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Atlantoaxial instability with hydrocephalus in a dog

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Abstract : An 8-month-old 3.15 kg female Cocker-spaniel with history of ataxia referred to the Veterianary Medical Teaching Hospital, Chungnam National University. There were no abnormalities in CBC and serum chemical analysis. Agenesis of dens was found on dorsoventral view in cervical radiography. Compressed cervical spinal cord and enlarged cerebral ventricle were observed in magnetic resonance imaging. It was diagnosed as atlantoaxial instability with hydrocephalus. For conservative therapy, neck brace was applied and diuretics and prednisolone were administered. The dog's ataxia became better gradually.

Key words : atlantoaxial instability, dog, hydrocephalus, MRI, radiography

Introduction

Atlantoaxial instability is encountered most often in small breed dogs, particularly Yorkshire terriers, Chihuahuas and Miniature poodles [1]. Atlantoaxial instability that permits excessive flexion of the joint may result in compression of the spinal cord as a result of dorsal displacement of the cranial portion of the axis into the vertebral canal. Agenesis or hypoplasia of the dens, nonunion of the dens with the axis, absence of the transverse ligament of the atlas, and dorsal angulation of the odontoid process with compression of the spinal cord have been associated with atlantoaxial instability in dogs [2, 11, 12].

The diagnosis of atlantoaxial instability can be performed based on the signalments, history, and clinical signs described previously [1, 4, 9]. Survey radiographs provide the diagnostic signs in most cases. The flexed lateral view is the most useful. Mild flexion of the cranial cervical region may be required to demonstrate misalignment, but this must not be excessive. A ventrodorsal view and oblique radiographs can provide an excellent image of the dens [3, 11]. Although much simpler techniques are available to assess atlantoaxial instability, advanced imaging can add important preoperative information. Computed tomography (CT) provides excellent bone imaging, which will reveal abnormal dens conformation [7]. Magnetic resonance imaging (MRI) might prove to be prognostic if there is extensive spinal cord malacia and it will also reveal syringohydromyelia [10].

In this case, we described the atlantoaxial instability with hydrocephalus diagnosed by MRI in a 8-month old cocker spaniel dog.

Case

An 8-month-old female cocker spaniel had a history of ataxia and seizure for 2 months. There was cervical rigidity and pain on physical examination. The results of CBC and serum chemistry were normal. A lesion localized to the cranial cervical spinal cord was suspected.

On survey cervical radiographs, the dens was not be identified in dorsoventral view and abnormal alignment of C1-C2 was noted in flexed lateral view (Fig. 1). Therefore, it was diagnosed as atlantoaxial instability secondary to absence of the dens.

MRI was performed to find if there is abnormalities including myelomalacia, concurrent syringohydromyelia, and hydrocephalus. The dog was anesthetized with thiopental sodium and isoflurane. T1 and T2 weighted sagittal and transverse images were obtained. Sagittal T1 and T2 weighted images showed severe compression of spinal cord. Also, slightly high signal intensity was

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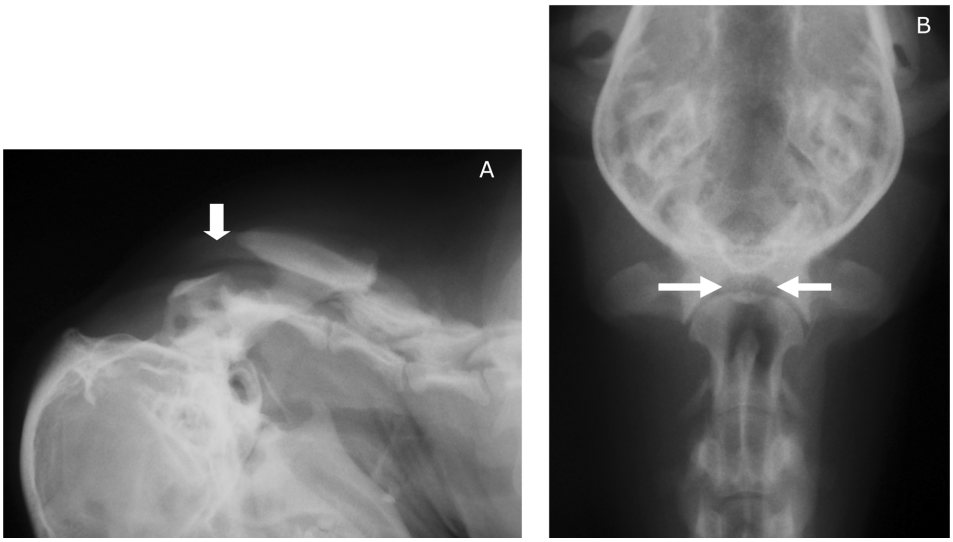

Fig. 1. Flexed lateral radiograph (A) shows marked increase in the space between the dorsal arch of C1 and spinous process of C2 (arrow). The dens is not identified (arrows) in dorsoventral veiw (B).

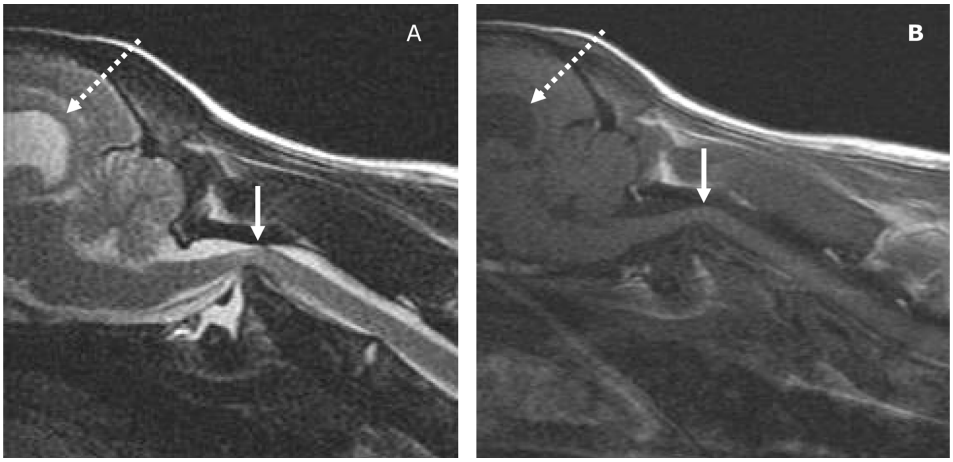

Fig. 2. Sagittal T2 weighted (A) and T1 weighted MR images (B). Lateral ventricle is dilated and presented as hyperintense on T2 weighted and hypointense on T1 weighted images (dotted arrows). There is severe compression of spinal cord between C1 and C2 on both images, and mild hyperintense foci on T2 weighted images indicate spinal cord edema (arrows).

presented at spinal cord between C1 and C2 level on T2 weighted images. Ventriculomegaly was seen as a hypointensity in T1 and a hyperintensity in T2 weighted images (Fig. 2).

The neck brace was applied to the patient. Medical managements include infusion of mannitol 1 g/kg intravenously and oral administration of prednisolone and furosemide twice a day. At 7 days post diagnosis, there was a gradual improvement in neurological status with improved gait and walking. At 2 weeks after diagnosis, the patient showed nearly normal gait. The medications was tapered with improvement of the dog's condition.

Discussion

Animals with congenital atlantoaxial joint abnormalities usually develop clinical signs during the first year of life [9, 11]. Clinical signs may have an acute onset,

may be slowly progressive, or may be intermittent. Clinical signs are indicative of a transverse myelopathy between C1 and C5 and vary from mild cervical pain to tetraparesis or tetraplegia and possibly death as a result of respiratory paralysis [11]. Hydrocephalus has been reported in dogs with atlantoaxial subluxation and could cause the animal to show forebrain signs [1]. Forebrain signs of disorientation and behavior change, along with vestibular deficits have also been associated with basilar artery compression caused by the dens [6].

In this case, the dog had shown slowly progressive neurologic clinical signs since it was 6-month old. Clinical signs were very typical for cranial cervical disease, such as neck pain, ataxia, and cervical rigidity. Also seizure, forebrain sign, was noted and thought that caused by hydrocephalus or severe basilar artery compression by the cranial part of the axis or both.

Atlantoaxial instability is best demonstrated by radiography. Radiographically, the body of the axis is displaced dorsally and cranially into the vertebral canal, and the distance between the dorsal arch of the atlas and the spinous process of the axis is increased [3]. Lateral radiograph may be nondiagnostic because of superimposition of atlas wing. Slight flexion of the head or oblique view may be necessary. Agenesis or malformation of the dens may be an incidental finding and is probably not of clinical significance unless associated with radiographic findings of atlantoaxial instability. However, spinal cord compression associated with hypoplasia of the dens has been reported in a dog [9]. In these cases, myelography or advanced imaging may be necessary to demonstrate spinal cord injury.

The present case was confirmed as atlantoaxial instability with dens agenesis by radiography, especially dorsoventral projection. Lateral view couldn't visualize atlantoaxial instability, but flexed lateral view showed malalignment and increase of distance between C1 and C2. We did not perform myelography. MRI examination was performed as advanced imaging tool and revealed severe spinal cord compression and mild focal hyperintensity lesion at C1-C2 level on T2 weighted image. Also, hydrocephalus was observed as hypointensity on T1 weighted image and hyperintenstiy on T2 weighted saggital MR imaging. There were no evidence of extensive cord malacia or syringohydromyelia previouly reported common concurrent disease with atlantoaxial instability.

Surgical stabilization is traditionally the preferred treatment for atalntoaxial instability [1, 8]. Nonsurgical treatments contain cage rest, application of a neck brace and use of analgesics. This approach was reported that produce remarkable good results [4, 5, 7]. Neck brace was used to stabilize the atlantoaxial joint by immobilizing the cervical vertebral column in an extended position in our patient. Corticosteroid was orally administered twice a day. In addition to traditional treatments, mannitol and furosemide was used to reduce hydrocephalus confirmed by MR imaging.

Residual or continued neurologic deficits after surgical or nonsurgical treatments may result from progressive demyelination, axonal degeneration or malacia, continued atlantoaxial instability or concomitant neurologic disease [9, 11]. In this case, residual signs was not shown after stabilization. It may be due to no malacia on MR imaging and no deviation of atlantoaxial alignment on radiography. Although concurrent hydrocephlus was treated by medications, it's unsure about long-term effect of hydrocephalus on clinical signs.

Conclusion

Atlantoaxial instability was diagnosed by flexed lateral and dorsoventral survey radiography in 8 month old cocker spaniel dog. MR imaging is considered very valuable method to identify spinal cord damage by dens or body of the axis and concurrent disease like hydrocephalus in atlantoaxial instability. Conservative treatment is very helpful for recovery of clinical signs in this case.

References

1. **Denny HR, Gibbs C, Waterman A.** Atlantoaxial subluxation in the dog: a review of thirty cases and an evaluation of treatment by lag screw fixation. J Small Anim Pract 1988, **29**, 37-47.
2. **Dewey CW.** Myelopathies: Disorders of the spinal cord. In: Dewey CW (ed.). A Parcitcal Guide to Canine and Feline Neurology. pp. 277-336, Iowa State Press, Ames, 2003.
3. **Farrow CS.** Congenital spinal malformations (Congenital spinal anomalies). In: Vetrinary Diagnostic Imaging: The Dog and Cat. Vol. 1. pp. 258, Mosby, St. Louis, 2003.
4. **Having ME, Cornell KK, Hawthome JC, McDonnell**

JJ, Selcer BA. Evaluation of nonsurgical treatment of atlantoaxial subluxation in dogs: 19 cases (1992-2001). J Am Vet Med Assoc 2005, **227**, 257-262.

5. **Hawthorne JC, Cornell KK, Blevins WE, Waters DJ.** Nonsurgical treatment of atlantoaxial instability: A retrospective study. Vet Surg 1998, **27**, 526.
6. **Jaggy A, Hutto VL, Roberts RE, Oliver JE.** Occipitoatlanto-axial malformation with atlantoaxial subluxation in a cat. J Small Anim Pract 1991, **32**, 366-372.
7. **Johnson SG, Hulse DA.** Odontoid dysplasia with atlantoaxial instability in a dog. J Am Anim Hosp Assoc 1989, **25**, 400-408.
8. **Lorinson D, Bright RM, Thomas WB, Selcer RR, Wilkens BA.** Atlantoaxial subluxation in dogs: the results of conservative and surgical therapy. Canine Pract 1998, **23**, 16-18.
9. **Oliver JE, Lorenz MD, Kornegay JN.** Tetraparesis, Hemiparesis, and Ataxia. In: Handbook of Veterinary Neurology. 3rd ed. pp. 173-215, Saunders, Philadelphia, 1997.
10. **Sanders SG, Bagley RS, Silver GM.** Complications associated with ventral screws, pins and polymethylmethacrylate for the treatment of atlantoaxial instability in 8 dogs. J Vet Intern Med 2000, **14**, 339.
11. **Sharp NJH, Wheeler SJ.** Atlantoaxial subluxation. In: Small Animal Spinal Disorders: Diagnosis and Surgery. 2nd ed. pp. 161-180, Mosby, Edinburgh, 2005.
12. **Shires PK.** Atlantoaxial conditinos and wobbler syndrome. In: Slatter D (ed.). Textbook of Small Animal Surgery. 3rd ed. pp. 1173-1180, Saunders, Philadelphia, 2003.
13. **Thomas WB, Sorjonen DC, Simpson ST.** Surgical management of atlantoaxial subluxation in 23 dogs. Vet Surg 1991, **20**, 409-412.
14. **Watson AG. Lahunta A.** Atlantoaxial subluxation and absence of transverse ligament of the atlas in a dog. J Am Vet Med Assoc 1989, **195**, 235-237.