

**Article Review**

***Hemophilia in Dogs and Options for Treatment***

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**Abstract**

*Haemophilia is an inherited bleeding disorder, and is a hereditary disorder linked to the X chromosome so that clinical symptoms occur in male animals, while females act as carriers. This article aims to increase understanding of haemophilia in dogs and efforts to appropriate diagnosis and treatment strategies for dogs with haemophilia. The method used is a literature study in the form of journals. The results of this article discuss the symptoms and appropriate treatment efforts for dogs with haemophilia. Through a better understanding of haemophilia, we can find out the symptoms, diagnosis, and manage haemophilia in dogs more efficiently, and provide appropriate treatment or treatment.*

**Keywords:** *Haemophilia, carrier, dog, X chromosome, inherited disorder*

**Abstract**

*Haemophilia is an inherited bleeding disorder, and is linked to the X chromosome so that clinical symptoms occur in male animals, while females act as carriers. This article aims to improve the understanding of haemophilia in dogs and the appropriate diagnosis and treatment strategies for dogs with haemophilia. The method used is a literature study in the form of journals. The results of this article discuss the symptoms and appropriate treatment efforts for dogs with haemophilia. Through a better understanding of haemophilia, we can identify symptoms, diagnose, and manage haemophilia in dogs more efficiently, and provide appropriate treatment.*

**Keywords:** *Haemophilia, carrier, dog, X chromosome, inherited disorder*

**INTRODUCTION**

Haemophilia is a bleeding disorder that rarely occurs in humans, but can also affect animals, including dogs. Haemophilia is a coagulopathic disorder in dogs that is inherited as a result of factor VIII deficiency in haemophilia A and factor IX deficiency in haemophilia B. Both disorders are strongly associated with chromosomes

X, so clinical symptoms will occur in males, rarely in females and usually females will act as carriers (Nielsen 2007). Clinical symptoms are spontaneous bleeding and will vary from individual to individual. Haemophilia disorders have been reported in several pure breeds of dogs as well as mongrels. The most commonly reported dog breeds with haemophilia A include German shepherd, German shorthaired pointer and Siberian husky. The disease is characterised by disorders in blood clotting due to deficiencies in certain clotting factors. Haemophilia in humans has been the subject of extensive research, but little information is available regarding similar cases in dogs.

Over the past few decades, several cases of haemophilia in dogs have been discovered and reported, and understanding of the condition remains limited. Understanding haemophilia in dogs is important, especially as dogs are often used as pets and even as blood donors for other animals. With a better understanding of the condition, we can improve the care and health management of dogs with haemophilia and identify the symptoms or characteristics of dogs with haemophilia.

Recently, a number of published studies have highlighted cases of haemophilia in dogs as a key factor in understanding the phenomenon of haemophilia in dogs. These results provide an important foundation for further research and demonstrate the importance of understanding the genetics of haemophilia in dogs. Through a comprehensive approach to the relevant literature, we have identified key trends and findings from many previous studies that form the basis of the review of haemophilia cases in dogs. The same study was published in the journal titled "Haemophilia in siberian husky dogs."

In this context, this review aims to present a case of haemophilia in dogs. Through an in-depth analysis of the case and review of the literature, we seek to enrich the understanding of haemophilia in dogs, its symptoms and appropriate treatment for dogs with haemophilia. The article also discusses potential treatment options for owners of affected dogs. It is hoped that the knowledge gained from these cases will broaden the horizons of haemophilia in pets and make a valuable contribution to the health of dogs affected by the disease.

## **IMPLEMENTATION METHOD**

This research uses a qualitative method approach with literature studies from various published sources including several journal titles of haemophilia in Siberian husky dogs and advances in science and technology for the benefit of the people published on Google Scholar. In the research obtained the results of haemophilia is a disease that can be inherited. So that dogs known to have haemophilia or who act as carriers should not be used for breeding or stud. The severity of haemophilia cases can be influenced or related to the activity level and size of an animal. Animals that have a large size and high activity have the possibility to develop more severe clinical symptoms compared to animals that have a smaller size with low activity (Tunjungsari, 2019).

## RESULTS AND DISCUSSION

Haemophilia is a hereditary disease resulting from a deficiency of the factor VIII in haemophilia A and factor IX in haemophilia B, both of which are linked to the X chromosome, occur in males, rarely in females and females will usually act as carriers.

Haemophilia cases are closely related to hemostasis disorders in the animal body. According to Ettinger (2017), haemophilia with factor VIII of 6-20% is mild, will not cause a tendency to bleed, but patients with factor VIII between 2-5% will show bleeding caused by minor trauma, while patients with a factor of less than 2% will cause severe bleeding and can cause death.

Haemophilia A and B are caused by a deficiency or dysfunction of the protein factor VIII and factor IX, and is characterised by prolonged and excessive bleeding after minor trauma or sometimes even spontaneously. There is also haemophilia C, which occurs due to deficiency of clotting factor XI but is rare.

Haemophilia is classified based on its severity. Haemophilia may be mild, moderate, or severe, depending on the level of blood clotting factors in the blood. The three main forms of haemophilia include:

1. Haemophilia A: Caused by a lack of blood clotting factor VIII about 85% of people with haemophilia have type A disease.
2. Haemophilia B: Caused by a deficiency of factor IX.
3. Haemophilia C: Some doctors use this term to refer to the lack of clotting factor XI.

Von Willebrand's disease: Part of the factor VIII molecule known as von Willebrand factor or ristocetin cofactor is reduced. Von Willebrand factor helps platelets (blood cells that control bleeding) stick to the lining of veins or arteries. This missing factor results in prolonged bleeding time as the platelets are unable to attach to the vessel wall and form a blockage to stop the bleeding.

Haemophilia is a hereditary disease (Nielsen 2007). Therefore, animals that are known to have haemophilia or act as carriers should not be used as sires or studs. Animals that will undergo major or minor surgery, especially in breeds that have a high predisposition to haemophilia, should have PT and aPTT checked (Nielsen 2007). This is to prevent spontaneous bleeding in animals with haemophilia. It is important that dogs with coagulation disorders are diagnosed early, so that if the dog requires surgery, the veterinarian can determine the course of the surgery.

treatment and prevention to avoid complications both during surgery and postoperatively.

The symptoms of haemophilia in dogs are varied, recurrent bleeding, bleeding under the skin, bruising during vaccine injection, bleeding during teething, bleeding from the nose, presence of blood in faeces or urine, etc. Clinical symptoms may vary from animal to animal depending on the location of the affected organ. According to Ettinger (2017), clinical symptoms in haemophilia patients may include localised disorders such as haematoma (often at the injection site), prolonged bleeding after trauma or surgery, mucosal bleeding, and lameness due to haemarthrosis. This has also been reported in mixed breed dogs (Jonkisz et al. 2016). Unrecognised signs, especially if they affect internal organs such as the respiratory tract, put the animal's life at risk. If haemophilia is suspected, the veterinarian will use special tests to determine and clarify the diagnosis. The diagnosis of haemophilia A is based on the determination of clotting factor VIII in the dog's blood and there are many other ways of diagnosis such as carrier testing, prenatal diagnosis and postnatal diagnosis.

The treatment strategy for haemophilia can be done through gene therapy treatment, which is one of the ways to cure haemophilia by repairing genetic damage, by replacing genes with undamaged ones that function normally. Healing through gene therapy cannot be permanent and still has to be done periodically. Studies on gene therapy for haemophilia are still being developed, and animal experiments have been conducted. A case of gene therapy performed on a dog with haemophilia was cured within 30 days, but the haemophilia attack returned after that. In humans with haemophilia, the healing period after gene therapy takes one to two years (Arsal, A. F., et al, 2023).

Treatment of haemophilia may also involve the management of acute bleeding to achieve rapid haemostasis, or it may involve a prophylactic approach. The treatment process must pay attention to the dose, schedule, and target level. In addition, safe treatment can also use recombinant factor VIII combined with viral inactivation and screening technologies. Complications in haemophilia can occur due to inhibitors that suppress the function of factors VIII and IX, the incidence of haemophilic arthropathy from recurrent musculoskeletal haemorrhage, and pseudotumours with the potential for soft tissue bleeding. One way to prevent bleeding is to restrict the patient from risky physical activities. Prevention can also be done by ensuring that people with haemophilia have a normal immune system and routinely receive vaccines injected subcutaneously or intramuscularly, provided it is done correctly.

## CONCLUSIONS

Haemophilia is a haemostasis disorder that occurs in animals. Haemophilia cases are strongly associated with low blood clotting factor severity. Haemophilia A and B are caused by deficiency or dysfunction of factors VIII and IX, while haemophilia C occurs due to deficiency of clotting factor XI. Von Willebrand's disease is also a disorder involving blood clotting factors. Haemophilia can be classified as mild, moderate or severe

depending on the level of clotting factors in the blood. Haemophilia is an inherited disease and animals that have haemophilia or are carriers should not be used as sires or studs. Prior to surgery, especially in breeds at high risk of haemophilia, screening is necessary to prevent spontaneous bleeding. Treatment of haemophilia may involve management of acute bleeding or prophylaxis. Complications of haemophilia may occur, including the presence of inhibitors that suppress the function of clotting factors and the presence of pseudotumours. Prevention of bleeding can be done by limiting risky physical activities and ensuring a normal immune system and receiving vaccines regularly. Gene therapy is also a method of curing haemophilia by replacing defective genes with normal ones, but this treatment is not permanent and needs to be done periodically.

#### LITERATURE

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