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Diagnosis and Treatment of a Case of Maxillary Cleft in a Cat Associated with Pulmonary Emphysema

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Abstract. Maxillary cleft in cats often occurs due to high-altitude falls, resulting in trauma and pulmonary emphysema. Clinically, it is characterized by oral and nasal bleeding and is classified into congenital and acquired types, with its etiology being related to husbandry practices. This paper presents a case of maxillary cleft in a cat associated with pulmonary emphysema. After initial symptom observation and inquiry, a definitive diagnosis was made through clinical examination, laboratory tests, and X-ray imaging. Treatment involving medication and surgery was administered, followed by an evaluation of its effectiveness. Given the limited literature on this condition and its increasing incidence, this case contributes to the guidance of diagnosis and treatment for cats with maxillary cleft associated with pneumothorax.

Keywords: maxillary cleft in cats, pulmonary emphysema, diagnosis, treatment.

1. Introduction

Maxillary cleft in cats refers to the presence of a fissure in the upper palate, causing food to flow back into the nasal cavity during eating, leading to symptoms such as sneezing and discomfort. In severe cases, it can result in aspiration pneumonia. This condition can be categorized into congenital and acquired forms. Congenital maxillary clefts occur due to incomplete development of the upper palate or trauma during birth [1]. Acquired maxillary clefts are primarily caused by external traumas, often involving high-impact forces, such as falls from great heights or accidents. Clinical observations have indicated that cats are more prone to maxillary clefts compared to dogs.

Severe maxillary clefts can lead to the entry of a significant amount of air into the chest cavity, compressing the lungs and heart, resulting in respiratory distress and loss of appetite. Surgical intervention is typically required, as delayed treatment is associated with a high mortality rate [2].

This paper presents a case of maxillary cleft in a cat associated with pneumothorax, elaborating on the pathogenesis, clinical symptoms, diagnostic methods, surgical treatment, and postoperative care. It aims to provide clinical veterinarians with a better understanding of the management and preventive measures for maxillary clefts in cats [3].

2. Case Presentation

The cat, named "Duo Duo," is a three-year-old female, weighing 3.7 kg, and has not been spayed. She is usually active but presented with intermittent oral and nasal bleeding, prompting an inquiry. The cat's

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owner had left a window open, and Duo Duo fell from the fourth floor, experiencing a significant impact that resulted in a fractured maxilla.

2.1. Clinical Examination

Upon examination, the cat had a body temperature of 38.6°C, a pulse rate of 180 beats/min, and mild dehydration (3%). Her body condition score was 5/9, indicating mild emaciation. She displayed poor mental status and slight restlessness. During the inquiry, it was noted that Duo Duo was allowed to roam freely and had been exhibiting signs of estrus over the past two weeks.

Upon palpation, the cat exhibited chest wall tension, but no significant reactions were observed upon pressing other parts of her body. Her overall physical condition was poor. Visual examination revealed that she preferred lying down, had slightly pale mucous membranes, no apparent changes in tongue coloration, rapid breathing, and an open mouth that revealed a fractured maxilla (see Figure 1).

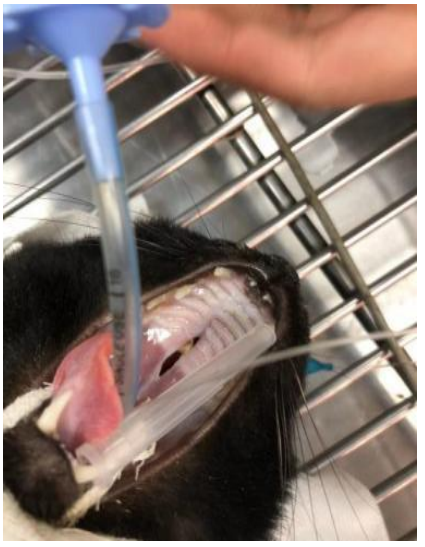

Figure 1. Oral examination results.

2.2. Laboratory Examination

2.2.1. Complete Blood Count (CBC) Analysis. The results of the complete blood count (CBC) analysis for the afflicted cat are presented in Table 1. Based on the data in Table 1, several clinical findings can be derived. Elevated white blood cell count suggests a possible mild inflammation due to stress [4]. An increase in mean red blood cell volume and a decrease in hemoglobin levels clinically indicate acute bleeding and anemia in the cat. All other parameters fall within the normal range.

Table 1. Complete Blood Count (CBC) Analysis Results.

Blood Parameter and Units	Results	Cat Reference Range	Clinical Significance
White Blood Cells (×10^9/L)	6.5↑	5.5-19.5	Elevated
Red Blood Cells (×10^9/L)	6.94	4.6.0-10.0	Normal
Hemoglobin (g/L)	71↓	93-153	Low
Hematocrit (%)	29.2	28-49	Normal
Mean Red Blood Cell Volume (fL)	58.2↑	39-52	Elevated
Red Cell Distribution Width SD (fL)	56.3	47-62.7	Normal
Red Cell Distribution Width CV (%)	16.3	14-18	Normal
Platelet Count (×10^9/L)	424	100-514	Normal

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Table 1. (continued).

Mean Platelet Volume (fL)	7.6	5.0-11.8	Normal
Platelet Distribution Width (%)	15.4	0.1-30	Normal
Lymphocytes (×10^9/L)	8.9	0.8-7	Normal
Monocytes (×10^9/L)	0.5	0.1-1.9	Normal
Granulocytes (×10^9/L)	8.9	2.1-15	Normal

Note: ↓ indicates values below the reference range, ↑ indicates values above the reference range.

2.2.2. Blood Biochemistry Analysis. The results of the blood biochemistry analysis for the afflicted cat are presented in Table 2. Based on the data in Table 2, several clinical findings can be derived. Elevated alanine aminotransferase (ALT) levels indicate liver damage. The decreased urea to creatinine ratio suggests dehydration. Elevated blood glucose levels may be due to discomfort or stress. All other biochemical parameters fall within the normal range.

Table 2. Blood Biochemistry Analysis Results.

Test Parameter	Test Results	Reference Range	Organ Implication
Albumin (ALB)	27.3g/L	22-44	Liver
Total Protein (TP)	56.8g/L	57-89	Systemic
Globulin (GLOB)	29.5g/L	23-52	Liver Function
Albumin/Globulin Ratio (A/G)	0.94		Liver Function
Total Bilirubin (TB)	1.6umol/L	0-15	Liver Function
Gamma-Glutamyl Transferase (GGT)	5U/L	0-12	Liver Function
Aspartate Aminotransferase (AST)	21U/L	0-448	Liver Function
Alanine Aminotransferase (ALT)	224U/L↑	5-130	Liver Function
Alkaline Phosphatase (ALP)	65U/L	14-111	Liver
Total Bile Acids (TBA)	3.31umol/L	0-9	Liver, Pancreas
Amylase (AMY)	674U/L	500-1500	Pancreas
Lipase (LPS)	23U/L	0-40	Pancreas
Lactate Dehydrogenase (LDH)	271U/L	0-798	Myocardium, Liver
Creatine Kinase (CK)	104U/L	0-559	Myocardium
Creatinine (Crea)	79umol/L↓	80-180	Kidneys
Uric Acid (UA)	11.46umol/L	0-60	Kidneys
Blood Urea Nitrogen (BUN)	2.26mmol/L	1.76-3.28	Kidneys
Urea to Creatinine Ratio (U/C)	14.9↓	17.5-21.9	Kidneys
Blood Glucose (GLU)	168mmol/L↑	4.11-8.83	Systemic
Total Cholesterol (TC)	2.26mmol/L	1.68-5.81	Liver, Kidneys
Triglycerides (TG)	0.20mmol/L	0-1.13	Kidneys
Total Carbon Dioxide (tCO2)	17.1mmol/L	13-25	Kidneys
Calcium (Ca)	1.22mmol/L	1.98-2.83	Kidneys
Inorganic Phosphate (PHOS)	1.04mmol/L	1-2.42	Kidneys

Note: ↑ indicates values above the reference range, ↓ indicates values below the reference range.

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2.2.3. Cat Serum Amyloid A (SAA) Examination Results. The results of the cat serum amyloid A (SAA) examination for the afflicted cat are presented in Table 3. Based on the data in Table 3, it can be inferred that there is no inflammation within the cat's body. Consequently, it is deduced that there has been no bacterial infection, as the SAA levels remain within the normal range.

Table 3. Cat Serum Amyloid A (SAA).

Serial Number	Abbreviation	Parameter	Result	Units	Reference Range (for reference only)	Clinical Interpretation
1	fSAA	Cat Serum Amyloid A	6.1	mg/L	Cat: 0-8 mg/L	Cat: 0-8 mg/L 8-40 mg/L: Elevated or mild inflammation >40 mg/L: Significant inflammation

2.3. Radiographic Examination

Through a lateral abdominal X-ray examination of the afflicted cat (see Figure 2), the following findings were observed: both lung patterns were clear and exhibited normal orientations. The lung transparency was symmetrical, and there were no signs of pulmonary parenchymal lesions. The cardiac silhouette appeared reduced in size, with an increased gap between the right cardiac border and the sternum, indicative of pneumothorax.

Figure 2. A lateral abdominal X-ray examination of the afflicted cat.

2.4. Diagnosis

Based on the clinical, laboratory, and radiographic examinations conducted on the afflicted cat, a preliminary diagnosis of maxillary cleft in the cat associated with pulmonary emphysema was established. Considering factors such as the cat's age and mental status, and following communication with the owner, the decision was made to proceed with surgical treatment.

3. Treatment

3.1. Pneumothorax Treatment

Pneumothorax treatment typically involves conventional methods, including placing the cat in an oxygen chamber to maintain calmness, providing adequate oxygen supply to reduce lung activity, prevent pneumothorax recurrence, and ensure oxygen absorption and lung expansion [5].

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3.2. Liver Damage Repair

As there was minor liver bleeding, medication was administered orally to address the issue. The cat received hepatic tonic (1.5 ml/day) for blood supplementation.

3.3. Maxillary Cleft Surgical Repair

Anesthesia and Preparation:

The cat was fasted for 8 hours before surgery, with a 4-hour water restriction.

Medication was administered preoperatively, including a subcutaneous injection of hemostatic sensitivity (0.8 ml) and intramuscular injection of Tolfedine (0.4 ml). A venous access line was established, and intravenous infusion of propofol at 5 mg/kg was slowly administered to reach intubation standards. After achieving intubation, an oral speculum was used to open the mouth, and intubation was rapidly performed. Inhalation anesthesia was maintained using isoflurane, with controlled positive pressure assistance for respiration. The cat was positioned in dorsal recumbency, with the surgical table temperature maintained at 28°C.

Electrocardiographic monitoring, Doppler blood pressure measurement, and body temperature measurement were established to monitor physiological parameters.

Cleaning and Disinfection:

Cleaning was performed using physiologic saline containing ampicillin (100 ml of physiologic saline with 1 gram of ampicillin). Cotton balls were used to clean the area. Care was taken to avoid flushing, as it could lead to water backflow into the trachea, potentially causing pneumonia. In such cases, gauze was inserted into the throat to absorb excess moisture [6].

3.4. Surgical Procedure

A 3.0 absorbable suture was chosen for nodular or continuous suturing along the edges of the wound. Care was taken to maintain suture density, ensuring tight and complete closure. In cases of bleeding with rapid clotting during surgery, forceps were immediately used to remove the clot or gauze was applied to stop bleeding and prevent blood from flowing into the trachea. The wound was disinfected with iodine tincture (see Figure 3).

Figure 3. The wound with iodine tincture.

4. Postoperative Care

During the treatment process, adjustments were made based on various indicators, typically focusing on correcting acid-base balance, liver protection, and infection control. The prescription included 0.9% sodium chloride + cefuroxime, 0.9% sodium chloride + marbofloxacin, 5% glucose + aminocaproic acid, 0.9% sodium chloride + water-soluble vitamins, and lactated Ringer's solution. Intravenous administration was performed daily according to the above prescription. Oral administration of Danofloxacin was given one tablet per day for one week. Antibacterial spray was administered twice daily until wound healing.

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Food and water intake was allowed three days post-surgery, with a gradual transition to a soft diet between days four and seven. Hard foods were strictly prohibited during this period. On the eighth day, wound inspection was conducted, and the sutures were removed upon complete healing.

5. Discussion and Conclusion

The primary causes of maxillary cleft in cats are as follows:

Genetic Factors: Genetic factors, including recessive genes or irregular dominant genes, play a significant role in the occurrence of maxillary cleft in cats. Research has shown that methylenetetrahydrofolate reductase plays a crucial role in the activation of folate, and certain cat breeds with short skulls, such as Persian cats, Maine Coons, and Garfield cats, are more susceptible to this condition, with Persian cats being the most prone [7].

Nutritional Factors: Nutritional factors are another major cause of maxillary cleft in cats. Congenital clefts are often the result of incomplete closure of the two palatal bones during embryonic development. Studies abroad have demonstrated that administering folate supplements during days 25-28 of feline pregnancy can lead to this condition. The most critical period for fetal palatal development and closure is between days 25-28 of feline pregnancy. Therefore, nutritional factors, including the health of the mother cat and folate deficiency, can result in cleft palates in offspring.

Other Factors: Other factors that can lead to incomplete palatal closure include hormonal influences (such as corticosteroids), mechanical injuries (such as accidents and high falls), mechanical pressure (such as oral tumors), and viral toxic factors. In this particular case, the cat suffered mechanical injury due to improper care by the owner.

In daily pet care, it is essential to consider the individual characteristics and sensitivities of each cat, especially during the spring and autumn seasons when cats are more prone to go into heat and exhibit a desire to roam outside. During these times, pet owners should take precautions to prevent their cats from escaping when they are not at home. To avoid such problems, early spaying or neutering can help reduce the behavioral changes associated with cats in heat, as well as prevent other physiological diseases. Both prevention and control should be addressed.

When a cat frequently sneezes, breathes with an open mouth, has a rapid heartbeat, exhibits nasal bleeding, and avoids close contact, it is crucial to seek prompt medical treatment rather than delaying it. Delaying treatment can lead to aspiration pneumonia, which can be life-threatening. Within three days post-surgery, fasting is recommended to promote wound recovery and healing. During this period, intravenous fluid therapy helps meet the animal's energy requirements. After three days, a soft diet can be gradually introduced while monitoring the wound healing progress[8].

During the surgical repair process, it is essential to ensure a tight closure of both sides of the wound edges. Gauze can be used to absorb any foreign substances in the throat. It's worth noting that maxillary clefts can occur in both congenital and acquired forms. The author has previously encountered a case in which a young kitten accidentally aspirated milk through the cleft during nursing, leading to choking and suffocation. Therefore, informing pet owners about the importance of regular check-ups during the rearing process is crucial. Timely diagnosis and treatment of congenital maxillary clefts can prevent disease progression and extend the lifespan of afflicted cats.

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