

Exploration of Diagnostic and Therapeutic Strategies for Feline Cutaneous Mast Cell Tumors in Cats

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Abstract: As a common and hazardous malignant tumor, feline cutaneous mast cell tumors occur most frequently in older cats with diverse clinical symptoms, which pose a challenge for diagnosis and treatment. This article provides a comprehensive analysis of the pathogenesis, diagnostic methods, treatment strategies, and prognosis and follow-up of feline cutaneous mast cell tumors, aiming to provide clinicians with a more comprehensive and systematic approach to understanding and managing this disease, in order to improve the survival rate of affected cats.

Keywords: Feline cutaneous mast cell tumors; Diagnosis; Treatment; Prognosis

Introduction

As one of the common pets, cats are highly susceptible to various health problems during their life cycle, and the appearance of feline cutaneous mast cell tumors poses a threat to their health and survival. It usually develops in the skin or subcutaneous tissues and manifests as localized lumps, ulcers, bleeding and other symptoms, which bring pain and discomfort to cat life. In clinical practice, the diagnosis and treatment of cutaneous mast cell tumors in cats is challenging^[1]. Clinicians need to accurately determine the nature and extent of the lesion, choose appropriate treatment options, and pay attention to the prognosis and follow-up of the affected cat.

1. Pathogenesis of Feline Cutaneous Mast Cell Tumors

The pathogenesis of cutaneous mast cell tumors in cats is more complex, and at present the medical community has not yet elucidated the pathogenesis perfectly, and it is generally believed that the appearance of cell tumors is affected by the following factors:

1.1 Genetic Factors

Studies have shown that some specific gene mutations may be associated with the occurrence of mast cell tumors, as gene mutations lead to abnormal cell proliferation and differentiation, thus forming tumor tissue. Also, inherited diseases or genetic susceptibility factors may increase the risk of mast



cell tumors in cats ^[2].

1.2 Environmental Factors

Typically, environmental factors such as excessive exposure to sunlight, exposure to harmful chemicals, and poor nutrition may affect the skin health of cats and increase the risk of feline cutaneous mast cell tumors. Especially in light-rich environments, skin damage by ultraviolet rays may lead to cellular DNA damage and mutation, thus inducing the development of tumors.

1.3 Immune Regulation

The immune system is an important line of defense for the body against disease, and dysregulation of immune function may lead to the escape and growth of tumor cells. And immune-related factors, such as inflammatory response, the use of immunosuppressants, etc., may have an impact on the process of tumor development in cats.

2. Diagnostic Methods of Cutaneous Mast Cell Tumors in Cats

2.1 Clinical Signs

Common clinical symptoms of feline cutaneous mast cell tumors include skin lumps, tumor ulcers, bleeding, pain, itching, etc., which may cause discomfort and affect the quality of life of affected cats. First of all, skin lumps are the ones that usually grow on the skin surface or subcutaneous tissues, with hard texture and different sizes, sometimes accompanied by erythema or ulcers on the skin surface. Cat owners who find the presence of lumps during daily petting should visit the clinic for further examination. Secondly, when the tumor grows to a certain extent, the local tissues are compressed, ischemic necrosis, and ulcers are easily formed. The surface of the ulcers may have ooze or necrotic tissues, which is highly susceptible to infection and pain, and affects the normal life of the cat. Finally, feline cutaneous mast cell tumors may be accompanied by bleeding, pain and itching^[3]. Bleeding is commonly found on the surface of the ulcer or inside the tumor, and pain and itching may be caused by the tumor's irritation of the nerves of the surrounding tissues. The presence of the above symptoms can affect the cat's behavior and mood, requiring prompt diagnosis and treatment.

2.2 Imaging Examination

As a commonly used diagnostic and therapeutic tool for feline cutaneous mast cell tumors, imaging examination

can help physicians understand the location, size, morphology and invasive range of the tumor, and provide an important basis for the development of treatment plans. Commonly used imaging methods include: (1) X-ray photography, as a simple and rapid imaging method, X-ray photography is suitable for preliminary understanding of the general situation of feline cutaneous mast cell tumors. The location, density and boundary of the tumor can be observed through X-ray film, and the benign or malignant nature of the tumor can be preliminarily judged. However, X-ray photography has a limited understanding of the tissue structure and internal condition of the tumor, and should be combined with other imaging examinations for comprehensive analysis according to the actual diagnosis and treatment. (2) Ultrasonography, as a non-invasive, radiation-free imaging method, ultrasonography is of great value in the diagnosis of feline cutaneous mast cell tumors^[4]. Ultrasound can clearly show the internal structure of the tumor, blood flow and the relationship with the surrounding tissues, which helps to assess the nature of the tumor and the degree of invasion. Ultrasound can be used to help doctors accurately formulate treatment plans and improve the success rate of surgery and the prognosis of patients. (3) CT and MRI examinations can provide more detailed information about feline cutaneous mast cell tumors, of which CT can show the three-dimensional structure of the tumor and its relationship with the surrounding tissues, while MRI can provide clearer soft tissue contrast to help doctors more accurately assess the extent of the tumor and the depth of invasion, and subsequently support the development of surgical plans and assessment of treatment effects.

2.3 Cytologic Examination

Cytological examination is mainly to analyze the morphological characteristics and chromosomal structure of tumor cells to help doctors clarify the nature and type of lesions. In the examination of feline cutaneous mast cell tumors, the main cytological examination tools include:

Cytological smear examination, which is a simple and rapid method suitable for preliminary understanding of the cytological characteristics of feline cutaneous mast cell tumors. Before diagnosis, cell samples need to be scraped from the surface of the tumor, and cell morphology, size, nucleoplasmic

ratio and other characteristics can be observed under the microscope after making a smear, which can initially determine the benign or malignant nature of the tumor^[5]. It should be noted that cytology smear examination is subject to the limitations of sample acquisition, and should be combined with other examination methods for comprehensive analysis as appropriate.

Cytology puncture biopsy, as a relatively accurate cytological examination method, can obtain richer cytological information. Tumor tissue samples are collected by puncture, and cytology specimens are stained and microscopically observed after preparation, which can clarify the tissue origin, cell type and degree of heterogeneity of the tumor, and help to confirm the diagnosis and assess the aggressiveness of the tumor.

Cytology immunohistochemistry, as one of the auxiliary cytological examination methods, mainly detects the expression of specific protein molecules on the surface or inside of tumor cells, which can effectively distinguish different types of tumors. In the diagnosis of feline cutaneous mast cell tumors, cytology immunohistochemistry can help doctors clarify the origin and nature of the tumor, and provide a reference basis for the selection of treatment options.

Pathological tissue biopsy is one of the gold standards for the diagnosis of feline cutaneous mast cell tumors. Through detailed analysis of the morphological and immunohistochemical features of the tumor tissue specimens, the type, grade and biological behavior of the tumors can be clarified, which can provide an important basis for the development of the therapeutic regimen and the assessment of prognosis. Among them, tissue biopsy is a key step in obtaining tumor tissue specimens, which can be obtained by surgical excision, puncture or biopsy sampling. After obtaining the specimen, following the treatment of tissue fixation, embedding and section staining, the morphological characteristics of tumor cells, karyoplasmic ratio and karyokinesis index can be observed through the microscope, which can clarify the source of tumor tissues and the degree of anisotropy. Immunohistochemical staining, on the other hand, detects the expression of specific protein molecules on the surface or inside of tumor cells, which can help distinguish different types of tumors and assess the aggressiveness and prognosis of tumors.

In the diagnosis of feline cutaneous mast cell tumors, immunohistochemical staining can detect mast cell markers such as CD117, CD34, etc., which can help to clarify the diagnosis and differential diagnosis, and guide the choice of treatment options.

3. Treatment Strategies for Feline Cutaneous Mast Cell Tumors

3.1 Surgical Treatment

As one of the main treatments for feline cutaneous mast cell tumors, surgical treatment mainly involves the surgical removal of tumor tissues to achieve the goal of eradicating or alleviating symptoms. The surgical treatment plan and effect are affected by a variety of factors, specifically involving the location, size, aggressiveness of the tumor and the overall health of the cat. Prior to surgical treatment, the surgeon needs to carry out a comprehensive pre-operative assessment, including imaging, cytology and pathological tissue biopsy to determine the nature and extent of the tumor and to provide a basis for the development of the surgical plan. For smaller and localized feline cutaneous mast cell tumors, local excision can be used to enhance the therapeutic effect; while for larger or more aggressive tumors, adjuvant measures such as wide excision or radiation therapy are required. When surgically removing feline cutaneous mast cell tumors, the surgeon needs to pay attention to protecting the surrounding normal tissues and removing the tumor as completely as possible while maintaining functional and cosmetic integrity. During surgery, care should be taken to avoid rupture and spread of the tumor, so as not to affect the surgical outcome and prognosis. Postoperative care and observation of the cat is strengthened, and measures such as wound healing status, pain management, and infection prevention are implemented.

3.2 Chemotherapy

During the treatment of feline cutaneous mast cell tumors, chemotherapy is mainly used to inhibit the growth and proliferation of tumor cells with the help of chemical drugs to achieve the purpose of reducing symptoms, prolonging survival time or improving quality of life. Chemotherapy can be used as an auxiliary treatment in the treatment of feline cutaneous mast cell tumors, which is mostly used for the auxiliary treatment after surgery or the control of advanced

disease. When selecting chemotherapeutic agents, a comprehensive evaluation is required in conjunction with the analysis of factors such as the cat's age, health status, tumor type and grading. For example, with the help of drugs such as Adriamycin, Cyclophosphamide, Vincristine, etc., the growth and division of tumor cells are inhibited through different mechanisms, further enhancing the effect of killing tumor cells. When chemotherapy is used to treat feline cutaneous mast cell tumors, the cat's physical condition and drug response need to be closely monitored. As chemotherapeutic drugs may have a certain degree of toxic side effects on normal cells, attention needs to be paid to dose control, regular monitoring of blood indexes and liver and kidney functions, etc., as well as timely management of adverse drug reactions during the treatment. In addition, during chemotherapy treatment, cat owners need to cooperate with the doctor's treatment plan, including reasonable diet, maintaining good living habits and avoiding infection.

3.3 Radiotherapy

As one of the main treatment means, radiotherapy mainly uses high-energy radiation to kill tumor cells to achieve the therapeutic purpose. Radiotherapy can be used for tumors that are incompletely or inaccessibly removed by surgery, cases of locally advanced recurrence, or as a preoperative or postoperative auxiliary treatment. Before radiotherapy treatment, doctors need to conduct a comprehensive preoperative assessment, including determining the location, size, depth of the tumor and the involvement of surrounding tissues. Based on the evaluation results, an individualized radiotherapy treatment plan is formulated, including the radiotherapy dose, irradiation mode, number of irradiations and duration of treatment. Radiotherapy can be performed by traditional external beam irradiation or internal radiation source irradiation. Doctors need to closely monitor the cat's radiotherapy response and side effects during radiotherapy treatment. Radiotherapy may cause a certain degree of damage to normal tissues, resulting in adverse reactions such as radiation dermatitis, digestive reactions, bone marrow suppression and so on. Therefore, attention needs to be paid to adjusting the irradiation program, controlling the dose, and dealing with radiotherapy-related adverse reactions in a timely manner during treatment.

4. Prognosis and Follow-up of Feline Cutaneous Mast Cell Tumors

4.1 Complications and Recurrence Prevention

Feline cutaneous mast cell tumors are very prone to complications during treatment, and the disease has a higher chance of recurrence. In view of this, the following measures can be taken to prevent complications: (1) Skin infection. After surgical removal of feline cutaneous mast cell tumors, poor wound healing or infection is a common complication. Regular dressing changes, keeping the wound clean and dry, and avoiding cat licking are needed to prevent skin infections. (2) Radiotherapy-related complications. Radiotherapy may cause skin reactions, digestive reactions, bone marrow suppression and other adverse reactions. Doctors need to adjust the radiotherapy program according to the specific conditions of the cat, and at the same time, closely monitor the cat's physical reaction during the treatment process, so as to promptly deal with related complications.

In order to avoid recurrence of the cell tumor, attention should be paid to the following after treatment: (1) Regular review. Cats need to be regularly rechecked after completion of treatment, including imaging tests, blood tests, physical examination, and so on. (2) Dietary management. Good dietary management helps to maintain the cat's health, enhance immunity and reduce the risk of disease recurrence. Avoid feeding too much high-sugar and high-fat food, and maintaining an appropriate body weight is an important measure to prevent recurrence. (3) Living environment management. That is, focusing on maintaining a clean and comfortable living environment for cats and avoiding exposure to harmful substances can help reduce the risk of disease recurrence.

4.2 Follow-up Strategy

In order to comprehensively monitor the progress of the disease in affected cats, and to assess the treatment effect and effectively prevent complications, it is necessary to increase the implementation of follow-up work. For the control of the frequency of follow-up, it should be noted that after the initial treatment, the cat needs to be closely followed up, which can be controlled every 1-3 months. As the disease stabilizes, the frequency of follow-up visits can be gradually extended to every 3-6 months, until annual follow-up

visits. The frequency of follow-up visits will also be adjusted according to the specific conditions of the cat and the treatment program, which needs to be agreed upon by the doctor, the cat owner and the veterinarian. The follow-up visit involves regular checking of blood indicators, including routine blood tests, liver and kidney functions, tumor markers, etc., to monitor the cat's physical condition and treatment effect; and regular comprehensive physical examination, including palpation, lymph node examination, etc., to detect signs of disease recurrence or complications.

Conclusion

In summary, thanks to the continuous innovation and upgrading of veterinary treatment techniques, more technical tools are being used in the diagnosis and treatment of feline cutaneous mast cell tumors. In view of this, it is necessary to improve the diagnostic accuracy of feline cutaneous mast cell tumors with the help of imaging and cytology on the basis of clarifying the pathogenesis of the cell tumors, and to improve the therapeutic effect through the comprehensive application of surgical treatment, chemotherapy, radiotherapy, etc., and to improve the therapeutic effect and quality of life of cats by combining with the effective implementation of

the prognosis and follow-up.

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