Neck problems in horses

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Highlights

- *Neck problems were more common in showjumpers*
- *Hindlimb lameness was not attributable to neck problems*
- *Problems that can masquerade as being related to the neck may reflect a different problem*
- *Radiological abnormalities in the neck do not mean that the horse will show clinical signs of pain*
- *Anatomical variations may be present at birth in: 1) the shape of the neck vertebrae; 2) the size or presence of the first rib; 3) the symmetry of a large muscle which extends under the neck and thoracic vertebrae.*

***Horses diagnosed with neck problems** showed symptoms such as: patchy sweating on the neck, abnormal reactions to touch, pain response to pressure applied over the neck joints, restricted range of motion of the neck, occasional "neck locking", pain response when a forelimb was passively extended forwards, abnormal posture when grazing, low head and neck carriage, restricted range of motion of the neck when turning in small circles, tilting of the head and neck, uneven rein tension, marked resistance to turning in one direction, hopping-type forelimb lameness, forelimb stumbling or tripping, forelimb lameness more variable when ridden to a contact compared with on a loose rein or vice-versa, stopping spontaneously during work and standing with a forelimb non-weight bearing, a short, low stepping forelimb gait in canter, exacerbation of forelimb lameness after nerve blocks, or weakness and incoordination.*

Introduction

With the advances in x-ray equipment in recent years, it has become easier to acquire radiographs (x-rays) of the neck in the field, and this has led to an increasing diagnosis of suspected neck problems. **This is in part through lack of appreciation that a large proportion of mature comfortable horses have radiological (x-ray) abnormalities of the cervical (neck) vertebrae that are clinically silent, especially in the caudal (lower) neck region** (Figs. 1, 2).

Fig. 1 A horse’s neck. Cranial (towards the head) is to the left and caudal is to the right.

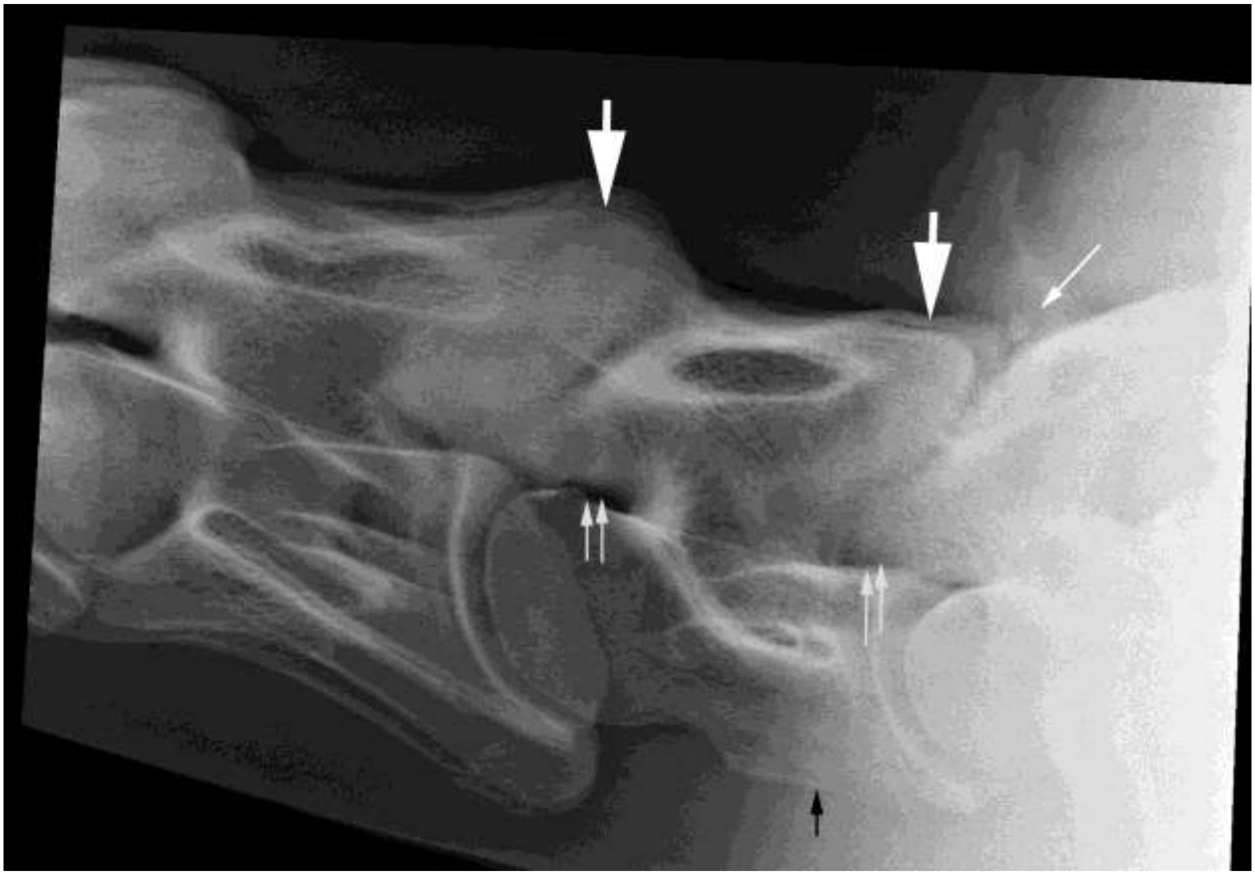

Fig. 2 Lateral-lateral radiographic image of the sixth cervical to first thoracic vertebrae from a control horse with **no** clinical signs referrable to the neck. Cranial is to the left. There are small ventral laminae on the ventral aspect of the seventh cervical vertebra (black arrow). The articular processes of the sixth and seventh cervical vertebrae and seventh cervical and first thoracic vertebrae are enlarged (modelled) (large white arrows). This results in narrowing of the intervertebral foramina (double white arrows). There is a small, mineralised opacity dorsal to the articular processes of the seventh cervical and first thoracic vertebrae (single small white arrow). Compare with Fig. 4.

There is a tendency for veterinarians to attribute a variety of clinical signs (for example, lack of hindlimb power) to radiological abnormalities in the caudal cervical region without proof that there is an association. Moreover, there are clinical problems that can masquerade as possibly being related to the neck but in fact reflect an unrelated problem. For example, a horse may be unwilling to turn to the right and appear to a rider to have a stiff neck, whereas the primary problem is right hindlimb lameness (Fig. 3). With abolition of the lameness using appropriate nerve blocks, the horse turns easily, despite the presence of radiological abnormalities of several neck vertebrae. **The presence of radiological abnormalities does not equate with there being associated clinical signs.**

Fig. 3 A 10 year old showjumper, competing at 1m 40. The rider complained that the horse was difficult to turn to the right and therefore lost time in jump offs. She felt that the horse was stiff in the neck. The horse is in right canter on a 20m diameter circle. The rider is using a strong right arm/ hand cue and the bit is pulled through to the right. Note that the right hindlimb is crossed under the trunk. The horse had a bilateral low-grade hindlimb lameness. Initially the horse appeared grade 2/8 lame on the right hindlimb when ridden. When nerve blocks had abolished right hindlimb lameness the horse could turn easily to the right but then showed low-grade left hindlimb lameness (grade 2/8) and was more difficult to turn to the left. When the left hindlimb lameness was abolished by nerve blocks the horse could turn easily in both directions with the rider using much more subtle rein cues, the bit was symmetrically positioned and the neck was much less rigid. The horse had bilateral proximal suspensory desmopathy, was treated surgically and made a successful return to full athletic function.

It is therefore of critical importance to be aware of key clinical features that may reflect a primary neck problem and to determine which radiological abnormalities are of likely clinical significance.

For more than 40 years it has been recognised that there are anatomical variations in the shape of the caudal cervical vertebrae which are present at birth (i.e., congenital variants). On the ventral (lower) aspect of the sixth cervical vertebra there are two ventral laminae of the transverse processes (effectively two downward projections of bone). These are not present on the seventh cervical vertebra. A congenital variation may result in one or both ventral laminae being transposed to the seventh cervical vertebra. In association with this, or independent from this, there are occasional variants in the presence or absence of the first rib and the size of the first rib. There may also be asymmetry in size of the left and right parts of the longus colli muscle, a large muscle which extends on the ventral aspect of the cervical and cranial thoracic vertebrae.

Fig. 4 Lateral-lateral radiograph of the fifth cervical (C5) to first thoracic (T1) vertebrae. Cranial is to the left. This is normal. Compare with Fig. 2.

There has been considerable discussion about the clinical significance of these congenital variants and their relationship to other radiological abnormalities. Previous studies have estimated an approximately 30%-35% prevalence of the congenital variants of the sixth and seventh cervical vertebrae. However there have been no studies in which comprehensive standardised clinical examinations have been performed in horses with clinical signs definitively referrable to the caudal neck region and control horses. A recent study sought to explore this area further.

The Study

The purposes of this large three-part study were to establish which clinical features were more likely to be seen in horses with caudal neck problems compared with control horses, and to relate these to the presence of the congenital variants of the sixth and seventh cervical vertebrae and other radiological abnormalities.

The two-centre study was restricted to all Warmblood horses evaluated consecutively at UC Davis, California in the USA and at the Animal Health Trust in the UK over a two year period [1]. All horses were examined using a comprehensive predefined protocol by two experienced clinicians, Professor Monica Aleman and Dr Sue Dyson. Systematic, standardised clinical assessments were performed to assess posture, muscle development, range of motion, reaction to palpation and movement patterns in all gaits in hand and on the lunge and when appropriate also ridden (Figs. 5, 6). Additional tests, such as walking up and down steps or blindfolding, were performed in selected horses to assess neurological dysfunction. Cases comprised horses with neck pain or stiffness which was not explained by other problems unrelated to the neck, those with forelimb lameness attributable to the neck, or those with incoordination and weakness (ataxia and proprioceptive deficits) consistent with compression of the spinal cord in the neck region. The results from these ‘case horses’ were compared with control horses, which were either working comfortably and undergoing pre-purchase examinations, or had another problem such as lameness which was abolished by nerve blocks of the affected limb(s). The data were analysed statistically and the results presented are those in which there were statistically significant differences between case horses and controls.

Fig. 5 Palpation of the neck to assess left-right symmetry. The horse has been positioned so that the forelimbs are square and bearing weight evenly and the neck is straight.

Fig. 6 Assessing range of motion of lateral bending and the way in which the horse bends. The horse has been positioned against a fence to prevent the hindquarters swinging to the right. This horse was clinically normal and had an excellent range of motion, with a smooth curve to the neck. The range of motion was similar to the left and to the right. The horse's ears are level, and the horse has not twisted at the poll. The horse did not shift the forelimbs. Compare with Fig. 9.

There were 96 case horses and 127 control horses. Horses with neck-related problems localised to the cranial (for example, nuchal bursitis) or mid-cervical (third or fourth cervical vertebrae) regions were not included in this study. The study was restricted to horses with problems associated with the caudal cervical and cervicothoracic regions.

Study results

Focal muscle atrophy (wastage) in the caudal half of the neck was only seen in cases and not control horses.

Fig. 7 Marked atrophy of the caudal neck musculature resulting in concavity cranial to the scapula. This was a case with subluxation (spondylolisthesis) of the sixth and seventh cervical vertebrae and associated incoordination and weakness, as well as neck pain and reduced range of motion (see Figs.16,33,34).

Patchy sweating on the neck, focal areas of reduced reaction to touch (**hypoaesthesia**), or areas which were unusually sensitive to firm touch (**hyperaesthesia**) or hyperreactive to light touch (**allodynia**), were also only observed in cases.

Only cases showed **a pain response to firm pressure applied over the caudal cervical articular process joints and transverse processes** (Fig. 8). Pain was manifest by the horse moving away sideways or backwards when pressure was applied and an alteration in its facial expression.

Fig. 8 Reaction to firm pressure applied over the left articular processes and transverse processes of the sixth and seventh cervical vertebrae of a case. The horse is stepping sideways to the right and has a low head and neck posture and tight facial muscles and an intense stare, reflecting pain. The horse had a history of the neck getting stuck ('locked') when the horse was grazing. See also Figs. 13 and 32.

A restricted range of motion of the neck was more prevalent in cases compared with control horses. Sideways flexion of the neck, assessed using food as 'bait', with the horse standing next to a fence or wall, was restricted in a higher proportion of the cases compared with controls, often associated with alterations in posture. The range of motion of lateral flexion was more likely to be asymmetrical turning to the left and to the right in cases compared with control horses (Fig. 9). In a minority of cases, but not in control horses, extension of the neck was restricted

Fig. 9 Restricted lateral bending to the right of a case with right forelimb lameness associated with cervical radiculopathy. The horse has positioned the right forelimb slightly in front of the left and has lowered and tilted the head. The left ear is much lower than the right. The horse could not reach further caudally than the elbow. Compare with Fig. 6.

Pain on palpation and /or hypertonicity of the caudal aspect of the brachiocephalicus muscles was a non-specific finding observed in both cases and control horses (Fig. 10).

Fig. 10 Pain on palpation of the caudal aspect of the right brachiocephalicus muscle in a pony with bilateral foot pain. This type of reaction is not specific for a primary neck problem, although primary brachiocephalicus muscle injuries can occur resulting in altered limb flight and performance.

Only cases episodically developed ‘**neck locking**’ – the horse standing with the neck low, sometimes flexed to one side, and being reluctant to move (Fig. 11).

Fig. 11 A horse in which the neck is ‘locked’ in a low position, bent to the left. The lighter coloured patch of hair on the right side of the caudal neck region was associated with a region of patchy sweating.

Only cases showed a **pain response when the left or right forelimbs was passively extended forwards**. Only cases had areas of hyperaesthesia on one or both forelimbs.

Only cases showed **an abnormal posture when grazing**, either straddling the forelimbs sideways, spreading the forelimbs very widely with one protracted and the other retracted (Fig. 12), or crossing the forelimbs (Fig. 13).

Fig. 12 An abnormal posture to graze in a horse with neck-related left forelimb lameness and mild hindlimb incoordination. The forelimbs are widely spaced with the right forelimb protracted and the left forelimb retracted. The hindlimbs are unusually far behind the trunk and spread wide apart.

Fig. 13 An abnormal posture with the forelimbs crossed during grazing. The same horse as in Figs. 8 and 32.

Cases were more likely to have a **low head and neck carriage** when moving in hand and on the lunge and when ridden compared with control horses (Figs. 14, 15).

Fig. 14 A horse with neck stiffness and pain, walking with a low head and neck posture and a low height of arc of foot flight of the right forelimb. (Figure courtesy of Monica Aleman)

Fig. 15 A Warmblood stallion in trot with low-grade hindlimb incoordination and neck pain associated with subluxation (spondylolisthesis) of the sixth and seventh cervical vertebrae. The head and neck carriage is relatively low, with a lot of tension in the dorsal neck muscles. The head and neck are tilted slightly, and the mouth is slightly open, reflecting pain.

Restricted range of motion of the neck when turning in small circles (Fig. 16), on the lunge and ridden was more prevalent in cases compared with control horses.

Fig. 16 A case with hindlimb incoordination, neck pain and restricted range of motion. The horse's neck posture was very different turning to the right compared with turning to the left (see Fig. 33). The movement of the hindlimbs is poorly coordinated.

Cases were more likely to show **tilting of the head and neck** during exercise than control horses (Figs. 17, 18). In some horses this was seen when moving in hand. In other horses, head and neck tilt was only apparent during ridden exercise (Figs. 19, 20). The rider felt uneven rein tension and could not straighten the head and neck. This was often worse in canter than in trot.

Fig. 17 A horse with caudal neck pain and mild hindlimb incoordination. The head and neck are tilted with the nose to the right.

Fig. 18 A case with mild right forelimb hopping type lameness when ridden. On the lunge on the right rein the head and neck were tilted to the left. As the right forelimb was protracted there was closure of the eyelids, reflecting discomfort, and the head and neck tilted more to the outside, with the right ear being lower than the left.

Fig. 19 A showjumper competing at 1m 30. The horse is cantering on the left rein. The clinical complaint was a severe head tilt on approach to fences. The horse showed a low-grade (2/8) neck-associated left forelimb lameness on the right rein only when ridden. Head tilt, with the nose to the left, was worst on the left rein, especially in canter.

If a case with forelimb lameness tilted the head during lungeing or ridden exercise, the nose was generally pointed to the side opposite the lame limb (Figs. 19, 20).

Fig. 20 Head tilt with the nose to the left in association with a neck-related right forelimb lameness which was only seen when the horse was ridden on a loose rein (see also Fig. 29).

Cases were more likely to show marked **resistance to turning in one direction** compared with control horses (Fig. 21).

Fig. 21 A pony which was very difficult to turn to the left and with the normal child rider would bolt in a straight line and not turn to the left. There was a low-grade neck-related left forelimb lameness which was only apparent on the lunge.

Hopping-type forelimb lameness was only observed in cases (Figs. 22, 23, 25). It was seen most frequently during ridden exercise and varied in severity and duration of occurrence. In mild cases it felt to the rider that the horse was trying to break to canter. In more severe cases there was obvious raising of the head and neck as the affected forelimb was brought forwards and then the head and neck were lowered as the lame limb started to bear weight, mimicking a contralateral forelimb lameness. Some affected horses could trot willingly, reacting normally to cues, and then suddenly slow down, with a change in facial expression (for example, putting the ears back), before taking a series of hopping-type forelimb lameness steps (Figs. 23,24,25). In some horses with hopping-type forelimb lameness, more conventional lame steps also occurred sporadically.

Fig. 22 Sequential images of a horse with a hopping-type right forelimb lameness in trot on the right rein. As the right forelimb is protracted the head and neck are raised. The left hindlimb start to bear weight ahead of the right forelimb. The horse has a glazed expression with the ears back. As the right forelimb starts to bear weight the head and neck are lowered. The head and neck remain low during the stance phase of the right forelimb.

Fig. 23 A dressage pony with an episodic hopping-type right forelimb lameness. In the absence of lameness (a) the pony went freely forwards and was responsive to the rider’s cues (a) with a steady head and neck posture. During lame steps the pony’s facial expression changed (b and c), the trot rhythm became slower and the head and neck were raised as the right forelimb was protracted.

Fig. 24 A horse with episodic hopping-type left forelimb lameness. When non-lame there was a head tilt with the nose to the right. The ears were forward and the horse had an engaged expression in its eyes. Compare with Fig. 25

Fig. 25 The same horse as Fig. 24 showing hopping type left forelimb lameness. The ears are back, the eyelids are semi-closed and the horse has a glazed expression.

Cases were more likely to show **forelimb stumbling or tripping** than control horses (Fig. 26).

Fig. 26 A pony with a propensity to stumble severely in front with neck stiffness and pain. The pony has knuckled forward on the left front fetlock and the right front foot is being placed to the ground toe first. This severe stumble clearly induced pain because one stride later the pony jumped upwards shaking the head and neck with the nose tilted to the right – see Fig. 27.

Fig. 27 The same pony as in Fig. 26 one stride later. The pony jumped upwards shaking the head and neck with the nose tilted to the right.

Historically a few cases had fallen on landing when jumping (Fig. 28) or stumbled badly. Alternatively, there had been sudden onset of severe forelimb lameness associated with ipsilateral cervical hyperaesthesia immediately after landing. Asymmetrical flexion of the forelimbs because of reduced flexion of one limb had also been observed during the airborne phase of the jump in a small number of showjumpers.

Fig. 28 Collapse on landing after a fence associated with caudal neck pain

Forelimb lameness in cases was more likely to vary in presence and/ or severity when ridden to a contact (with rein tension) compared with on a loose rein (no rein tension) compared with control horses. The effect was variable – in some horses the lameness was more apparent when ridden to a contact, whereas in others the lameness was worse on a loose rein (Fig. 29).

Fig. 29 (see also Fig. 20) There was an obvious head tilt with the nose to the left when ridden to a contact in trot (Fig. 20) or canter (image on the left). On a loose rein (image on the right) the head was much straighter, but the horse now showed consistent neck-related right forelimb lameness.

Only cases showed ‘**root signature posture**’ (Fig. 30). Affected horses pulled up spontaneously during work on the lunge or when ridden and stood with the limb semi-flexed. This was often accompanied by the development of hypersensitivity to touch (hyperaesthesia) in the caudal neck region on the same side.

Fig. 30 Root signature posture. The horse had reduced range of motion of the neck when turned in small circles before ridden exercise. The horse would work satisfactorily for a while and then suddenly stop and adopt this typical posture associated with nerve root pain. This persisted for approximately five minutes and then improved progressively. From the time of onset of root signature posture there was focal hyperaesthesia over the left caudal neck in the region of the articular process joints of the sixth and seventh cervical vertebrae. Hyperaesthesia persisted for approximately 45 minutes.

Occasionally only cases showed other abnormalities of forelimb posture or movement. (Figs. 31 and 32)

Fig. 31 The same horse as Fig. 12. The horse is being asked to step backwards. Note the abnormal position of the left forelimb, slightly abducted. Note also the patchy sweating over the shoulder region.

Fig. 32 The same horse as Figs. 8 and 13. The horse was asked to walk forwards and did so with a very low arc of foot flight of the left forelimb, dragging the toe.

When ridden in canter horses with neck pain or stiffness or neck-related forelimb lameness had a short stepping forelimb gait, with a low height of arc of foot flight. This created a jarring sensation being generated through the rider's back. Willingness to canter and forelimb step length were often better on a loose rein (no rein tension) than when the horse was ridden to a contact (with rein tension).

Deterioration in forelimb lameness after perineural anaesthesia of the palmar digital nerves (nerve blocks) at the base of the proximal sesamoid bones was observed in both cases and control horses. This is a well-recognised phenomenon. If the foot is desensitised and it is not the source of pain, pain may be accentuated because the horse loads the limb more normally and the painful structure becomes more painful. However, **exacerbation of forelimb lameness after more proximal limb nerve blocks** occurred only in cases and not control horses and is an unusual observation, seemingly typical of neck-related forelimb lameness. Occasionally horses also showed neurological dysfunction of the affected forelimb after numerous nerve blocks had been performed.

In no case was hindlimb lameness attributable to neck problems. Hindlimb incoordination and weakness were not observed in control horses, although were identified in 40% of case horses. However, a small proportion of horses with hindlimb incoordination and weakness had mild intermittent upward fixation of the patella associated with poor development of the quadriceps femoris muscles. In a small proportion of cases there was a mixture of incoordination and weakness and neck-related forelimb lameness, or neck pain and stiffness. In a minority of horses with neck-related forelimb lameness there was neck pain, although this was sometimes variable in its presence.

Horses with hindlimb incoordination and weakness had a **hypermetric gait in all four limbs**. When turned in small circles many showed **circumduction of one or both hindlimbs** and/or pivoted on the forelimbs (Fig. 33). When decelerating from trot to walk the height of the hindlimb steps was often variable and asymmetrical (Fig. 34). When the hindlimbs were placed to the ground there were differences in sound reflecting asymmetrical forces.

Fig. 33 The same horse as Figs. 7 and 16, turning to the left. There is circumduction (swinging outwards) of the right hindlimb. The horse turned much more comfortably to the left than to the right.

Fig.34 Decelerating from trot to walk. Note the higher foot flight of the right hindlimb compared with the left during the swing phase of each step. The same horse as in Figs. 7,16 and 33.

Cases were more likely than control horses to show weakness, being demonstrated by pulling the tail while a horse is walked in hand. A normal horse should be able to resist this, and the hindlimbs continue to follow the tracks of the forelimbs, but if the hindlimbs can easily be pulled to one side, that reflects weakness (Fig. 35).

Fig. 35 Pulling a horse's tail to highlight hindlimb weakness.

In a small proportion of cases there was concurrent hindlimb lameness, resulting in poor hindlimb impulsion. This was abolished by diagnostic anaesthesia of the hindlimbs. This hindlimb lameness was therefore independent from and **not** related to the concurrent neck problem. If there was coexistent hopping-type forelimb lameness or other neck-related forelimb lameness, this became more apparent after abolition of the hindlimb lameness. In these horses there was a persistently high Ridden Horse Pain Ethogram score (usually ≥8/24) after removal of the hindlimb lameness, indicating that there was another source of pain.

Showjumping horses were over-represented among cases (43%) compared with control horses (13%). When landing after a jump the caudal neck is in extension and this narrows the intervertebral foramina through which the caudal cervical and cranial thoracic nerve roots pass, increasing the likelihood of compression (Fig. 36). **Dressage horses were underrepresented among cases** (30%) compared with control horses (55%), despite the controversy surrounding hyperflexion and Rollkur. With flexion of the neck there is less pressure on the articular processes in the caudal cervical region and the intervertebral foramina are larger than in extension.

Fig. 36 Caudal neck extension during landing will result in narrowing of the intervertebral foramina, with the potential to cause nerve root compression.

Conclusions

It was concluded that **systematic comprehensive clinical evaluation should enable differentiation between horses with caudal cervical and cervicothoracic lesions and horses with other causes of gait abnormalities**. Most affected horses show a variety of clinical signs that are suggestive of caudal cervical or cervicothoracic dysfunction. Hindlimb lameness or lack of hindlimb impulsion are not characteristic of caudal cervical or cervicothoracic dysfunction. Correct diagnosis is essential for the development of appropriate treatment and management strategies.

In subsequent articles the relationship between clinical signs and radiological features will be discussed.

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