Gas-containing lumbar disc protrusion in Dogs: Three Cases

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Objective: To report 3 dogs who developed a gas-containing lumbar disc protrusion.

Study Design: Clinical report

Animals: Dogs (n=3)

Methods: Three dogs were referred for the diagnosis and treatment of spinal hyperesthesia and ataxia. CT and MRI scans were performed. In two dogs the gas-containing lumbar disc protrusion was removed surgically.

Results: The two operated dogs improved after the surgery and showed no symptoms at the follow up examinations.

Conclusion: Gas-containing lumbar disc protrusion is a rare condition in humans and dogs, and based on the successful treatment of these cases and the experiences in human spine surgery, surgical decompression of the cauda equina affected by a gas-containing disc protrusion can be recommended.

Pneumorrhachis or spinal gas is a rare clinical diagnosis reported the first time in human medicine in 1977. Traumatic and iatrogenic pneumorrhachis are distinguished from disk-associated or spontaneous spinal gas. After a trauma gas can enter the spinal canal originating from a pneumothorax/pneumomediastinum or through open skull fractures. Also surgical interventions of the head and epidural injections can lead to iatrogenic spinal gas. A disk-associated or spontaneous spinal gas formation is very rare and can follow the accumulation of gas within a degenerating or infected intervertebral disk. This condition in the thoracic spine has been reported in 2011 in a neurologically symptomatic Rottweiler. It is the purpose of this
study to describe three cases of a gas-containing lumbar disc protrusion, a to the author’s
knowledge unpublished form of disk-associated pneumorrhachis in dogs.

CLINICAL REPORT

Case 1: Cane Corso, intact male, two years old, was presented for the evaluation and therapy
of lumbo-sacral pain. General exam was unremarkable. During orthopaedic and neurologic
examination a clear pain reaction was found during palpation and extension of the lumbo-sacral
junction. No neurologic deficits were noted. The following CT and MRI scans showed a
reduced signal intensity and marked dorsal protrusion of the L7-S1 intervertebral disc (IVD)
together with a vacuum phenomenon (VP) (Figure 1a). A surgical dorsal decompression with
removal of the protruded disk was performed, and the dog improved to normal within 2 months
of rehabilitation.

A 2nd MRI 12 months later showed a small disk-associated pneumorrhachis dorsal of the L7-
S1 IVD without compression of the cauda equina.

Three years after the surgery the dog was referred again because the clinical signs had returned.
Palpation of the lumbo-sacral junction was painful, the dog vocalized when getting up or
walking on stairs. A new CT scan showed that the pneumorrhachis had increased in size and
was compressing the cauda equine from ventral together with a soft tissue density interpreted
as prolapsed IVD (Figure 1b). Surgical exploration was recommended. The dorsal approach to
the L7-S1 laminectomy revealed a healthy fat graft. The pneumorrhachis was a smooth soft
tissue elevation from the vertebral floor which collapsed after incision. The cyst wall and the
protruded IVD was removed after releasing the cauda equina from adhesions to the spinal canal
floor and the compressing tissue. Closure with a fat graft was routine. Postoperative CT showed
successful decompression (Figure 1c), and the dog improved again and had no signs of lumbar
pain at the 3 months follow up examination.
Figure 1a  Pre-operative transverse CT and sagittal T2-weighted MRI of case 1 showing a vacuum phenomenon and a L7-S1 Hansen type II IVD protrusion

Figure 1b  3 years after the surgery to remove the IVD protrusion described in Figure 1a a symptomatic compression of the cauda equine by a gas-containing disc protrusion is visible on the transverse CT and sagittal CT and MRI images (arrow). The vacuum phenomenon is visible on the sagittal CT image (arrow head)

Figure 1c  Post-operative CT scan show the removal of the gas-containing disc protrusion in case 1
**Case 2**: A German Shepherd Dog, 8 years old intact female was referred for the further imaging and therapy of pain in the lumbo-sacral junction. The dog showed no neurological deficits of the hind limbs, but signs of pain during jumping and climbing stairs. According to the owner the dog was also showing behavior changes due to the chronic pain, being more aggressive towards other dogs. Conservative therapy with rest and NSAID had not improved the situation within six weeks. The CT scan revealed a sacral OCD lesion with a large fragment in the left vertebral canal caudal of the L7-S1 IVD. Cranial of the fragment an IVD protrusion with gas inclusion can be seen in the right vertebral canal, also affecting the cauda equina (Figure 2a).

Because of the unsuccessful conservative treatment surgery was performed. The OCD fragment and the disk protrusion Hansen type II including the pneumorrhachis was removed via a dorsal laminectomy L7-S1 (Figure 2b). After 6 weeks the patient had improved, and 3 months after the surgery the dog was walking and running normally, and the owner reported a better social behavior.

**Figure 2a** Pre-operative CT scan of case 2 showing the bony OCD fragment (white arrows) and the gas-containing disc protrusion (black arrows) affecting the cauda equina at the L7-S1 level.
Figure 2b: Post-operative CT scan of case 2 showing that the bony OCD fragment and the gas-containing disc protrusion have been removed.

Case 3: A 4-year-old French Bulldog, castrated male, was referred with the anamnesis of progressing ataxia of the hind limbs. General examination and blood values were normal, but a marked ataxia of both hind limbs with reduced proprioception was recorded. The reflexes of the hind limbs were hyperactive, front limbs normal. Strong pain was detected in the lumbo-sacral junction. With a clinical localization of the neurological deficit causing pathology within Th3-L3, CT and MRI scans were performed. A small vacuum disc phenomenon and more degenerative changes of the L7-S1 IVD were visible. Additionally the L7-S1 IVD was protruded (Hansen type II) and a pneumorrhachis had developed (Figure 3a). In the area of Th6-Th7 malformations of the vertebra were detected together with a T2 hyperintense signal change within the spinal cord indicating trauma to the nervous tissue or a vascular incident (Figure 3b). Because of the progressing symptoms and the malformations, a vertebral instability plus a Hansen type II protrusion was considered to be most likely. After discussing the findings, the owner decided not to decompress the cauda equina and treating the dog’s ataxia conservative with NSAID and rehab.
Figure 3a CT scan of case 3 showing the gas-containing disc protrusion (black arrows) affecting the cauda equina at the L7-S1 level.

Figure 3b MRI scan of case 3 showing the vertebral malformation, ventral compression and intramedullary signal change at the level Th6-7 (white circle) and the gas-containing disc protrusion (white arrow) affecting the cauda equina at the L7-S1 level.

DISCUSSION

The vacuum disc phenomenon (VP), known as a presence of gas in the intervertebral disc (IVD), is a relative common radiological finding in humans and dogs, especially on computed tomography (CT). The vacuum phenomenon is caused by the accumulation of gas in the disc as it degenerates or the nucleus pulposus material extrudes as Hansen type I herniation. It has also been associated with infection, invasive procedures and trauma to the IVD. The created spaces within the IVD fills up with gas containing nitrogen, which originates from gases dissolved in the extracellular fluid and diffuses into areas of subatmospheric pressure during
movement of the IVD. In patients with degenerative disc disease, the nitrogen is liberated in the disc fissures and cannot be reabsorbed or replaced by liquid because the degenerated disc is mainly avascular. If the annulus fibrosus ruptures, this air is released. Accumulation of this gas in the epidural space is a rare finding and an unusual cause of clinical symptoms. The gas can accumulate either within a herniated disc or within a cyst in the absence of disc herniation. Ball-valve type connection may cause an increase in the pressure of gas inside the gas containing disc or cyst in the epidural space. If the gas cyst grows, the clinical features can be similar to those of more common causes of nervous tissue compression within the spinal canal like Hansen type I and II IVD extrusion/protrusion, intraspinal cyst formation or tumours.

CT is the investigation of choice for the diagnosis. The CT scans not only show that the mass within the spinal canal is composed of gas but also provide useful information on the condition of the disc and the rest of the spine. The typical findings include degenerative disc disease with VP and, at the same level, a collection of epidural gas in contact with the nerve root corresponding to the distribution of the pain. This last point is important because epidural gas is sometimes present in asymptomatic patients. The gas collection can range in size from a few millimetres to 1 centimetre and in density from - 200 to - 900 Hounsfield units. Rim enhancement can be seen. Gas in the epidural space may be absorbed spontaneously. Therefore, in patients with gas-related neurologic symptoms, conservative treatment with nonsteroidal anti-inflammatory drugs, gabapentin and muscle relaxants should be the first choice. Aspiration of the gas collection under fluoroscopic guidance has been used in human patients, but when the procedure induced pain relief, this effect lasted 6 months at the most. Disk-associated pneumorrhachis is surrounded by a fibrotic capsule, and can grow with time as shown in case 1. Surgery is recommended in patients who fail to respond to conservative
The here presented canine cases resemble the human cases described as gas-containing lumbar disc herniation, which have been successfully treated by surgery. The two canine patients treated with surgical removal of the gas-containing disk protrusion improved after the procedure and rehabilitation. Based on the successful treatment of these cases and the Rottweiler with a thoracic disk-associated pneumorrhachis described by MacDonald and co-authors, together with the experiences in human spine surgery, surgical decompression of the cauda equina affected by a gas-containing disc protrusion can be recommended.

REFERENCES


