Radiological Diagnosis and Surgical Stabilization of the Atlantoaxial Subluxation in a Dog

Nam-Soo Kim

Small Animal Surgery, School of Veterinary Studies, Murdoch University, WA 6150, Australia

개의 환축추 아탈구의 방사선진단 및 외과적 고정

김 남 수

호주 머독 대학교 수의과대학 소동물 외과

요 약 : 10개월령의 그리폰 밴딘 수컷 강아지가 8개월령 부터 점점 운동 실조 및 마비증상 을 나타내어 머독대학 동물병원에 내원 하였다. 내원 했을 때 주변에 매우 민감한 반응과 경계 를 늦추지 않았지만 호흡과 심박수 및 체온은 정상이었다. 일반 방사선 사진 및 척수조영사진 (myelography)을 촬영하여 확인한 결과 환축추의 불안정에 따른 척수의 복측 압박을 확인할 수 있었다. 외과적 고정은 복측 접근을 통하여 2개의 키르크너 강선(Kirschner wire)과 자가골 이식을 실시하였으며 8주동안 외부 고정을 하였다. 수술 후 5개월 동안 지켜본 결과 증상은 꾸 준히 좋아졌으며 환축추 관절의 관절고정술(arthrodesis)은 완벽한 고정을 유지하고 있었다.

Key words : atlantoaxial subluxation, dog

Introduction

Atlantoaxial subluxation is a relatively common cause of neck pain and neurological dysfunction that usually occurs in miniature and toy breeds of dogs[1,3]. The aetiology and pathogenesis of the condition has been reviewed previously[2]. It has occasionally been reported in large breed dogs, and rarely reported in the cat[8,12,15]. Atlantoaxial subluxation can be associated with aplasia or hypoplasia of the dens(odontoid process), absence of the transverse ligament or trauma[1,5,14]. Instability of the atlantoaxial joint results in subluxation with compression of the spinal cord. Affected dogs are usually less than one year of age, though older animals may be seen[13]. Diagnosis may be confirmed by radiography with demonstration of an abnormally shaped dens and an increased distance between the neural arches of the atlas and axis on a flexed lateral view.

Surgical treatment is frequently employed in atlantoaxial subluxation, although conservative management has been used. Various methods of surgical treatment have been described, but dorsal fixation has been the mainstay. Dorsal fixation has several disadvantages including technical difficulty, implant failure and iatrogenic nervous system damage[4,6,9]. An alternative to dorsal fixation was described by Sorjonen and Shires[10]. In this method, a ventral approach to the cervical spine was made and stabilization of the articulation was accomplished with two ventrally positioned pins placed across the atlantoaxial joint.

In this paper, I describe the successful surgical treatment of atlantoaxial subluxation in a dog by arthrodesis of the atlantoaxial joint using ventrally placed pins and a cancellous bone graft.

Case report

A male Griffon vendeen dog was initially presented to the Murdoch University Veterinary Hospital at 10 months of age with a 8 month history of hindlimb ataxia. The owner reported that the dog had al-

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[1]Corresponding author.

ways been clumsy and that the condition was deteriorating. There was no history of trauma or other disease. Neck pain was not evident. He appeared to resent extension of both hindlimbs, so radiographs of the pelvis, thoracolumbar and lumbar spine were taken. Abnormalities were not detected. The dog was re-admitted after 3 weeks with a progression of the ataxia to involve all four limbs.

Neurological examination

Proprioceptive deficits were noted in the hindlimbs but were inconsistent in the forelimbs. He was constantly falling over while ambulating, predominantly to the left side, and was unable to right himself after being placed in left lateral recumbancy. He appeared unwilling to move his neck voluntarily, though pain was not evident following right and left lateral flexion. As a cervical lesion was suspected we were unwilling to perform dorsal or ventral flexion. Cranial nerve function appeared to be normal.

Radiological findings

The dog was anaesthetized and radiography performed. Lateral radiographs of the cervical spine were not gross lesions, but it was not possible to evaluate the C1/C2 articulation fully. Cerebrospinal fluid collected from the cisterna magna; the fluid was normal. Contrast medium was injected into the subarachinoid space at L5/L6. Myelography demonstrated ventral compression of the spinal cord at C1/

C2. Gentle flexion revealed an increased space between the neural arches of C1/C2 and hypoplasia of the dens. A diagnosis of the atlantoaxial subluxation with absence of the dens was made (Fig 1, 2).

Surgical stabilization

A decision was made to perform a ventral stabilization of the atlantoaxial joint using two Kirschner wires and cancellous bone graft. The dog was placed in dorsal recumbency, with the neck hyperextended over a small soft pad. A ventral midline skin incision was made from the level of the larynx to just cranial to the manubrium. The sternohyoideus muscles were divided in the midline and the esophagus and trachea were retracted to the left. The longus colli muscle was reflected from the ventral surface of the atlas and axis and retraction was maintained with Gelpi retractors. The left and right articular facets of the atlantoaxial joint were identified, the joint capsules opened and the articular cartilage was removed with a scalpel blade and curette. Cancellous bone collected from the greater tubercle of the humerus was packed into both atlantoaxial joints. Two 0.045 inch Steinman pins were driven from the caudoventral surface of the axis and directed towards the alar notch of the atlas. The pin were driven dorsolarterally, to the left and right, at an angle 30 degrees from the midline and 30 degrees from the ventral surface of the axis, as described by Sorjonen and Shires. The angle of insertion was det-

Fig 1. Lateral view of the cervical region with myelographic evidence of ventral compression of the spinal cord.

Fig 2. Ventrodorsal view of the atlantoaxial joint demonstrating absence of the dens.
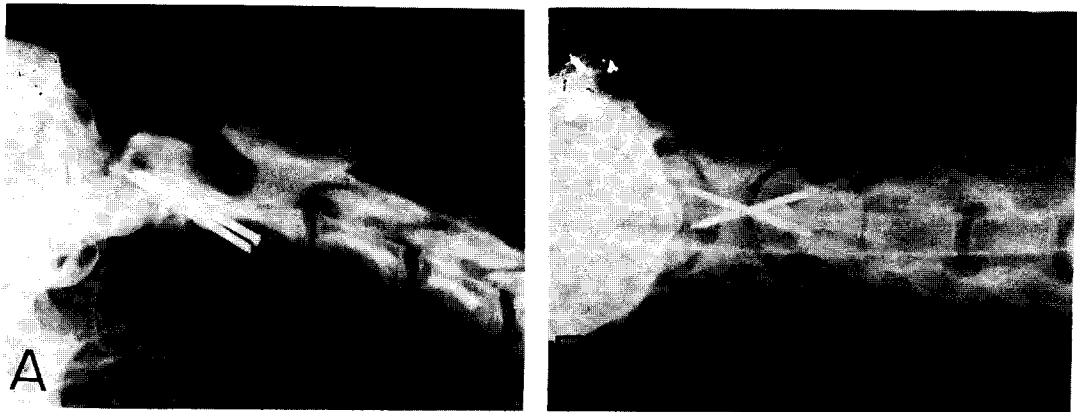
Fig 3. Lateral (A) and ventrodorsal (B) postoperative view of the atlantoaxial joint.

ermined by placing a goniometer within the surgery site and measuring 30 degrees from the midline then measuring 30 degrees from the ventral aspect of the axis. The pin insertion distance was calculated from the radiographs to be 2 cm. Shortly after placement of the second pin, left to right, the dog suffered a respiratory and cardiac arrest. The pin was withdrawn and significant haemorrhage was noted. The dog was successfully resuscitated with external cardiac massage, positive pressure ventilation and the intravenous administration of adrenalin. Haemorrhage from the pin site was controlled by digital pressure. The second pin was again inserted and the dog required positive ventilation until the end of the procedure. The ends of the pins were bent to try to prevent pin migration (Fig. 3-A, B). Wound closure was

routine. A fibreglass cast was placed around the neck and thorax. When he regained consciousness he was bright and alert and when hand fed ate and drank on the second postoperative day. Dexamethasone was administered at 1 mg/kg daily for seven days, then reduced to tapering doses over the next seven days.

Prognosis and follow-up

On the fourth day after the operation when assisted he was bearing weight and was able to stand on his own by the 10th day. By four weeks postoperatively there was not any evidence of arthrodesis so the cast was maintained for eight weeks, when the beginning of bony fusion was noted radiographically. Further radiographs were taken five months after the operation which showed arthrodesis was slowly pro-
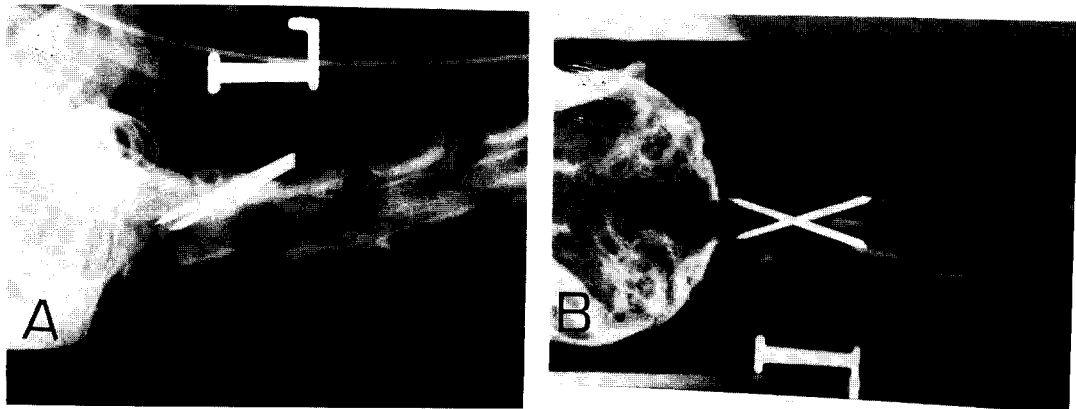

Fig 4. Lateral (A) and ventrodorsal (B) view of the atlantoaxial joint five months postoperatively, displaying early signs of the bony fusion.

gressing and evidence of pin migration nor instability were not seen (Fig. 4-A, B). The dog was able to run and play normally, though signs of posterior ataxia were still evident.

Discussion

In small animal with progressive cranial cervical spinal cord lesion, the following diagnosis should be considered[8,14]. Lymphosarcoma is the most commonly acquired cervical spinal cord lesion in dog and cat[8]. Affected animal have progressive neurological dysfunction and tetraparesis is the most common neurological sign[1,12]. The condition occurs in dogs and must be considered in the differential diagnosis of any patient with signs referable to the cranial cervical spinal segments[10,12].

The correct diagnosis was evident on the plain radiographs taken under anaesthesia. The radiographs of the conscious dog were of little value. Abnormalities of the C1/C2 articulation are often suspected on such radiographs, but these findings cannot be depended upon. Studies by Watson and others showed that the dens in the cat is formed from two separate ossification centres[13]. They proposed that vascular compromise may cause ischaemic necrosis and resorption of the caudal section of the dens, leaving a separate cranial ossicle. In this dog appeared that a separate ossicle was present in the region of the foramen magnum, cranial to the hypoplastic dens. It is unknown whether the condition was congenital or traumatically induced.

The surgical objectives for correction of atlantoaxial subluxation are to decompress the spinal cord and reduce and stabilize the atlantoaxial joint without causing morbidity and mortality[3,4,13]. Dorsal techniques provide for decompression, reduction, and stabilization of the atlantoaxial joint. Because fusion of the atlantoaxial joint is not generally achieved with dorsal techniques, failure of the fixation material may be associated with subsequent subluxation[2,5,12].

The ventral approach also permits decompression of the spinal cord by allowing alignment and stabilization of the atlantoaxial joint. The ventral technique was first described by Sorjonen and Shires

who claimed it to be a safer procedure as it reduces the manipulation of the vertebrae during surgery and allows fusion of the atlantoaxial joint[7,9,10]. Other studies have concluded that dorsal fixation has been associated with a greater incidence of complications including respiratory arrest and fixation failure than ventral fixation[12]. Modifications of the original technique describe the use of lag screw fixation[7,15] and threaded pins instead of Kirschner wires[11,12].

Cardiac and respiratory arrests have been associated with both ventral and dorsal techniques, usually resulting in death of the animal[13,11,12]. Fortunately in this case, the dog was successfully resuscitated and made a full recovery. Arthrodesis in this case did not proceed as rapidly as reported by other authors[12,15]. In a few reported cases of bone graft after arthrodesis and the ventral surgical stabilization of the atlantoaxial joints in dogs and cats[12]. In the case reported herein the dog made steady progress to the point that it was able to lead a functional lifestyle. Although neurological deficits were still present 5 months postoperatively, his preoperative neurological deficits were more severe and of longer duration than in the other previously reported cases[12,13,15].

The surgical results of in this and a few previous cases indicate that cancellous bone graft after arthrodesis and the ventral surgical stabilization of the atlantoaxial joint for the treatment of atlantoaxial subluxation in the dog and cat offers a favourable prognosis.

Conclusion

A 10-month-old male Griffon vendeen dog was presented to the Murdoch University Veterinary Hospital with a 8 month history of progressive ataxia and paresis. The dog was alert and responsive, and its vital signs were normal. Radiography and myelography confirmed atlantoaxial instability and ventral compression of the spinal cord. Surgical stabilization was achieved with two Kirschner wires and a bone graft via ventral approach, and an external splint was applied for eight weeks. Five months postoperatively the dog had steadily improved and arthrodesis of the atlantoaxial joint was complete.

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