*Opis przypadku* *Case report*

# Congenital urachal diverticulum in dogs: a case report

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Summary

**This study reports the case of a 4-year-old female Mastiff dog in which a congenital urachal diverticulum was diagnosed. The disorder was related with atypical clinical manifestations. The animal was referred for a radiological evaluation with the clinical signs of ataxia. The owner stated that the symptoms improved after each spontaneous micturition of a dog.**

**The radiological study revealed the presence of degenerative changes in the lumbosacral spine. Moreover, an abnormal shape of the urinary bladder in the abdominal cavity was observed. The ultrasound imaging showed a large diverticulum in the cranioventral part of bladder. The operative procedure and histopathological analyses have confirmed the presence of a urachal diverticulum. The clinical symptoms completely abated after the surgery.**

**Keywords: dog, urachal diverticulum, urinary bladder**

Bladder diverticula occur infrequently in domestic animals. Congenital and acquired diverticula (9, 10) currently are known. The acquired diverticula (pseudodiverticulum) develop after traumatic injury to the bladder or may be of neurogenic or iatrogenic origin (5, 10, 12). The common causes for diverticulum development are such conditions like: cystitis, neoplastic tumors or urolithiasis that lead to the intravesical pressure growth as a result of a lack or increased resistance of urine outflow (5, 10, 11). More frequently reported diverticula are those arising from malformation and anatomical defects, including, among others, anomalies within the urachal duct (4, 10).

These disorders have been addressed in only a few scientific reports on veterinary research (5, 9). Some of them focus on the occurrence of diverticula related with the urachal abnormalities.

In the prenatal life, the urachus is continuous between the fetal urinary bladder and the allantois. After parturition it undergoes atrophy during the lumen cicatrization at the bladder apex (4). If this process is disturbed or the obliterated duct gets re-patented, a number of pathologies occur within this structure. Depending on the a urachal part involved in the pathological process, the development of patent urachus, urachal ligament, sinus or urachal cyst and urachal diverticulum (3, 4, 9) can be discerned.

The paper reports a case of a dog whose initial diagnosis of a urachal diverticulum was made on the basis of the ultrasonographic and radiological examination. This initial evaluation was confirmed during the surgical intervention and histological examination.

## Case report

A female Mastiff aged 4 years was presented to the Laboratory of Radiology and Ultrasonography for examination of the lumbosacral spine and abdominal cavity. The medical history revealed that the dog showed signs of ataxia. According to the owner, the signs could not be associated with any reason and they disappeared after each micturition of the animal. The laboratory urinalysis indicated a slight amount of squamous epithelium, leukocytes and erythrocytes in the urine sediment (tab. 1).

**Tab. 1. Analysis of dog's urine**

| | |
|---|---|
| Color | straw |
| Appearance | clear |
| Urinary specific gravity | 1.010 |
| Protein | +/– |
| pH | 6.0 |
| Blood pigment, ketones, glucose, bilirubine | negative |
| Sediment: squamous epithelial cells | 0-8 |
| Leukocytes | 0-4 |
| Red blood cells | 0-1 |
| Urine casts | negative |

A radiographic examination was carried out in the lateral right recumbency (fig. 1). An image of the lumbosacral spine visualized the presence of degenerative changes between the seventh lumbar and the first sacral vertebrae (cauda equine syndrome). A view of the visceral organs did not show any abnormalities. The only anomaly observed in the abdominal cavity appeared to be a round shadow of 3 cm diameter; its opacity was similar to soft tissues at the cranioventral part of the moderately filled urinary bladder. The round shadow was clearly visible due to the adipose tissue that separated it from the small intestine and other abdominal organs.

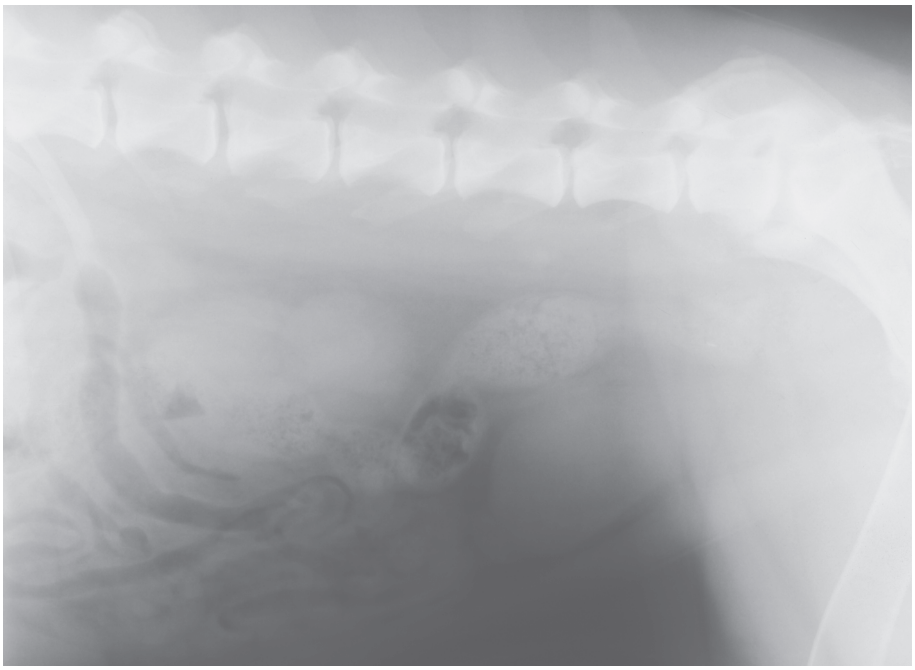

**Fig. 1. The survey radiograph of the abdominal cavity. Visible round shadow at cranioventral part of the urinary bladder**

Another diagnostic modality used was the ultrasound examination. It confirmed the evidence of an oval thin-walled, liquid-filled structure projected cranioventrally out of the urinary bladder lumen (fig. 2). Its dimensions were 2.8 × 2.6 cm with a clearly visible connection of 1.5 cm distance to the bladder. During the ultrasound imaging procedure, the transducer pressure directed towards the urinary bladder caused the thin-walled structure change its shape and size. At the ventral and dorsal wall of the bladder, in the site of the lesion communication with the bladder lumen, some echogenic structures resembling an incomplete septum of the structure characteristic of a bladder wall were also visualized. The urinary bladder was moderately filled with aechogenic urine. No deviations in the structure or echostructure of the other visceral organs, including kidneys, were recorded.

The ultrasonographic studies performed immediately after animal micturition had the purpose of determining potential urinary retention in the bladder (fig. 3). The reduction of the urinary bladder volume and diverticulum to only a slight level was visualized. The actual lesion size was 2.7 × 1.5 cm and the shape of the discovered formation was also changed.

On the basis of the ultrasonographic and radiological evaluation an initial recognition of a gross diverticulum at the cranial-ventral part of urinary bladder with concomitant urostasis in the urinary bladder and diverticulum was

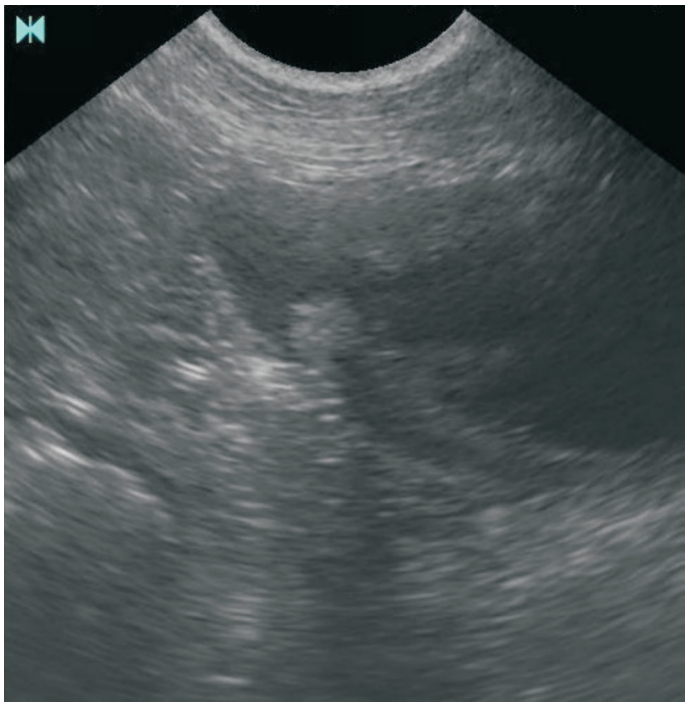

**Fig. 2. Ultrasound evaluation. Noticeable gross diverticulum in communication with the urinary bladder lumen**

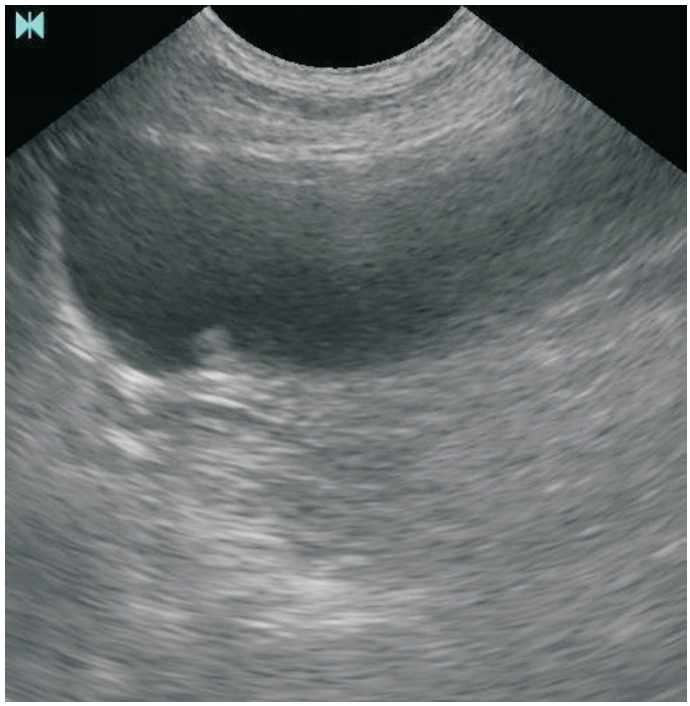

**Fig. 3. Ultrasound image of the urinary bladder and diverticulum – examination immediately after the dog's micturition**

established. The dog was referred to the doctor who decided to perform a surgical resection of the lesion.

The surgical procedure was conducted under general (xylasine and ketamine iv.) anaesthesia. The dog positioned in a dorsal recumbency had the integument incised for a distance of 10 cm at the median line of the postumbilical region. The urinary bladder was slightly filled and the diverticulum was visible only after its expansion by urine and pressure on the bladder base. It involved the bladder apex and had a diameter of approximately 3 cm with a centrally located scar after the urachus. The lesion without any clinical signs of an active neoplastic process was excised at the diverticulum base and closed with two series of simple interrupted sutures using 3/0 Safil thread (polyglycolic acid). As no postoperative inflammatory reaction was observed within the urinary bladder, the dog was administered a single--dose of amoxicillin therapy (Hostamox L.A.).

The resected diverticulum was sent for histopathological evaluation. Having fixed the sections in 10% neutral phormol, they underwent the routine hematoxylin-eosin (H&E) staining.

The microscopic image revealed all the layers of the urine bladder.

The marked hypertrophy of the muscle layer was found, visualized by the occurrence of thickened trabecula carnea running in many directions as well as a proliferation of the fibrous connective tissue (fig. 4). The other bladder structures did not show any pathomorphological changes.

The pain symptoms persisted for around 2 weeks following the surgical operation of the dog. At the time of acute post-operative pain, the animal showed the best therapeutic response to diastolic drugs (Biovetalgin, NO--SPA). Significantly, during the follow-up and at present (15 months) the dog has demonstrated full clinical symptom relief.

## Discussion

Abnormalities within the urachal duct, including the development of a urachal diverticulum have been rarely reported in veterinary literature. Most frequently they are documented in cats (8). A urachal diverticula develops as a result of partial obliteration and closure of the lower portion of the urachus at the bladder apex. In humans they account for only 3% of anomalies within this structure, thus constituting the rarest entity in this group of disorders (2, 4, 13).

Quite frequently, diverticula remain asymptomatic so are usually diagnosed incidentally. Only the complications following urine retention in the bladder causes occurrence of clinical signs like stranguria and dysuria (10, 11). The aforementioned complications include recurrent urinary tract infections, urolith formation (ammonium magnesium phosphate), development of vesicoureteral reflux, hydroureter and hydronephrosis (5, 9, 10). Some fistulas between the urinary bladder and the adjacent organs may occur as a result of the diverticulum infection (7). Chronic persistent irritation of the urinary bladder mucosa due to urinary stasis directly exposes the mucous membrane to harmful metabolites. Consequently, metaplasia of the urinary bladder mucosa may develop and, in turn, neoplastic lesions are formed (6). In humans a correlation between the formation of a urinary bladder diverticula and development of neoplastic changes has been observed. These have been reported to occur in approximately 1-10% of all bladder diverticula and 1.5% of all carcinomas arising in the bladder and recognized in humans (6, 11).

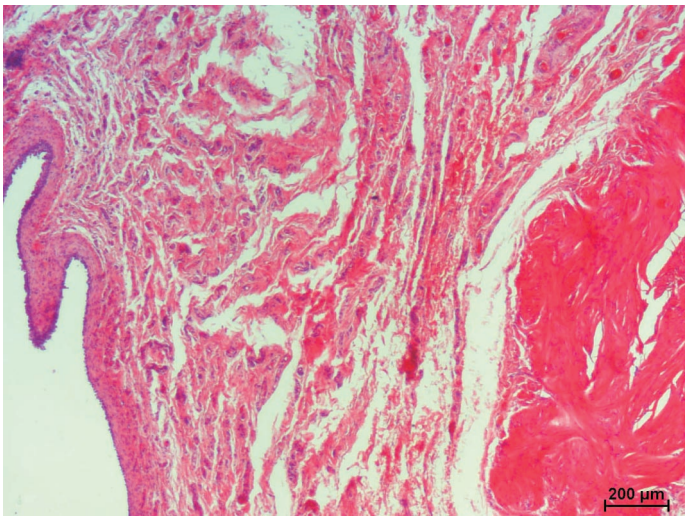


**Fig. 4. Microscopic view of bladder diverticulum**

Survey radiographs of the abdominal cavity prove unsatisfactory for complete diagnosis, therefore positive contrast cystography or double contrast cytography is required (10). Studies allow for visualization of a diverticulum as a smooth-walled structure connected with the urinary bladder lumen and, in the case of the anomalous urachus, located at the cranial-ventral part of bladder (1, 7, 8). Radiographs need to be taken in the lateral right and left side projections (10). This is important because thin-walled diverticula tend to collapse, so frequently they can not be visualized on the basis of only one projection. In the discussed case, a spherical structure of diverticulum was noticeable on the survey radiograph; however, a definitive diagnosis could not be established on the grounds of the radiographs taken. As a result ultrasound examination was recommended and performed. This evaluation, though, appears to have some difficulties. The diverticulum localization at the cranioventral part of urinary bladder causes its collapse when the patient is positioned dorsally and thus any abnormalities within the urinary tract might not be detected in the examination. An additional diagnostic problem proves to be the incomplete filling of the bladder (10). In the present case, none of the above-mentioned difficulties occurred, most likely due to the large size of the pathological change and various positioning of the dog during the examination, predominantly in the right lateral recumbency and in a standing position. However, changes in the diverticulum shape and size were visualized between the successive examination stages. The diverti-

culum was visible as a thin-walled structure in direct communication with the urinary bladder lumen. Importantly, some features indicating urine retention were noted in the absence of other characteristics associated with cystitis or other disorders that may arise from the retention indicated in the laboratory findings or imaging study.

Taking into account the medical history with the ultrasonographic image of a lesion and its characteristic localization in the cranioventral part of the urinary bladder, it was possible to establish an initial diagnosis. It was definitely confirmed at surgery and histological evaluation.

This 4-year-old patient manifested the clinical symptoms relatively late, yet the literature reports that urinary bladder diverticula may remain asymptomatic for a long time. In this case the clinical manifestations were noted a month before the radiological examination. An atypical symptom associated with ataxia was most likely to result from severe pain prior to micturition. Strong abdominal pain which can be typical for other disorders is often reported in humans (12). The clinical symptoms observed in the dog under study disappeared completely two weeks after the surgery repair.

Subject to the nature of a lesion, diverticulum may be histologically differentiated into a congenital anomaly or an acquired defect. In the lesions congenital in origin, all the urinary bladder layers are noticeable as opposed to acquired diverticula, where the muscular fiber layer is not found (5, 10, 12). This follows from the fact that the latter type of change is associated with seromuscular tears with herniation of bladder mucosa. It is usually reported in the cases of traumatic injuries or diseases characterized by difficult micturition (10). Whereas the congenital anomalies are due to weakness of the bladder detrusor muscle, with no risk of rupture (5).

In the presented case, the canine diverticulum was found to consist of all urinary bladder layers and the medical report did not have any past history of difficult micturition, which may imply the congenital origin of the disorder.

## References


1. *Kaealy J. K., McAllister H.*: Diagnostic radiology and ultrasonography of the dog and cat. Elsevier Inc., St. Louis 2005, 126-143.
2. *Khati N. J., Enquist E. G., Javitt M. C.*: Imaging of the umbiliculus and periumbical region. RadioGraphics 1998, 18, 413-431.
3. *Klim M., Kordasz J., Ołubiec J.*: Przypadek zakażonej torbieli moczownika. Urol. Pol. 2006, 59, 1.
4. *Laverty P. H., Salisbury S. K.*: Surgical management of true patent urachus in a cat. J. Small. Anim. Pract. 2002, 43, 227-229.
5. *Lobetti R. G., Goldin J. P.*: Emphysematous cystitis and bladder trigone diverticulum in a dog. J. Small. Anim. Pract. 1998, 39, 144-147.
6. *Matta E. J., Kenney A. J., Barré G. M., Vanlangendonck R. M.*: Intradiverticular bladder carcinoma. RadioGraphics 2005, 25, 1397-1403.
7. *Nyland T. G., Matton J. S.*: Diagnostyka ultrasonograficzna małych zwierząt. Galaktyka, Łódź 2002, 235-249.
8. *O'Brien R., Barr F.*: BSAVA Manual of Canine and Feline Amdominal Imaging. BSAVA. Gloucester 2009, 205-221.
9. *Remedios A. M., Middleton D. M., Myers S. L., Outerbridge C. A., Arnold P. M.*: Diverticula of the urinary bladder in a juvenile dog. Can. Vet. J. 1994, 35, 648-650.
10. *Scheepens E. T. F., L'Plattenier H.*: Acquired urinary bladder diverticulum in a dog. J. Small. Anim. Pract. 2005, 46, 578-581.
11. *Tamas E. F., Stephenson A. J., Cabell S. C., Montague D. K., Trusty D. C., Hansel D. E.*: Histopathologic features and clinical outcomes in 71 cases of bladder diverticula. Arch. Pathol. Lab. Med. 2009, 133, 791-796.
12. *Wiśniewski J., Rożniecki M., Janiak Z.*: Zapalnie zmieniony uchyłek pęcherza moczowego naśladujący ostre zapalenie wyrostka robaczkowego. Urol. Pol. 1982, 35, 1-2.
13. *Yu J. S., Kim K. W., Lee H. J., Lee Y. K., Yoon C. S., Kim M. J.*: Urachal remnant diseases: spectrum of CT and US findings. RadioGraphics 2001, 21, 451-461.


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