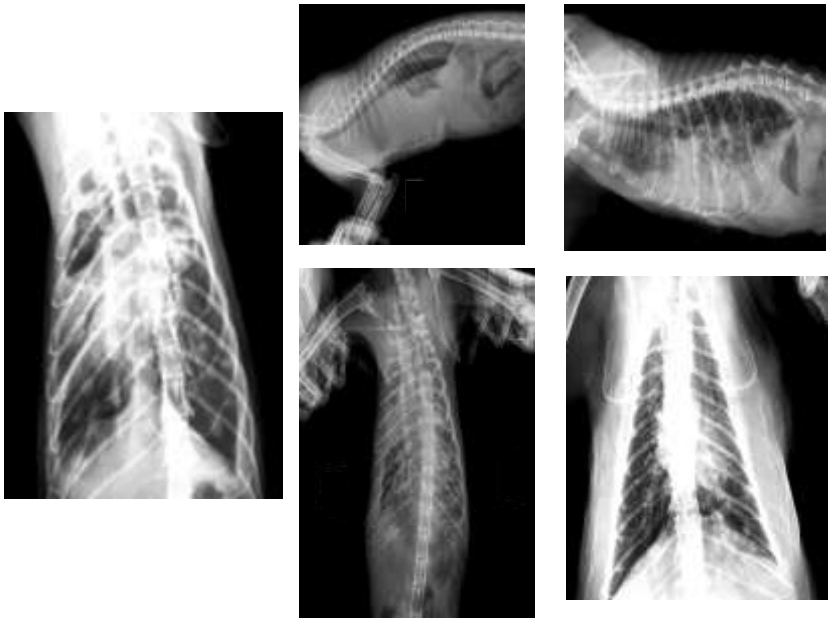

Figure 5. Metastatic lung involvement with and without pleural effusion

Сравнение с другими исследованиями показывает, что комбинированные схемы химиотерапии (например, доксорубицин + циклофосфамид, карбоплатин + 5-

фторурацил) могут быть более эффективными за счёт синергетического воздействия цитостатиков [15]. Однако в данном Comparison with other studies shows that combined chemotherapy regimens, such as doxorubicin plus cyclophosphamide or carboplatin plus 5-fluorouracil, may be more effective due to the synergistic effects of cytostatic drugs. However, in the present study, monotherapeutic regimens were used, which was determined by practical feasibility and lower toxicity for the patients. Further studies may focus on evaluating the efficacy of combined chemotherapy regimens in cats with metastatic mammary gland cancer.

In addition, symptomatic therapy plays an important role in palliative treatment, including thoracocentesis in cases of pleural effusion, supportive treatment of the liver and kidneys, and antiemetic drugs. The use of these measures made it possible to significantly improve the quality of life of animals even at advanced stages of the disease.

Thus, the conducted study confirms that palliative chemotherapy using doxorubicin and carboplatin prolongs the survival of animals and improves their general condition. However, considering the availability of other chemotherapy regimens, a promising direction is the study of combined protocols including additional cytostatic agents, as well as the search for new biomarkers for the early detection of pulmonary metastatic lesions in cats with mammary gland cancer.

4. Conclusion

Pulmonary metastatic involvement in cats with mammary gland cancer remains a serious problem in veterinary oncology, requiring a comprehensive approach to diagnosis and treatment. The conducted study showed that even at advanced stages of the disease, combined treatment can improve the quality of life of animals and increase their life expectancy. The obtained data indicate the need for further development of chemotherapeutic protocols and the search for new therapeutic solutions.

Based on the conducted study, the following conclusions can be drawn:

1. **Palliative chemotherapy is the main treatment method** for cats with pulmonary metastatic lesions associated with mammary gland cancer, since surgical intervention is not performed at this stage of the disease. Chemotherapy contributes to increased life expectancy and improvement of the general condition of animals, making it possible to control disease symptoms and reduce the severity of clinical manifestations compared with symptomatic treatment alone.
2. **The average life expectancy of cats after the detection of metastases ranged from 63 to 128 days**, with no significant differences observed between the groups treated with doxorubicin or carboplatin. This indicates the comparable efficacy of these chemotherapeutic agents within the framework of palliative therapy.
3. **The main factors affecting the rate of development of pulmonary metastatic lesions** include the stage of the disease, the degree of tumor differentiation, and the presence of regional lymph node involvement. These data allow for a more accurate prognosis of the disease course and adjustment of treatment regimens.
4. **Further studies should focus on the development of new treatment methods**, including targeted therapy, immunotherapy, and personalized chemotherapy regimens, as well as on the search for early biomarkers of metastasis, which would improve disease diagnosis and prognosis.

The results of the present study confirm the importance of a comprehensive approach to the treatment of pulmonary metastatic lesions in cats with mammary gland cancer and emphasize the need for further investigation of effective therapeutic strategies in veterinary oncology.

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