

Clinical features and imaging characteristics of penile hematoma mimicking priapism in a dog

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Abstract

A 2-year-old, castrated male Jindo dog presented with 6 days of penile swelling and protrusion, suggesting priapism. Blood gas was analyzed by aspirating the corpus cavernosum to differentiate the type. However, the results were ambiguous. Ultrasound and computed tomography revealed a well-encapsulated mass ventral to the urethra. Magnetic resonance imaging showed a mass (T2-hyperintense, T1-hypointense, with no contrast enhancement) located ventral to the urethra. Cytology revealed only red blood cells, confirming a hematoma. Penile hematoma mimicking priapism was diagnosed. After 11 weeks of glucocorticoid administration, the hematoma and the protruded penis resolved. This case suggests that penile hematoma can be confused with priapism in dogs. MRI can be useful for evaluating penile membranous structures in dogs with swollen penises.

Keywords: canine, hematoma, penile mass, priapism

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Introduction

Priapism is defined as a persistent penile erection lasting longer than 4 hours without sexual stimulation (Lavelly, 2009). It is classified into two types: non-ischemic and ischemic priapism. Non-ischemic priapism results from increased arterial flow through the corpus cavernosum (El-Sherry and Abdel-Ghani, 2018). Treatment for non-ischemic priapism is not an emergency, and spontaneous resolution occurs in approximately 60% of cases (Bassett and Rajfer, 2010; Roux *et al.*, 2022). In contrast, ischemic priapism is caused by venous congestion of the penis and increased blood viscosity (Lavelly, 2009; El-Sherry and Abdel-Ghani, 2018). Immediate intervention is necessary to prevent irreversible damage to the erectile structure and function of the penis (Salonia *et al.*, 2014; Roux *et al.*, 2022). Therefore, distinguishing between the two types of priapism is crucial for appropriate treatment and for preventing irreversible damage to the corpus cavernosum.

While prolonged protrusion and swelling of the penis are suggestive of priapism (Lavelly, 2009), it is essential to consider other potential causes. Other conditions, such as penile hematoma or abscess, can also lead to penile swelling and have been reported in colts and bulls (Mohindroo and Singh, 2011; Koziol, 2023). Based on our review of the literature, there are no documented cases of penile hematoma resembling priapism in dogs. Penile hematoma primarily results from blunt trauma and may be associated with traumatic rupture of the tunica albuginea (Türkay *et al.*, 2016). In human medicine, diagnosing penile hematoma involves assessing the integrity of the tunica albuginea and identifying the hematoma using ultrasound and magnetic resonance imaging (MRI) (Ash *et al.*, 2012; Dell'Atti, 2016). Although ultrasound has been used to diagnose penile hematoma in bucks (Ismail and Ababneh, 2007), there are no specific reports in dogs. Only one case of MRI imaging for penile hemorrhage has been reported (Hicks *et al.*, 2007). Hematomas are typically self-limiting, and no standardized treatment protocol exists for penile hematoma in dogs (Deneuche *et al.*, 2002). This case report describes a dog with a penile hematoma mimicking priapism, including clinical signs, diagnostic imaging findings (ultrasound, computed tomography [CT], and MRI), and treatment.

Case description

A 2-year-old castrated male Jindo dog weighing 13 kg was referred to the Veterinary Medical Teaching Hospital of Kyungpook National University with a history of persistent erection lasting 6 days. Two days before the hospital visit, the dog had been neutered at a local animal hospital to alleviate the persistent erection, but no improvement was observed. Despite the ongoing erection, the dog's urination remained normal, and it was otherwise in good health. The dog was bright and alert on presentation with a slightly increased rectal temperature (39.6°C). Pulse and respiratory rates were within normal ranges, and no significant abnormalities were detected during auscultation. The complete blood cell count, including red blood cell counts and platelet levels, as well as

serum biochemical analysis and electrolyte examination, were all within normal limits, except for mild neutrophilia ($16.1 \times 10^9/L$; reference range: $3.6\text{--}12.5 \times 10^9/L$). The dog was sedated using an intramuscular injection of 30 $\mu\text{g/kg}$ medetomidine (Domitor®; Zoetis, Seoul, Korea), and the penile area was shaved and examined. Although the penis could be retracted into the prepuce, the erection persisted. The mucous membrane color of the penis was reddish, and the bulbus glandis was firm and swollen (Fig. 1A). Based on the physical examination, priapism was suspected. Given that the ischemic type of priapism is considered an emergency, blood was collected from the corpus cavernosum (without ultrasound guidance), and blood gas analysis was performed to differentiate the type of priapism. The blood gas analysis results from the first sample showed a pH of 6.93, pO₂ of 3 mmHg, and pCO₂ of 71.5 mmHg. The second sample showed a pH of 7.11, pO₂ of 18 mmHg, and pCO₂ of 40.9 mmHg (Reference range for ischemic priapism: pH < 7.25, pO₂ < 30 mmHg, pCO₂ > 60 mmHg; non-ischemic priapism: pH < 7.25, pO₂ > 90 mmHg, pCO₂ < 40 mmHg) (Lavelly and Davidson 2018). Based on these results, the type of priapism remained ambiguous.

Abdominal radiographs revealed a soft tissue mass ventral to the os penis, along with protrusion of the penis (Fig. 1B). Ultrasound examination showed a large, encapsulated, heterogeneous fluid-containing mass ventral to the penile urethra, extending from the pars longa glandis to the corpus cavernosum measuring 10×3.6 cm (Figs. 1C). No blood supply was detected within the mass on color Doppler ultrasound. The mass was not directly connected to the urethra or other anatomical structures, and the surrounding capsule appeared distinct. However, precise evaluation of the boundary between the mass and adjacent structures posed challenges, particularly in assessing the surrounding corpus cavernosum and tunica albuginea. Fine-needle aspiration of the mass yielded cytology results consistent with red blood cells, indicative of hematoma. Despite attempts at ultrasound-guided drainage using a 16-gauge over-the-needle catheter, only small amounts of blood were aspirated, and drainage was unsuccessful.

To plan for surgical intervention, abdominal CT was performed using a 32-multislice CT scanner (Alexion; Canon Medical Systems, Tokyo, Japan). General anesthesia was induced with propofol (5 mg/kg, Anepol; Hana Pharm, Seoul, Korea) and maintained with 2% isoflurane. The patient was positioned in ventral recumbency on the CT table. Scanning parameters included 120 kV, 112 mA, a slice thickness of 1.0 mm, and a rotation time of 0.75 sec. Following intravenous administration of 300 mgI/kg iohexol (Omnipaque 300 injection; GE Healthcare, Oslo, Norway) at an injection speed of 1.5 ml/sec using an autoinjector (A-60; Nemoto Kyorindo Co., Tokyo, Japan), an elliptical mass measuring $4.9 \times 4.6 \times 13$ cm with an attenuation value of 50–55 HU was delineated on the right ventral side of the os penis within the subcutaneous tissue. No enhancement was observed within the mass parenchyma, but a small amount of contrast medium extravasation was noted at the dorsal right margin on postcontrast CT (Figs. 2A, D). The

capsule surrounding the mass exhibited strong contrast enhancement, connecting ventrally to the corpus spongiosum and dorsally to the corpus cavernosum. The dorsal aspect of the mass appeared distinct from the urethra and cavernosal bodies. A marked protrusion of the distal end of the penis was detected cranial to the mass. The penile urethra and membranous urethra near the mass remained intact. A hematoma was the tentative diagnosis based on the absence of parenchyma enhancement and the minimal contrast medium leakage into the mass.

Subsequently, an MRI was performed using the 1.5 T MR system (Signa Explorer; GE Healthcare, Chicago, IL, United States) to investigate the possible rupture of membranous structures. Under general anesthesia, the patient was positioned in ventral recumbency, and images were obtained with spin-echo sequences with a 16-channel flexible coil. Images of the penile region were acquired with a 22×22 cm field of view, 2 mm slice thickness. Following intravenous administration of gadoterate meglumine (0.3 mL/kg; Clariscan; GE Healthcare, Chicago, IL, United States), a well-defined mass ($4.2 \times 5.0 \times 13.6$ cm) was identified ventral to the penile urethra. The mass had heterogeneous, hyperintense parenchyma on T2-weighted and STIR images and heterogeneous hypointensity on T1-weighted images. Subtle signal voiding was observed within the mass and its peripheral regions on T2 images. The parenchyma of the mass did not enhance with contrast. The mass had a distinct capsule, and the corpus cavernosum, corpus spongiosum, and urethra were located on the dorsal aspect of the mass. The mass

was situated externally to the intact tunica albuginea within the squamous epithelium. Consequently, a well-defined mass situated ventrally on the os penis, at the level of the urethra's epidermis, was diagnosed as an extra-albugineal hematoma mimicking priapism.

Considering the prolonged exposure of preputial mucosa and the failure of ultrasound-guided drainage, surgical intervention was recommended. However, the owners declined surgical options due to post-operative management and financial reasons. Consequently, glucocorticoid treatments were prescribed, following the approach proposed for aural hematomas in dogs. The patient received oral administration of prednisolone (0.3 mg/kg, Solondo; Yuhan CO., Seoul, Korea) and amoxicillin-clavulanate (15 mg/kg, Amocla; Kuhnle Pharm, Seoul, Korea) twice a day for 2 weeks. By day 14 following the presentation, the size of the mass had decreased on ultrasound, and the reddish mucous membrane and edema resolved. As clinical signs were alleviating, the same dosage of oral medications was prescribed for an additional 2 weeks. On day 28, the mass size decreased even further, prompting a 50% tapering of the prednisolone dosage, which was continued for 2 weeks. After 6 weeks from the initial presentation, the penis retracted into the prepuce, and the hematoma size decreased on ultrasound. Therefore, oral medications were discontinued. Finally, 11 weeks from the initial presentation, the swelling and protrusion of the penis had clearly resolved upon physical examination, and treatment was finished.

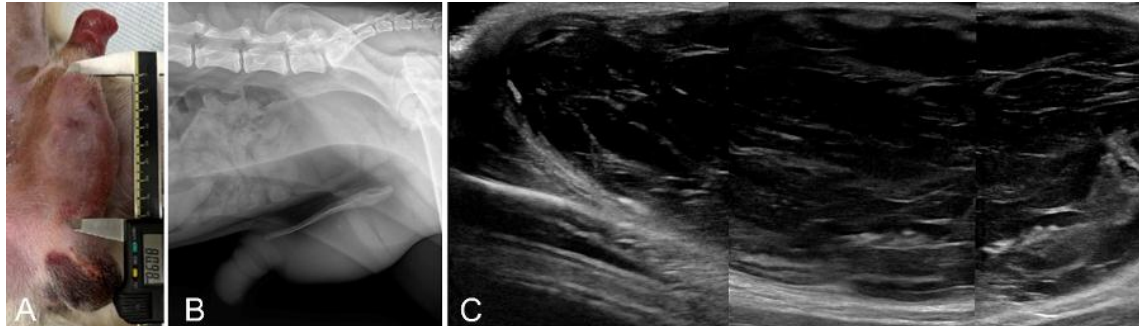


Figure 1 Photograph (A), radiograph (B), and ultrasound (C) in a dog with penile hematoma mimicking priapism. A swollen, protruded penis and a warm and firm mass at the pars longa glandis (A). Ventral to the os penis, soft tissue opacity mass confirmed (B). The penile mass has a distinct capsule and heterogeneous parenchyma on ultrasound (C).

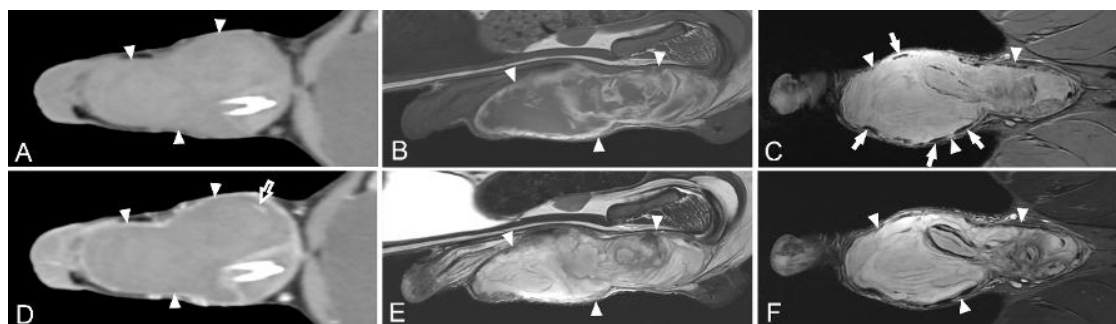


Figure 2 Non-contrast (A), delayed phase (D) of dorsal computed tomography (CT), T1-weighted (T1W) (B) and T2-weighted (T2W) (E) sagittal images, T2*-weighted (T2*W) (C) and fat-suppressed T2W (F) dorsal plane images of magnetic resonance imaging (MRI). On CT and MRI, the mass has a distinct capsule (arrowheads). The mass exhibited no parenchymal contrast enhancement, whereas the capsule showed enhancement. In the mass parenchyma, there was a linear enhancement on postcontrast images, which suggests contrast leakage into the hematoma (open arrow). On MRI, the mass has heterogeneously hyperintense parenchyma on T2W, fat-suppressed T2W, and hypointense on T1W. Subtle signal voiding is observed within the mass and its peripheral parts on T2*W (arrow).

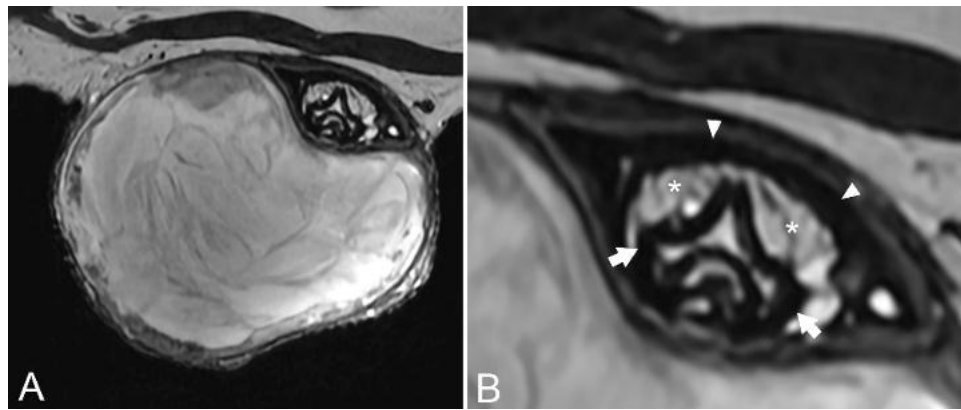


Figure 3 Transverse T2-weighted (T2W) magnetic resonance images of the penile mass (A) and its partially enlarged images of intact penile structure (B). The heterogeneous mass is located ventral to the penile structure and distinct from the normal penile structure. Dorsal to the mass, the intact penile structure is located. The intact tunica albuginea is hypointense on T2W images (arrowheads). Hyperintense bulbus glandis (asterisk), os penis (arrow) located within the tunica albuginea on T2W images.

Discussion

This case report describes a penile hematoma mimicking priapism, a condition not previously reported in veterinary medicine. Diagnosis of male reproductive disorders often relies on history and clinical examinations, particularly in emergencies. In this case, the patient was initially considered to have priapism based on presentation. Clinical features and penile MRI findings led to the diagnosis of a penile hematoma with an intact penile structure.

Priapism is categorized into two types based on its mechanism: ischemic and non-ischemic priapism (Roux *et al.*, 2022). Treatment varies depending on the type, with some types requiring emergency intervention (Salonia *et al.*, 2014). Differentiating between these types of priapism is crucial for appropriate treatment and to prevent irreversible damage to the corpus cavernosum. Blood gas analysis from aspirated corpus cavernosum blood aids in diagnosing ischemic and non-ischemic priapism. Ischemic priapism typically exhibits pH < 7.25, PaO₂ < 30 mmHg, and PaCO₂ > 60 mmHg, while non-ischemic priapism shows pH of 7.4, PaO₂ > 90 mmHg, and PaCO₂ < 40 mmHg (Rochat, 2001). In this case, the blood gas analysis results lacked consistency—one sample indicated an ischemic type, while the other did not. CT and MRI scans clarified the inconsistencies, revealing an intact corpus cavernosum and the presence of a penile hematoma. The penile hematoma resembling priapism may have been mistakenly aspirated from the hematoma itself rather than the corpus cavernosum. Therefore, in suspected priapism cases, ultrasound-guided aspiration of blood from the corpus cavernosum is recommended for precise diagnosis (Robitschek *et al.*, 2010).

Hematoma is mainly caused by trauma, although coagulation disorders can also contribute (Deneuche *et al.*, 2002). While penile hematoma has been reported in bulls and colts due to mating-related injuries (Ismail and Ababneh, 2007; Mohindroo and Singh, 2011), such occurrences are rare in dogs. Blunt trauma or mating-related injuries are the usual causes (Hicks *et al.*, 2007). Previous studies have reported cases of penile trauma in three dogs associated with exposure to females in estrus (Lobetti *et al.*, 1995; Hicks *et al.*, 2007). In the

present case, the dog's coagulation factor levels were normal in the blood analysis, ruling out the hematoma due to coagulation disorders. The patient was an intact male dog and living outdoors. Although no external evidence of trauma was observed in this case, traumatic penile hematoma may develop from attempted mating with nearby females or other blunt trauma, such as a fall from stairs.

Treatment of traumatic penile hematoma depends on the integrity of the tunica albuginea, both in humans and dogs (Choi *et al.*, 2000; De La Puerta and Baines, 2012). Therefore, evaluating the rupture of the tunica albuginea is crucial for treatment planning. Ultrasound is recommended for assessing penile hematoma in dogs (Payan-Carreira and Bessa, 2008). Ultrasound findings typically reveal an echogenic and heterogeneous mass without blood flow confirmation on Doppler (Gupta *et al.*, 2017). While ultrasound allows for a relatively accurate and rapid assessment of the extent and surrounding membrane rupture, accurate diagnosis can be challenging due to variations in the sonographer's scanning ability, potentially leading to missed ruptures. Additionally, detecting tunica albuginea rupture can be difficult on ultrasound alone (Guichard *et al.*, 2008). In human medicine, ultrasound and MRI are commonly used for evaluating traumatic penile hematoma, while CT is rarely employed for this purpose (Türkay *et al.*, 2016; Yan *et al.*, 2019). Rupture of the tunica albuginea diagnosed by CT is rare, and the CT findings typically reveal disruption of the hyperattenuated linear tunica albuginea (Yan *et al.*, 2019). On MRI, penile structures and the scale of the hematoma can be precisely visualized due to excellent soft tissue contrast. Rupture of the tunica albuginea appears as a discontinuity of tunica albuginea, which is hypointense in both T1- and T2- weighted images (Choi *et al.*, 2000). In the present case, the assessment of tunica albuginea on ultrasound was ambiguous due to the large hematoma ventral to the tunica albuginea. Furthermore, accurate assessment of the tunica albuginea using CT was challenging due to similar attenuation with nearby structures. In contrast, MRI allowed for precise evaluation of penile soft tissue structures, including the tunica albuginea, corpus cavernosum, and urethra.

Thus, MRI is an excellent modality for evaluating the integrity of the tunica albuginea and other penile structures due to its superior soft tissue contrast.

Hematomas are usually self-limiting, and no standard treatment protocol has been established for penile hematoma in dogs (Deneuche *et al.*, 2002). In the present case, the penile hematoma persisted, causing clinical signs such as exposed penile mucous membrane and penile swelling. An attempt at drainage of hematoma was made for clinical resolution, but it failed, likely due to prolonged duration leading to clot formation. According to a previous study on cervical hematoma in dogs, surgical options were recommended for large hematomas (Deneuche *et al.*, 2002). Left untreated, a hematoma can cause fibrosis and become painful (Deneuche *et al.*, 2002; Ohta *et al.*, 2013). In the present study, we recommended surgical drainage for the large penile hematoma, but the owner declined. Therefore, the patient was prescribed glucocorticoids, as proposed, for aural hematomas in dogs (Hewitt and Bajwa, 2020). According to this study, the recommended prednisolone dosage ranges from 0.125 to 1 mg/kg every 24 hr. In our case, prednisolone was prescribed at 0.3 mg/kg twice a day.

In conclusion, this case represents the first report of a penile hematoma mimicking priapism in a dog. It underscores the importance of considering penile hematoma when priapism is suspected in dogs. In addition, MRI provides valuable information for evaluating the tunica albuginea and diagnosing penile hematoma due to its exceptional tissue contrast. Conservative glucocorticoid therapy may aid in hematoma resolution

Conflict of interest: The authors declare no conflict of interest.

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