Uningá Review

doi.org/10.46311/2178-2571.39.eURJ4681

Spina bifida and myelomeningocele in a newborn canine: case report

Espinha bífida e mielomeningocele em um cão neonato: relato de caso

Lucilena Benites[1*], Karina Maria Basso de Oliveira[2]

[1]Small Animal Medical Clinic, Anclivepa, SP, Brazil.

[2]Philadélfia University Center – UniFil, Londrina, PR, Brazil.

*lucilenabenites@hotmail.com

Received: July 03rd, 2024.
Accepted: November 23rd, 2024.
Published: December 13th, 2024.

ABSTRACT

Spina bifida is a congenital bone malformation characterized by failure of neural tube closure during the embryonic phase. It can present in the form of spina bifida occulta, meningocele or myelomeningocele. This work reports the clinical case of a two-day-old dog treated at the ANCLIVEPA-SP Veterinary Hospital which was born with spina bifida in the form of myelomeningocele. In the macroscopic findings, the animal presented a fissure in the thoracic region, with exposure and protrusion of the spinal cord due to failure of neural tube closure. Radiographic findings showed the involvement of several segments of the spine and spina bifida in the form of myelomeningocele. In the lateral projection, an important dorsal deviation of the anatomical axis of the thoracic spine and the thoracolumbar transition between T5 and T13 were observed, in addition to exposure of the dorsal portion of the articular facets from L1 to L4 to the external environment. In the ventrodorsal projection, the absence of closure of the dorsal arch of the C1 to L7 vertebrae was visualized. The owner opted for euthanizing the animal as there was no effective treatment for this illness.

Keywords: Dog. Malformations. Vertebrae.

RESUMO

A espinha bífida é uma malformação óssea congênita caracterizada pela falha do fechamento do tubo neural durante a fase embrionária e pode se apresentar na forma de espinha bífida oculta, meningocele ou, ainda, mielomeningocele. Neste trabalho, foi relatado o caso clínico de um cão com dois dias de vida atendido no Hospital Veterinário ANCLIVEPA-SP que nasceu com espinha bífida na forma de mielomeningocele. Nos achados macroscópicos, o animal apresentou fissura na região torácica, com exposição e protusão da medula espinhal em decorrência da falha no fechamento do tubo neural. Os achados radiográficos mostraram o acometimento de vários segmentos da coluna vertebral e a espinha bífida na forma de mielomeningocele. Na projeção lateral foi observado importante desvio dorsal do eixo anatômico da coluna torácica e transição toracolombar entre T5 e T13, além de exposição da porção dorsal das facetas articulares de L1 a L4 para o meio externo. Na projeção ventrodorsal, foi visualizada a ausência do fechamento do arco dorsal das vértebras de C1 a L7. O proprietário optou pela eutanásia por não haver tratamento eficaz para essa enfermidade.

Palavras-chave: Cão. Malformações. Vértebras.

INTRODUCTION

The main congenital disorders of the spinal column of dogs are: the vertebra being in a block, characterized by the failure of the separation of one or more vertebrae during vertebral development, which may fuse the vertebrae, forming the block; transitional vertebra, which exhibit characteristics of another vertebral segment and typically occur in the lumbosacral, cervicothoracic or thoracolumbar junctions; hemivertebrae, when there is a failure in the development of a vertebral body during the embryonic period, which is characterized by an asymmetry and incomplete fusion of the vertebral body structures, particularly in the middle and ventral portions, resulting in an abnormal anatomical shape (Leal, 2022). In this context, spina bifida stands out as a rare condition caused by the failure of the dorsal segment of the spinal column to close correctly during embryonic development, which can affect one or more vertebrae (Gomes, Sampaio, Anacleto, Malagó & Akamatsu, 2019).

The etiology of spina bifida remains unclear, however, it is believed to be influenced by nutritional, genetic, teratogenic, and, primarily, breed-related factors, with brachycephalic breeds being the most predisposed (Lempek, Bordelo, Veado & Dias, 2016; Kubaski, 2017). Maternal folic acid deficiency, as well as excessive vitamin A, have been cited in the literature as potential causes of this spinal column malformation (Kubaski, 2017).

Kubaski (2017) classifies spina bifida into three types: spina bifida occulta, characterized by bone alterations without involvement of the nervous tissues; open spina bifida, where there is herniation of the spinal cord and meninges, exposing them to the external environment; and cystic spina bifida, in which the spinal cord and meninges herniate above the skin, forming a cyst-like protrusion. The diagnosis is made through physical examination and imaging tests, such as radiography and myelography. Magnetic resonance imaging, on the other hand, is used to assess the degree of spinal cord involvement and is considered as the gold standard exam (Moraillon, Boussarie & Sénécat, 2013). Differential diagnoses include the formation of hemivertebrae, inflammatory or infectious diseases, and trauma (Fossum, 2014).

In mild cases, the recommended treatment focuses in pain management through analgesia, acupuncture, the use of adapted seats and physical therapy (Rabelo, Sousa & Beier, 2023). In more severe cases of spina bifida, surgical intervention may be considered, although the prognosis remains guarded (Moraillon et al., 2013).

This study reports a case of spina bifida in a newborn dog based on clinical and radiographic findings.

CASE REPORT

A two-day-old mixed-breed puppy weighing 150 grams was treated at the ANCLIVEPA-SP veterinary hospital. The animal presented a rectal temperature of 36 °C, normal-colored mucous membranes, mild dehydration, bradypnea, bradycardia, apathy, and exposure of the spine in the thoracolumbar region

(Figure 1). The animal presented paresis of the pelvic and thoracic limbs and remained in the prone position. The owner reported that it would try to move by dragging itself.

In the radiographic examination (performed on a MP 084-000 device, Series: 1445, OP: 27780, Type B, manufactured by Merpe Ltd. in February 2023) in the right lateral position (Figure 2), a significant dorsal deviation of the anatomical axis of the thoracic spine and a thoracolumbar transition (kyphosis) between T5 and T13 were observed, along with exposure of the dorsal portion of the articular facets from L1 to L4 to the external environment.

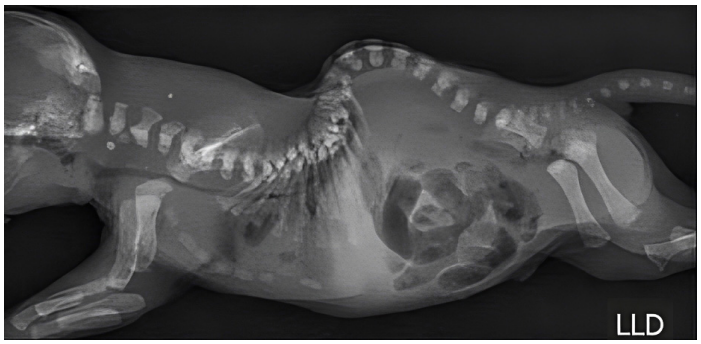
In the ventrodorsal projection (Figure 3) of the radiographic examination, the absence of closure of the dorsal arch in the vertebral segments from C1 to L7 was observed.

Radiographic findings indicated a severe form of spina bifida, characterized by the incomplete closure of the vertebral segments from C1 to L7, which could result in the exposure of nervous tissue to the external environment. Following the diagnosis and prognosis, the owner made the decision to euthanize the animal.

Figure 1
Dorsal aspect of the vertebral column, with exposure of the meninges in the thoracolumbar region.

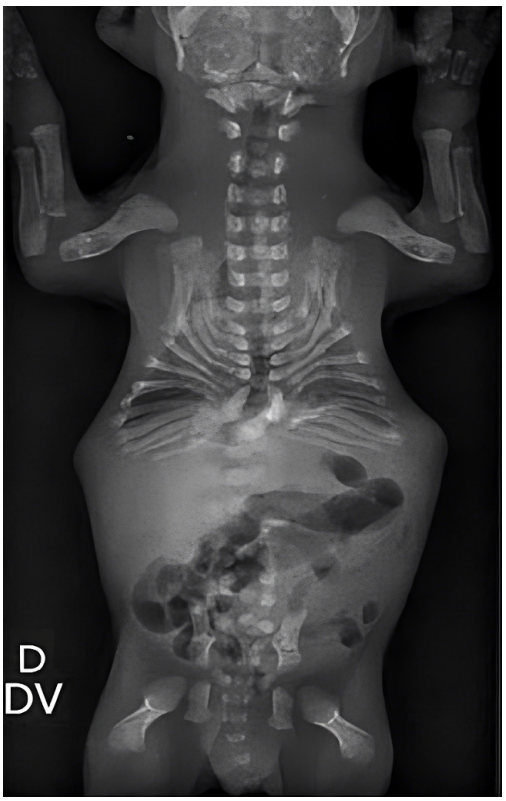
Source: The authors.

Figure 2
Right lateral radiographic image of the dog's spine, showing a significant dorsal deviation of the spinal anatomical axis.



Source: The authors.

Figure 3
Radiographic image in ventrodorsal projection of the dog's spine, showing the absence of closure in the vertebral segments from C1 to L7.



Source: The authors.

DISCUSSION

The dog described in this report was not brachycephalic, although these breeds are the most commonly predisposed to developing spina bifida (Moraillon et al., 2013). While there are few reports of spina bifida in mixed-breed dogs, this condition can occur due to defects in embryonic development.

The causes of spina bifida may be related to vascular malformations, accumulation of cerebrospinal fluid, and dilation of a focal area of the meninges, and can arise from either congenital or acquired factors (Westworth & Sturges, 2010).

The animal presented exposure of the meninges in the thoracolumbar region, dorsal deviation of the spinal anatomical axis, and failure of closure in the vertebral segments from C1 to L7. According to Lempek et al. (2016), the spina bifida of this animal can be classified as myelocele due to the defects in the vertebral structures associated with the protrusion of the spinal cord. The other two puppies in the litter, which consisted of three animals, showed no abnormalities.

The animal had urinary incontinence, though there was no report of fecal incontinence. It also exhibited ataxia in both the pelvic and thoracic limbs, along with herniation of the spinal cord and meninges, visible as a protrusion above the skin, which is characteristic of myelomeningocele. These clinical signs are consistent with those described in the literature, confirming the diagnosis of spina bifida (Moraillon et al., 2013; Rabelo et al., 2023).

Differential diagnoses include hemivertebrae, inflammatory or infectious diseases, and trauma, which usually present with neurological signs (Fossum, 2014). According to Westworth and Sturges (2010), the type of deformity, its location, time of onset, and severity may vary widely.

Folic acid deficiency may impair the formation of

the neural tube in puppies, increasing the risk of spina bifida (Mendonça, 2021). Kubaski (2017) suggests that maternal folic acid deficiency might be associated with a higher risk of spina bifida in canine puppies, while excessive vitamin A during pregnancy may also predispose the puppy to this condition.

Rossetim and Rafael (2020) state that among the various methods for diagnosing nervous system disorders, magnetic resonance imaging (MRI) is considered as the preferred examination for accurately and thoroughly diagnosing spina bifida. However, due to its high cost and limited availability in some regions, MRI was not performed in this case. Consequently, the diagnosis was confirmed by radiographic examinations which revealed in the right lateral projection a significant dorsal deviation of the anatomical axis of the thoracic spine and thoracolumbar transition between T5 and T13, along with exposure of the dorsal portion of the articular facets from L1 to L4 to the external environment. In the ventrodorsal projection, the absence of closure of the dorsal arch of the vertebral segments from C1 to L7 was also observed. The final diagnosis was obtained through physical and radiographic examination (Gomes et al., 2019). Although computed tomography and MRI do provide more detailed visualization of the spine and spinal cord, allowing for better identification of the extent and location of the malformation (Mothé et al., 2024), such techniques were not utilized in this case.

Treatment options vary depending on the severity of the condition, ranging from analgesia to acupuncture, use of adapted seats, and physical therapy for milder cases (Rabelo et al., 2023). In cases of overt or cystic spina bifida, surgical treatment may be considered, although the prognosis is often poor, with a high risk of infection due to the exposure of tissues to the external environment (Moraillon et al., 2013).

CONCLUSION

Spina bifida should be considered as a key differential diagnosis for congenital vertebral malformations in puppies, since this condition results from a failure in the closure of the neural tube during embryonic development. Imaging tests are essential for confirming the presence and extent of the condition, with magnetic resonance imaging being the gold standard test. The presentation of spina bifida can range from mild to severe, and in more pronounced cases, the condition is often incompatible with life. While significant data on spina bifida is already available, further research is needed to more accurately determine its etiology in order to help prevent its development.

COMPETING INTERESTS

The authors declare that there are no conflicts of interest.

FUNDING ACKNOWLEDGMENTS

The authors declare that they have no financial interests.

AUTHOR CONTRIBUTIONS

Conceptualization: L. B. *Data curation*: L. B. *Formal analysis*: L. B. *Investigation*: L. B. *Methodology*: L. B. *Project administration*: L. B. *Resources*: L. B. *Supervision*: K. M. B. O. *Validation*: L. B. *Visualization*: L. B. *Writing the initial draft*: L. B. *Revision and editing of writing*: K. M. B. O.

PEER REVIEW

Uningá Review thanks the anonymous reviewers for their contribution to the peer review of this work.

REFERENCES

Fossum, T. W. (2014). *Cirurgia de pequenos animais*. 4a ed. Rio de Janeiro, RJ.

Gomes, C. A. R., Sampaio, L. M., Anacleto, T. P., Malagó, R., & Akamatsu, A. (2019). Síndrome do cão nadador associada à espinha bífida em um cão: relato de caso. *Revista de Educação Continuada em Medicina Veterinária e Zootecnia do CRMV-SP*, *17*(1), pp. 85-86.

Kubaski, R. (2017). *Malformações vertebrais caninas*. [Monografia. Universidade Federal do Rio Grande do Sul]. LUME. https://lume.ufrgs.br/bitstream/handle/10183/170673/001051476.pdf?sequence=1

Leal, P. I. (2022). *Alterações congênitas em coluna vertebral de cães atendidos no hospital veterinário da Universidade Federal de Uberlândia*. [Monografia. Universidade Federal de Uberlândia]. UFU. https://repositorio.ufu.br/handle/123456789/37334

Lempek, M. R., Bordelo, J., Veado, J. C., & Dias, M, I, R. (2016). Espinha bífida em um cão sem raça definida – Relato de caso. *Revista Brasileira de Medicina Veterinária,38*(3), pp.211-213.

Mendonça, C. J. (2021). *Abordagem nutricional em cadelas gestantes.* [Trabalho de Conclusão de Curso, Centro Universitário de Brasília]. CEUB. https://repositorio.uniceub.br/jspui/handle/prefix/15622

Moraillon, R., Boussarie, D. L. Y., & Sénécat, O. (2013). *Manual Elsevier de Veterinária: diagnóstico e tratamento de cães, gatos e animais exóticos*. 7a ed. Rio de Janeiro, RJ.

Mothé, B. G, Carbone, S. F., Alves, S. V. I. A., Bonfim, A. H. L., Abreu, A. G., Oliveira, S. D., ... Júnior, M. F. A. Anatomia da coluna dos cães e implicações clínicas de malformações vertebrais. *Research, Society and Development*, *13*(6), p. e5713646029. doi: 10.33448/rsd-v13i6.46029

Rabelo, A. L., Sousa, F. G., & Beier, S. L. (2023). Presumptive diagnosis of spina bifida in canine patient. *Veterinária e Zootecnia, Belo Horizonte*, *30*(1), pp. 1-10. Retrieved from https://rvz.emnuvens.com.br/rvz/article/download/1119/1019

Rossetim, G. P., & Rafael, H. S. (2020). *Aspectos tomográficos de mielomeningocele em cão: relato de caso*. [Trabalho de Conclusão de Curso – TCC, Cruzeiro do Sul Educacional]. Repositório Cruzeiro do Sul. https://repositorio.cruzeirodosul.edu.br/jspui/handle/123456789/3286

Westworth, D. R., & Sturges, B. K. (2010). Congenital spinal malformations in small animals. *Veterinary Clinics of North America: Small Animal Practice*, *40*(5), pp. 951-981. doi: 10.1002/vms3.1266