RADIOGRAPHIC DIAGNOSIS OF ATLANTO-AXIAL INSTABILITY

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Atlanto-axial instability refers to lax-ity of the articulation between the atlas (the first cervical vertebrae) and the axis (the second cervical vertebra) allowing increased angulation between the two bones and causing compression of the cranial cervical spinal cord. Stabil-ity of the atlanto-axial joint is normally provided by the dens (odontoid process) of C2 as well as by ligamentous attachments and when these structures are damaged or absent, atlanto-axial (AA) instability occurs. AA instability may be congenital (usually due to an aplastic or hypoplastic dens or non-union of the dens) or may be acquired due to trauma such as fracture of the dens or rupture of the transverse liga-ment of the atlas. [1, 2] A congenital defect such as hypoplasia or agenesis of the dens may predispose to traumatic injury of the spinal cord, though in animals with an intact dens, the dens may protrude into the spinal canal after trauma and exert greater pressure on the ventral spinal cord thus exaggerating the degree of spinal cord trauma.[3]

Young, small breed dogs are over-represented, and clinical signs may include varying degrees of cervi-cal pain, ataxia, tetraparesis, or respiratory paralysis which may lead to apnea and ultimately death. Symp-toms may be acute or gradual in onset, and may wax and wane in clinical signs. Asymptomatic or mildly symptomatic patients with congenital malformation may worsen acutely after even mild trauma such as jumping off furniture.[1, 3]

Radiographic Diagnosis

AA-subluxation is diagnosed radiographically when there is increased space between the dorsal arch of C1 and the spinal process of C2 on a lateral projection of the cervical spine (Figure 1a).

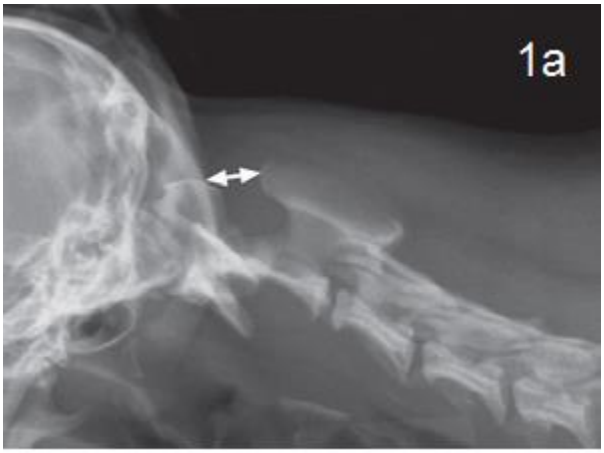

Figure 1a and 1b: Lateral (Figure 1a) and ventrodorsal (Figure 1b) projections of the atlanto-axial junction of a patient with a hypoplastic dens. Note the increased space between the dorsal arch of C1 and the cranial spinous process of C2 (double white arrow). The hypoplastic dens is well visualized in the VD view (black arrows), but on the traditional lateral projection (Figure 1a), the area of the dens cannot be clearly seen because of superimposition of the wings of the atlas.

Although slightly flex-ing the cervical neck (Figure 2a) can exaggerate the increased space often seen between the atlas and the axis in order to aid diagnosis, this is dangerous in a patient with AA instability as it can exert more pres-sure on the spinal cord at this level.An open mouth view has also been described in order to highlight the dens, but this technique, too, can further damage the spinal cord because of the increased flexion of the spine required. A safer alternative for obtaining a radiographic diagnosis when neutral lateral views fail to do so is obtaining an oblique lateral view with the cervical spine in a neutral position (Figure 2b). This view highlights the area of the dens by removing the superimposition of the lateral spinous processes/ wings of the atlas while protecting the cord from potential trauma.

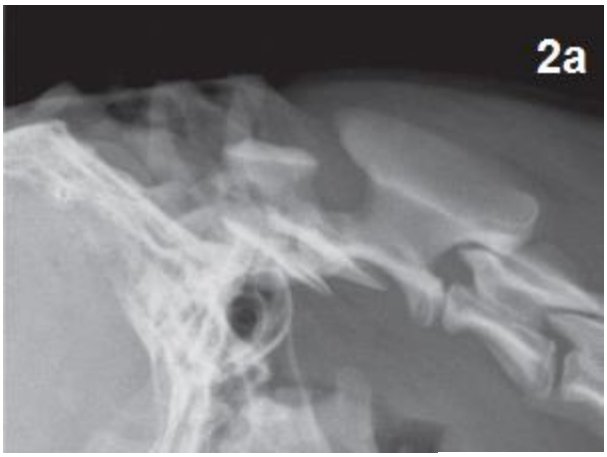

Figure 2a, 2b, and 2c: This 8 month old patient presented for intermittent episodes of ataxia and screaming which occurred every few weeks, but were becoming more frequent and severe. On physical exam, conscious proprioceptive deficits and ataxia were noted in all limbs. Lateral flexed (2a) and oblique lateral (2b) projections both show an aplastic dens, however the oblique lateral projection shows this without the need for flexion which could damage the spinal cord. A ventrodorsal projection confirms absence of the dens showing only a smooth margin between C1 and C2. The patient was managed conservatively with crate rest, a neck brace, steroids and pain management and improved clinically.

An oblique lateral projection of a patient with a normal AA junction and normal dens is shown for comparison in (Figure 3). Radiographi-cally, an increased angle between the vertebral canal over the body of C1 and C2 can also be seen whereas in a normal patient, the vertebral canals of C1 and C2 are parallel.

Figure 3: A normal patient is presented for comparison. An oblique lateral view shows a normally protruding dens (arrow) and normal overlap of the dorsal arch of C1 and the spinous process of C2.

Advanced imaging can also be useful to further characterize the spine and spinal cord; CT can help identify any additional abnormalities of the spinal column, and to see deformations of the dens. MRI can be used to further assess the spinal cord itself and can show syrinx formation, edema, and spinal cord compression.

Treatment and Prognosis

Conservative or surgical treatment can be per-formed and both are more successful in younger patients with milder pain and more acute symp-toms. Surgical treatment is usually the treatment of choice to definitively stabilize the joint, particularly in skeletally mature patients with chronic symp-toms and in whom conservative treatments have failed, but both conservative and surgical manage-ment involve at least 6-8 weeks of crate rest, and a neck brace or body cast to minimize motion of the AA joint. A number of surgical techniques may be used using either a dorsal or, more commonly, a ventral approach to the joint. Surgical stabilization may include the use of pins or screws, polymethyl methacrylate (PMMA), or bone plates.[4]

References

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