

Study on the diagnosis and surgical treatment for atlantoaxial instability in the dog

Abstract of Doctoral Thesis

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Atlantoaxial instability (AAI), commonly affecting young toy-breed dogs (TBDs), results in severe cervical spinal cord injury. In most cases of AAI, ventral fixation of the atlantoaxial joint (AAJ) results in a favorable prognosis. However, in some cases, patient outcome following surgical treatment of AAI was worse than expected. In these cases, pathologic participation of concurrent craniocervical junction abnormality (CJA) that does not include AAI is suspected. The purpose of this study was to clarify the diagnosis and treatment of AAI in dogs with pathologic causation of AAI and CJA.

In chapter 2, we calculated the ratio of the dens length to the axis body length (DALR) and the dens angle (DA), and evaluated morphological characteristics of the dens. Our findings suggest that in AAI-predisposed TBDs with low DALR and great DA, the values of DALR and DA may be important factors for predicting the development of AAI. In chapter 3, we studied incomplete ossification of the dorsal neural arch of the atlas (IODA) in TBDs with AAI. IODA was observed in approximately 70% of AAI-affected TBDs, and the results suggested that IODA was an etiology of AAI, which developed at middle to advanced age. In chapter 4, we evaluated the mechanical strength of implant in three types of ventral fixation techniques for AAJ, using the atlas and axis harvested from healthy Beagle dogs. The currently used multiple metallic implant and polymethylmethacrylate (PMMA) fixation (PMF) was once again proven to be a useful method for AAJ fixation, with the highest fixation strength in the flexural test and with no significant differences in the maximum load between the atlantoaxial plate fixation (APF) group and the PMF group in the torsional test. In addition, APF is considered an alternative fixation method to PMF. In chapter 5, we evaluated how ventral AAJ fixation techniques influence the fusion of AAJ. The possibility that APF can result in a more ideal AAJ bony fusion in terms of histology than PMF was suggested. In chapter 6, we studied the clinical outcomes after ventral

fixation in TBDs with AAI, based on the presence or absence of atlantooccipital overlapping (AOO). The findings suggested that the presence of AOO affects the clinical signs for dogs with AAI but does not directly affect the outcome of the surgical stabilization of AAI. In chapter 7, we studied the cerebral ventricle size, which seems to be related to AOO, in AAI-affected TBDs with or without AOO. AAI-affected TBDs, with concurrent AOO, exhibited significantly greater dilatation of the lateral and fourth ventricles than those without concurrent AOO.