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Generalized Subcutaneus Emphysema in Shih Tzu Mixed Breed Dog: A Case Report

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Abstract. Generalized subcutaneous emphysema is a rare occurrence in large and small animals. The author reports a case of a male Shih Tzu mixed breed dog, 5 years old, with a body weight of 7.74 kg, that presented with gas accumulation over almost the entire body for two days prior to the examination. The previous week, the owner reported that the dog was fighting with other dogs around the house. Physical examination of the dog revealed crepitation to palpation with gentle pressure on the head and extremities. Inspection revealed a massive tick infestation, but there were no injuries. Radiographs showed subcutaneous air accumulation throughout the body. Hematology showed elevated level of total leukocytes and lymphocytes, consistent with infection. The dog was diagnosed with generalized subcutaneous emphysema due to trauma from fighting with other dogs, with a favorable prognosis. Treatment options for the dog included needle aspiration and bandaging, as well as antibiotic and anti-inflammatory therapy. Antibiotics administered included cefadroxil monohydrate (Cefadroxil Hexpharm®, PT Hexpharm Jaya Laboratories, Indonesia) at doses of 10-25 mg/kg BW, given orally as 6 mL twice daily for 7 days. Anti-inflammatory medication in the form of carprofen (Rimadyl®, Zoetis Inc.) was administered at a dose of 4.4 mg/kg BW, given as one tablet orally per day for 7 days. Evaluation was conducted weekly to monitor the animal's progress. The dog was declared cured when no subcutaneous gas was observed after two weeks of treatment.

Keywords: dogs; general; subcutaneous emphysema; treatment

I. INTRODUCTION

The trapping air or gas under the skin is called subcutaneous emphysema. Airway and lung disorders, rib fractures, esophageal trauma, infection with gas-producing microorganisms, and trauma to the trachea or esophagus can cause this condition, which can occur in both large and small animals [1]. Acute onset and crepitus on palpation are characteristic of subcutaneous emphysema [2]. Bite wounds, gunshot wound, or blunt trauma that can cause damage to the neck structures of the larynx, trachea, or esophagus are the most common causes. Cases of tracheal perforation resulting in subcutaneous emphysema have been reported in dogs, cats, horses, and humans [3]. These cases are often associated with mediastinal puncture, which can result from

traumatic intubation, overinflation of the endotracheal tube, positive pressure ventilation, transtracheal lavage, esophageal dilatation, and jugular venipuncture [4]. When the mediastinum connects to the subcutaneous tissue in the neck through the chest inlet and with the retroperitoneum through the aortic hiatus, air diffuses, causing subcutaneous emphysema and/or pneumoperitoneum [5].

II. MEDICAL RECORD

Signalement

A male mixed breed Shih Tzu dog named Choki, aged 5 years old with a body weight of 7.74 kg, presented with gas accumulation in almost all parts of his body since two days before the examination.

Anamnesis

The dog in this case had been experiencing gas accumulation in almost all areas of his body for two days prior to the examination. The dog appeared somewhat quiet, and the signs of gas accumulation initially appeared only in the chest are, but then progressed symmetrically to the abdomen, legs, and head (Figure 1). The dog became markedly less active and had a decreased appetite. During the previous week, the owner reported that the dog had been involved in fights with other dogs around the house. The dog was usually allowed to roam the yard unleashed and was sometimes taken out of the yard to defecate. The dog was initially taken to the nearest veterinarian and treated with digoxin 0.04 mg twice daily and furosemide 40 mg twice daily. However, the owner discontinued the treatment after three days because there was no improvement in the dog's condition.

Physical Examination

On clinical examination, the temperature was 39.6°C; the heart rate was 140 beats/min; the respiratory rate was 60 breaths/min; and the capillary refill time (CRT) was less than 2 seconds. Examination revealed that the dog was hyperthermic and tachypneic. There was subcutaneous accumulation of gas over most of the body, except the tail and lower extremities (tarsals, metatarsals, and phalanges). Physical inspection revealed tick infestation on the animal's skin. No bruising or puncture wounds were noted on inspection. Crepitation sounds were heard on palpation with light pressure of the head skin and extremities. Tympanic sounds were heard on palpation of the thorax and abdomen.

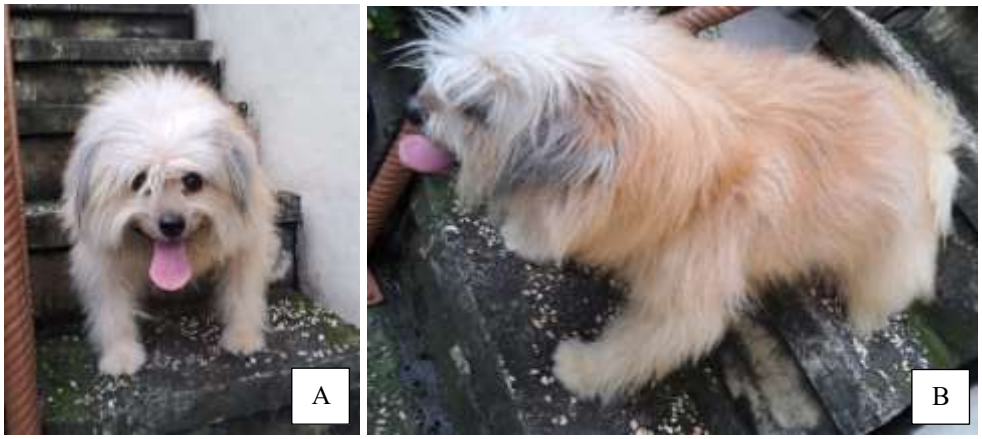

Figure 1. Front (A) and side (B) views of a dog with air/gas accumulation in almost all parts of the body.

Laboratorium test

Hematology Testing

In this case, a routine hematological examination was performed after one week of rest for the dog in this case, and there was no evidence of recovery or reduction of gas accumulation in the subcutaneous tissue. Blood samples from the dog were analyzed using an automatic hematology analyzer machine (Licare CC-3200, PT. Aerocom Global Sejahtera, West Jakarta, Indonesia).

Radiographic Examination

A radiographic examination was performed at the Udayana University Veterinary Hospital. The results of the radiographic examination showed the accumulation of air in the subcutaneous tissue, characterized by radiolucent opacities caused by air separating the skin from the underlying tissue, which occurred in almost all parts of the body (Figure 2).

The results of the routine hematology examination showed an increase in white blood cells (WBC), lymphocytes, hematocrit, and mean corpuscular volume (MCV). However, granulocytes were decreased. These findings were consistent with leukocytosis and lymphocytosis in the case dog. The results of the routine hematological examinations are presented in Table 1.

Diagnosis and Prognosis

Based on the history, physical examination findings, and supporting examinations, the case dog, named Choki, was diagnosed with generalized subcutaneous emphysema a prognosis of fausta.

Table 1. Results of hematology routine examination of Choki's blood

Parameter	Reference	Result	Description
WBC (10^9/L)	6.0-17.0	17.1	Increase
Limph (10^9/L)	0.8-5.1	6.3	Increase
Mid (10^9/L)	0.0-1.8	1.2	Normal
Gran (10^9/L)	4.0-12.6	9.6	Normal
Limph (%)	12.0-30.0	36.6	Increase
Mid (%)	2.0-9.0	7.1	Normal
Gran (%)	60.0-83.0	56.3	Decrease
RBC (10^{12}/L)	5.50-8.50	7.82	Normal
HGB (g/L)	110-190	181	Normal
HCT (%)	39.0-56.0	60	Increase
MCV (fL)	62.0-72.0	77.0	Increase
MCH (pg)	20.0-25.0	23.1	Normal
MCHC (g/L)	300-380	300	Normal
PLT (10^9/L)	117-460	186	Normal
PCT (%)	0.100-0.500	0.233	Normal

Note: WBC White Blood Cell, Limph Limphocyte, Mid Middle, Gran Granulocyte, RBC Red Blood Cell, HGB Hemoglobin, HCT Hematocrit, MCV Mean Cell Volume, MCH Mean Cell Hemoglobin, MCHC Mean Cell Hemoglobin Concentration, PLT Platelet, PCT Platelet Count

Treatment and Management

At the initial examination, the dog received no treatment and was only advised to rest for one week. After one week, the case showed no signs of recovery or reduction in the air accumulation under the skin. The dog was returned for examination and treatment, which included needle aspiration using a syringe to remove the air trapped under the skin. Gentle pressure was applied to concentrate the air in the puncture area. The aspirated air was then followed by the application of gentamicin sulfate ointment 0.1% over the puncture site to prevent bacterial contamination and further air entry. Needle puncture was performed on the skin until the air volume was significantly reduced. The dog was then bandaged to minimize air accumulation under the skin. After the treatment, the dog received antibiotic and anti-inflammatory therapy. The antibiotic used was cefadroxil monohydrate (Cefadroxil Hexpharm®, PT Hexpharm Jaya Laboratories, Indonesia) at a dose of 10-25 mg/kg BW, administered orally as 6 mL twice daily for 7 days. The anti-inflammatory drug, in the form of carprofen (Rimadyl®, Zoetis Inc.), was administered at a dose of 4.4 mg/kg BW, with one tablet administered once daily for 7 days. Weekly evaluations were performed to monitor the progress of the dog.

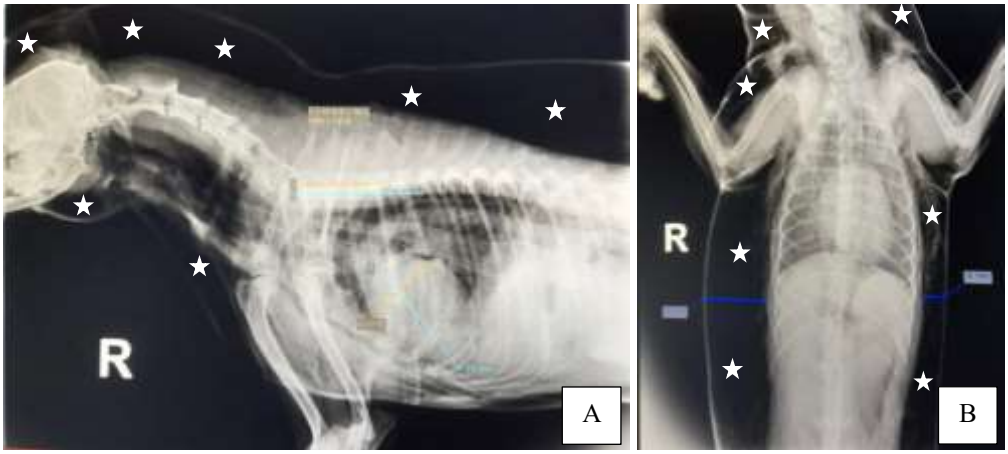

Figure 2. Right lateral (A) and ventro-dorsal (B) radiographs of the case dog. The subcutaneous area is radiolucent, indicating the presence of air separating the skin from the underlying tissue, which occurs in almost all parts of the body (asterisk).

III. DISCUSSION

Clinical examination shows an increase in breathing rate (tachypnea) from normal [6]. Rapid, short breaths, and mouth breathing are compensatory responses to the compression of the lungs by air under the skin to meet the body's oxygen needs. According to Filho *et al*. [7], the effect of subcutaneous emphysema depends on the location of the air accumulation under the skin. In this case, the air accumulation in the chest wall obstructs ventilation and is exacerbated by reduced pleural negative pressure caused by trauma.

The initial suspicion of the cause of generalized subcutaneous emphysema in the case dog was the result of a traumatic fight that caused minor injuries, that were not detected on examination. Such trauma can result in the loosening of soft tissues under the skin, allowing air from the lungs to infiltrate the subcutaneous tissue. This was supported by the owner's report that the dog had fought with another dog around the house the previous week. Trauma from fighting can cause loose tissue under the skin, creating negative pressure in the subcutaneous tissue and allowing air from the lungs to infiltrate it. Subcutaneous emphysema is cause by increased pressure in the lungs due to ruptured alveoli. Air can enter the soft tissues of the neck from the mediastinum and retroperitoneum. In subcutaneous emphysema, air travels from the ruptured alveoli into the interstitium and along the pulmonary vasculature, to the mediastinum, neck, head, and possibly other parts of the body.

The results of the physical examination showed an increase in body temperature, and the supporting examination in the form of hematological

examination showed an increase in WBC and lymphocyte values, indicating an infection. However, this infection was not bacterial, as there was no increase in neutrophils. This is supported by the results of the air sampling, which was odorless, indicating the absence of gas-producing bacteria that cause gangrene, eliminating the suspicion of a bacterial infection.

Radiographic results showed the accumulation of air in the subcutaneous tissue, indicated by radiolucent opacities, where air separates the skin from the underlying tissue in almost all parts of the body, without trauma to the respiratory system. Subcutaneous emphysema can be easily diagnosed with supportive diagnostics, such as x-ray, and can be treated directly by removing the air [8]. Generalized subcutaneous emphysema has been reported to occur in several species. Bauer and Currie [9] reported this condition in a 5-year-old miniature pinscher resulting from a traumatic fight with another dog. The dog recovered after surgery. Akhtardanesh *et al*. [10] reported widespread and progressive subcutaneous emphysema in a dog that was crushed by a large log that fell into the dog kennel. The dog recovered within 10 days without any treatment.

Various techniques have been used to treat subcutaneous emphysema, many of which are invasive or uncomfortable and tend to worsen the condition. These include placement of additional drains, either intrapleural or subcutaneous [11]. We opted for a non-invasive treatment by completely resting the dog and avoiding any activity for one week. This was chosen to reduce discomfort and pain for the animal. However, after one week had passed, the animal showed no signs of healing or reduction in subcutaneous air accumulation. Needle aspiration was chosen, where a needle and syringe were used to remove the air trapped air in the subcutaneous tissue. Massage and splinting with a bandage were performed to encourage the air to concentrate. The dog was then given antibiotic and anti-inflammatory therapy to prevent infection after the treatment and to reduce the pain caused by the pressure in the subcutaneous tissue. The antibiotic chosen was cefadroxil monohydrate (Cefadroxil Hexpharm®, PT Hexpharm Jaya Laboratories, Indonesia), which is a broad-spectrum antibiotic. Plumb [12] states that this drug acts as a broad-spectrum antibiotic by inhibiting the formation of bacterial cell walls. Cefadroxil is well absorbed after oral administration in dogs. Meanwhile, the chosen anti-inflammatory drug of choise is carprofen (Rimadyl®, Zoetis Inc.). Carprofen, a nonsteroidal anti-inflammatory drug, has analgesic, anti-inflammatory, and antipyretic properties. It used to prevent

pain caused by pressure on peripheral nerves in the subcutaneous tissues. The mechanism of action is to inhibit the catalysis of arachidonic acid cyclooxygenase against prostaglandin precursors (endoperoxides), thereby inhibiting prostaglandin synthesis in tissues [12]. In addition to the administration of therapy, the animals were temporarily rested to reduce activity.

After needle aspiration, the dog appeared to have returned to its normal size (Figure 3), as almost 70% of the air had been removed. The dog was then bandaged to reduce the space for air to reenter. One week after therapy, the dog became active again and his appetite increased. There was only a slight accumulation of air under the skin in the abdomen, characterized by a crepitation sound on palpation. The dog was asked to rest again by being in the cage to reduce excessives activity so that the remaining air could be absorbed by the body. Two weeks after treatment, subcutaneous accumulation of had air completely disappeared, as confirmed by radiographic examination (Figure 3-4).

Figure 3. The condition of the dog after needle aspiration and bandaging (A), and the condition of the dog 14 days after treatment (B).

Figure 4. Right lateral (A) and ventro-dorsal (B) radiographs of the case dog 14 days after treatment. There is no accumulation of gas/air trapped under the skin

IV. CONCLUSIONS

Based on the history, physical examination, and laboratory test, the dog named Choki was diagnosed with generalized subcutaneous emphysema with a prognosis of fausta. The dog was treated with needle aspiration and splinting. Antibiotics and anti-inflammatory were administered to prevent bacterial infection and pain. In addition to the therapy, the animals were temporarily rested to reduce overactivity. The results of the evaluation after two weeks of treatment and therapy were successful, as confirmed by radiographs with no accumulation of gas/air in the subcutaneous tissue.

V. RECOMMENDATION

Subcutaneous emphysema can result from a variety of causes, one of which is trauma from fighting. To prevent this, the author suggests that owners should pay more attention to the way their animals are kept, so that they do not fight with other animals or restrict their activities to the yard.

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