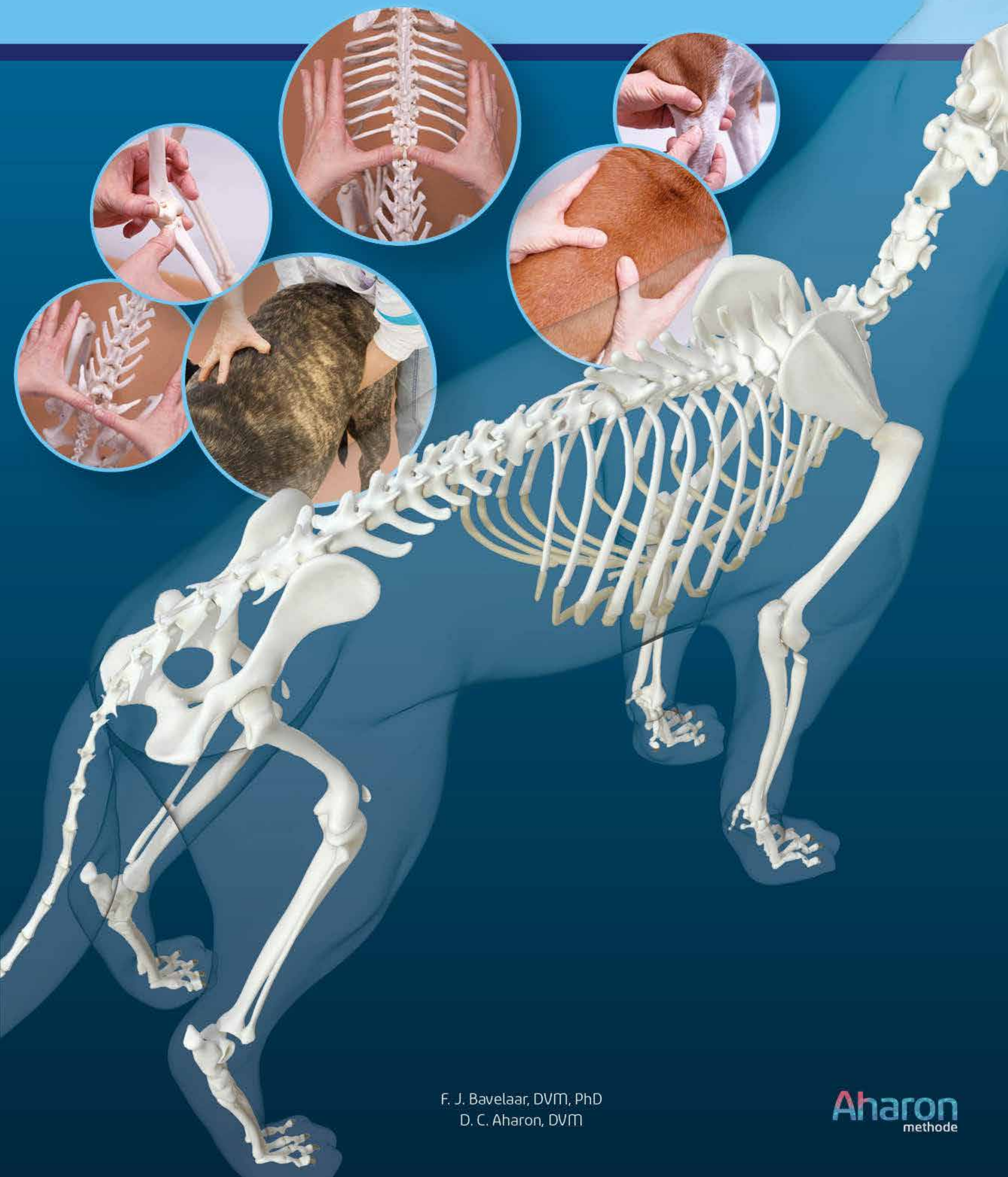
Back to the Clinic

A Practical Approach to the Veterinary Neurological and Orthopaedic Patient



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Aharon methode

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Preface

After many years of working as a frontline clinician and in government and academic positions I set off in an entirely new direction, training in orthomanual medicine. Upon successfully completing this human study, I became the first veterinarian in the Netherlands to adapt the technique to animals. That process led to development of the Aharon Method of Orthomanual Veterinary Medicine.

I have been applying this method to animals since 2002, refining the Aharon Method over the years. Now, after more than 15 years of practice in orthomanual veterinary medicine, Dr Frederique Bavelaar has written an extensive and thorough reference work. In it, she presents my method in detail, while also outlining the training required to practice orthomanual veterinary medicine according to the Aharon Method.

That training is organized by and offered under the auspices of the Netherlands Association for Orthomanual Veterinary Medicine, known by its Dutch acronym, the NVOMD. I am grateful to Frederique for her efforts, and proud of the result. Frederique dedicates her work to her father: Ron Bavelaar.

Dorit Aharon, DVM and Chairperson of the NVOMD

Noorden, June 2020

Misalignments

Ventral misalignment

Here the vertebral body is tipped ventrally due to a tilting of the vertebral body around the longitudinal axis, possibly in conjunction with a rotation around the dextro-sinistral axis.

A ventral position can occur at the following vertebrae:

- Sacrum
- T11-L7
- C1-C7. If C7 is displaced downwards, there could be, for example, cervical spondylomyelopathy (Wobbler syndrome). A ventral misalignment can be accompanied by a slight tilting of the vertebral body.
- Atlas

Tilting

This involves rotation around the ventrodorsal axis. The displacement is found on the dorsal plane.

Tilting can occur at the following vertebrae:

- Atlas
- C1-C7
- T11-L7

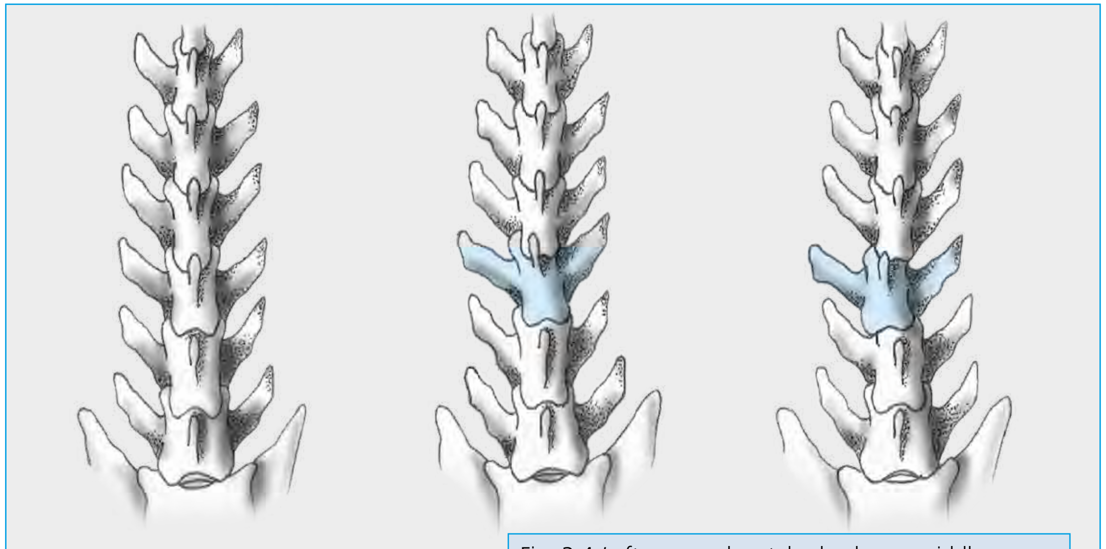

Fig. 3.4 *Left* a normal vertebral column, middle a tilting to the left, and *right* a vertebra shifted sideward towards the left. *Source: Aharon orthomanual veterinary medicine.*

Sideward shift

In this case, the issue is not one of rotation but rather a sideward shift on the dorsal plane.

A sideward shift can occur at the following vertebrae:

- S2, S3
- T1-T10
  Caution: *If there is a misalignment in this area, the rib will slide slightly away from the vertebral body and some degree of translation of the rib will be observed.*
- T11-L7

Dorsal misalignment

This is found predominantly in cats, though it may also be seen in Greyhounds and in other dogs following trauma. Here, the vertebral body is displaced in the dorsal direction.

There is a rotation around the dextro-sinistral axis. A dorsal misalignment can occur along the entire vertebral column.

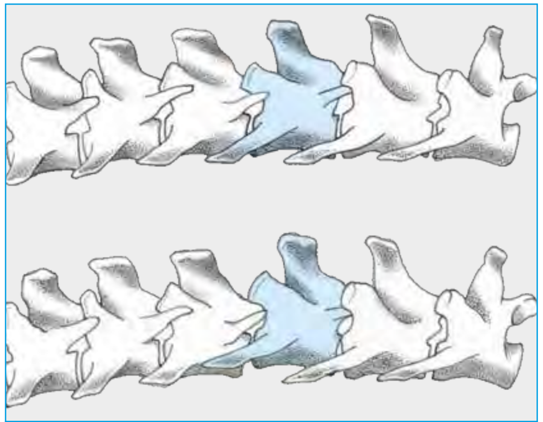

Fig. 3.5 *Above*, a normal vertebral column; *below*, a slight dorsal misalignment of the shaded vertebra. *Source: Aharon orthomanual veterinary medicine.*

Scoliosis

This is a displacement of entire vertebrae slightly to the left or to the right.
This occurs mainly in cats, but is rare.

5.2 Neurological examination

Before the examination starts, a comprehensive anamnesis must be taken. Only then should a full neurological examination be performed.

The anamnesis

Ask whether any changes have been observed in the patient's behaviour and if any vision problems have been noticed. Ask about central functions, particularly eating, drinking, urinating and defecation, and whether the animal has been observed stumbling, paw knuckling or any dragging of a foot (e.g., with nails scraping the ground). Be thorough in exploring the animal's behaviour with the owner. Is the animal's behaviour completely normal? Are the gaits normal? When did any deviations from normal begin? How long have they been observed? How have the symptoms progressed?

Neurological examination

The neurological examination consists of observation, evaluation, palpation and tests. In conducting a neurological examination, it is crucial to know what is normal, both in general terms and for a particular patient!

The aim of the neurological examination is to answer two questions:

1. Is there a neurological problem?
2. If so, what is its anatomical location?
   a. In the skull: cerebrum, cerebellum, brainstem
   b. C1-C5
   c. C6-T2
   d. T3-L3
   e. L3-S3
   f. L4-Cd
   g. Peripheral

The neurological examination consists of two main components: the hands off part and the hands on part.

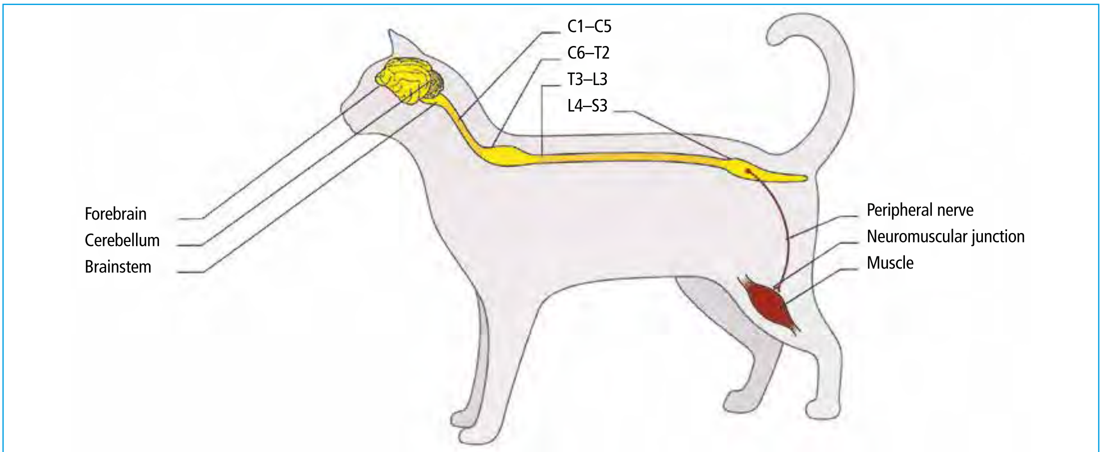

Fig. 5.1 Overview of the central and peripheral nervous systems. *Small Animal Neurological Emergencies. Source: Platt and Garosi (2012).*

Strength is determined within the brainstem – spinal cord – nerves
Coordination is determined within the cerebellum – brainstem – spinal cord.
Lesions in the brainstem lead to: vestibular ataxia + cranial nerve deficiency + weakness.
Lesions in the spinal cord lead to ataxia + weakness.
➡ a distinction between a lesion of the brainstem and of the spinal cord can therefore be made by involvement of the cranial nerves.
Lesions in the cerebellum lead to: only ataxia, not weakness.

Posture

To assess posture, the position and carriage of the head, body and legs are evaluated. If the animal seems to be exhibiting a problem in head carriage, take a good look at the alignment of the eyes. Sometimes head carriage can appear off because one ear is drooping, but the eyes are level. "Head tilt" occurs as a result of a lesion to the cerebellum and the vestibular system. "Head turn" occurs due to a lesion to the cerebrum.

Schiff-Sherrington posture: The forelimbs exhibit rigidity, with paresis in the hind limbs. This is due to a lesion of the spinal cord between T3 and L3.

Problems in back posture:
- Kyphosis (roached back): Pain in the thoracic region of the spine.
- Lordosis (hollow back): Is rarely seen, often the consequence of weakness.
- Scoliosis: Occurs as a result of a congenital malformation.

Table 5.1
Lower motor neuron paresis/upper motor neuron paresis differentiation criteria

Criteria	Lower motor neuron paresis	Upper motor neuron paresis
Posture	Difficulty supporting weight. Crouched stance as a result of overflexion of the joints	Often normal (unless the animal is paralysed). Abnormal limb position (knuckling, abducted, adducted or crossed over)
Gait	Short strides. Tendency to collapse	Stiff and ataxic strides. Delayed protraction
Motor function	Flaccid paresis/paralysis	Spastic paresis/paralysis
Segmental reflexes	Decreased to absent	Normal to increased
Resting muscle tone	Decreased resistance	Slight resistance
Passive limb flexion/extension	Decreased resistance	Slight resistance
Muscle atrophy	Early and severe neurologic atrophy	Late and mild disuse atrophy

Source: Platt and Garosi (2012).

Hands on examination

The second component of the examination consists of testing the reflexes. Four reflex groups can be tested:
- Reflexes involving the cranial nerves
- Postural reactions and proprioception
- Spinal reflexes
- Pain sensation

Note: If an animal can walk normally, the reflexes will also be normal.

Elicitation of the reflexes is important to identify the location of a problem.

Table 5.2
Localization of a lesion on the spinal cord. UMN = upper motor neuron; LMN = lower motor neuron.

	C1-C5	C6-T2	T3-L3	L4-S1	S1-S2
Forelimb	UMN	LMN	Normal	Normal	Normal
Hind limb	UMN	UMN	UMN	LMN	

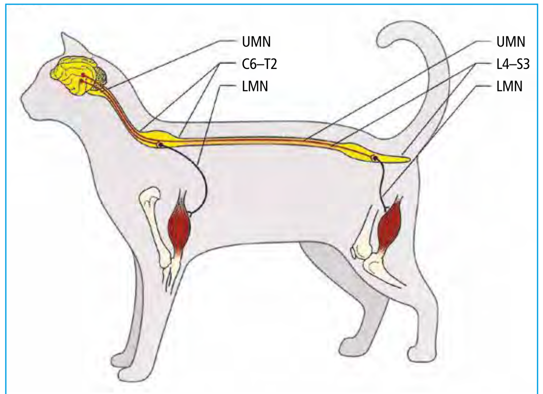

Fig. 5.2 Upper motor neuron (UMN) and lower motor neuron (LMN) systems. *Small Animal Neurological Emergencies. Manson Publishing/The Veterinary Press ISBN 978-1-84076-152-8.*

Reflexes involving the cranial nerves

Most cranial nerves originate in the brainstem. Often a problem in the brainstem affects multiple nerves. Anatomical localization in the brain is always bad news. A lesion of the brainstem causes impairment of the cranial nerves, weakness and ataxia. If there is a lesion external to the brain, there will only be a defect of the cranial nerves. When evaluating the cranial nerves, always listen carefully to what the owner has noticed, and closely observe the animal yourself!

Smell (CN I)

Place a food treat under the animal's nose, and see if the animal sniffs at it.

Eyes

Always start by looking at the eyes. Are there signs of anisocoria, abnormal pupil size or an unusual eye position?

Vision (CN II = optic nerve)

Drop a cotton ball and observe whether the animal follows it with its eyes.

Menace response (CN II and VII)

An animal should see the menace, or threat, and respond by blinking. If the patient does not respond, always test the blink reflex (by touching the animal's head). *This reflex often does not work in cats* (it is influenced by behaviour). Always test both eyes!

Structure of the joints

The shoulder is a modified ball-and-socket joint. This type of joint can allow for considerable mobility, but in most cases, movement is restricted mainly to flexion and extension. This is due to the relative shortness of the muscles and collateral ligaments (at the tendon end attachment points). The bone surfaces are thus held together by muscular force.

The carpus is a composite joint, but effectively works like a hinge.

The stifle is made up of three joints: The joint between the femur and the patella (the femoropatellar joint) and joints between the two distal condyles and the tibia. Between these joints is the meniscus, which provides structural integrity to the joint, as the femur and tibia are not well aligned. The joint is held together by collateral ligaments. The cruciate ligaments are found in the space between the condyles (outside the actual joint cavity). The cranial (anterior) cruciate ligament runs caudolateral of the Os Femoris to craniomedial on the tibia (like a hand in a pants pocket). The caudal (posterior) cruciate ligament runs from craniomedial of the Os Femoris to caudolateral on the tibia. With normal flexion and extension, the cruciate ligaments are not stretched. Injury to the cruciate ligaments thus results from simultaneous bending and rotation.

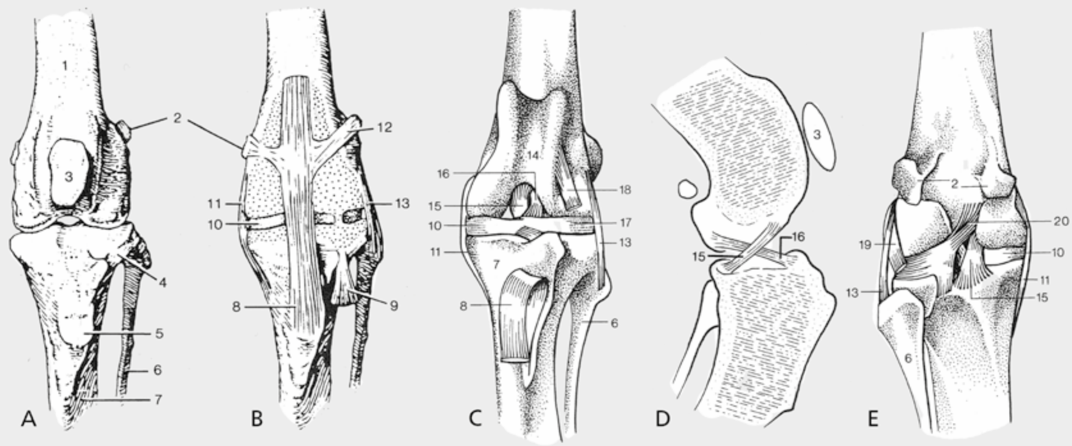

Fig. 7.18 Left stifle joint of the dog, cranial view (A-C). The extent of the joint capsule is shown in B. The patella has been removed in C. D shows the crossing of the cruciate ligaments in a medial view. E is a caudal view. 1. Femur; 2. sesamoid in gastrocnemius; 3. patella; 4. extensor groove; 5. tibial tuberosity; 6. fibula; 7. tibia; 8. patellar ligament; 9. tendon of long digital extensor passing through extensor groove; 10. medial meniscus; 11. medial collateral ligament; 12. lateral femoropattellar ligament; 13. lateral collateral ligament; 14. trochlea; 15. caudal cruciate ligament; 16. cranial cruciate ligament; 17. lateral meniscus; 18. stump of 9; 19. popliteus tenson; 20. meniscofemoral ligament. (A and B, modified after Taylor, 1970). *Source: Dyce, Sack and Wensing's Textbook of Veterinary Anatomy.*

The tarsus is a composite joint. Flexion and extension in the joint effectively occur only between the tibia and the talus.

Mobility of the joints

- Toes: Movement on one plane (hinge joint).
- Carpus: Movement on one plane (hinge joint).
- Elbow: Movement on one plane (hinge), as well as supination, 35-160 degrees, and pronation, 60 degrees.
- Shoulder: Movement in multiple directions (ball-and-socket joint).
- Tarsus: Movement on one plane (hinge joint).
- Stifle: Movement on one plane, but some slight lateral and medial movement is possible.
- Hip: Movement in multiple directions (ball-and-socket joint).

Table 7.1
Range of motion of various joints. Data from Reliability of goniometry in Labrador Retrievers. Jaegger G., Marcellin-Little D.J., Levine, D. Am. J. Vet. Res. 2002, 63:979-986.

Joint	Range of motion	
	Flexion	Extension
Shoulder (relative to scapula)	Up to 57°	Up to 165°
Elbow (relative to humerus)	Up to 36°	Up to 166°
Carpus (relative to antebrachium)	Up to 32°	Up to 196°
Hip (relative to the axis of the pelvis)	Up to 50°	Up to 162°
Stifle (relative to femur)	Up to 41°	Up to 162°
Tarsus (relative to the tibia with stifle joint at 90°)	Up to 38°	Up to 165°

Puncture points in joints

It is important to know where the various joints can be punctured. These are also the places where any excess fluid or swelling of the joints can be felt.

Puncture of joints can be performed for diagnostic or therapeutic intraarticular injections (e.g., injection of corticosteroids or autologous plasma or stem cells for arthrosis). Diagnosis of polyarthritis requires puncture of multiple joints. This should always be done under a light anaesthetic, as any movement of the limb and joint during the procedure can release a quick inflow of blood, in which case, interpretation of the joint fluid is no longer possible.

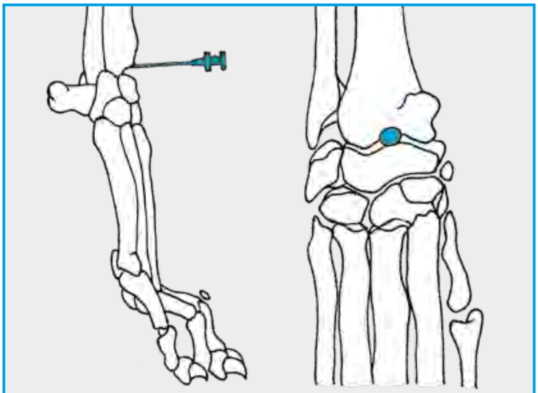

Fig. 7.19 Puncture point in canine carpus. *Source: Small Animal Clinical Techniques, S.M. Taylor, 2010, Saunders Elsevier.*

Walk

The walk is a symmetric gait. In walk, at least two feet are on the ground at all times. In walk, more of the animal's weight rests on the forelimbs (about 1.1 x body weight) than on the hind limbs (0.8 x body weight). The hind limbs play a larger role in acceleration of the stride.

In walk, a small part of the movement of the forelimbs comes from the bending of the joints, and a large part comes from rotation of the scapula relative to the body. For the hind limbs, the hip bends approx. 25 degrees and the stifle joint and tarsus bend 30 degrees. The head and the neck exhibit a downward motion as a forelimb strikes the ground, with upward motion of the head and neck as a forelimb is brought forward. The tail moves towards the hind limb that is about to strike the ground.

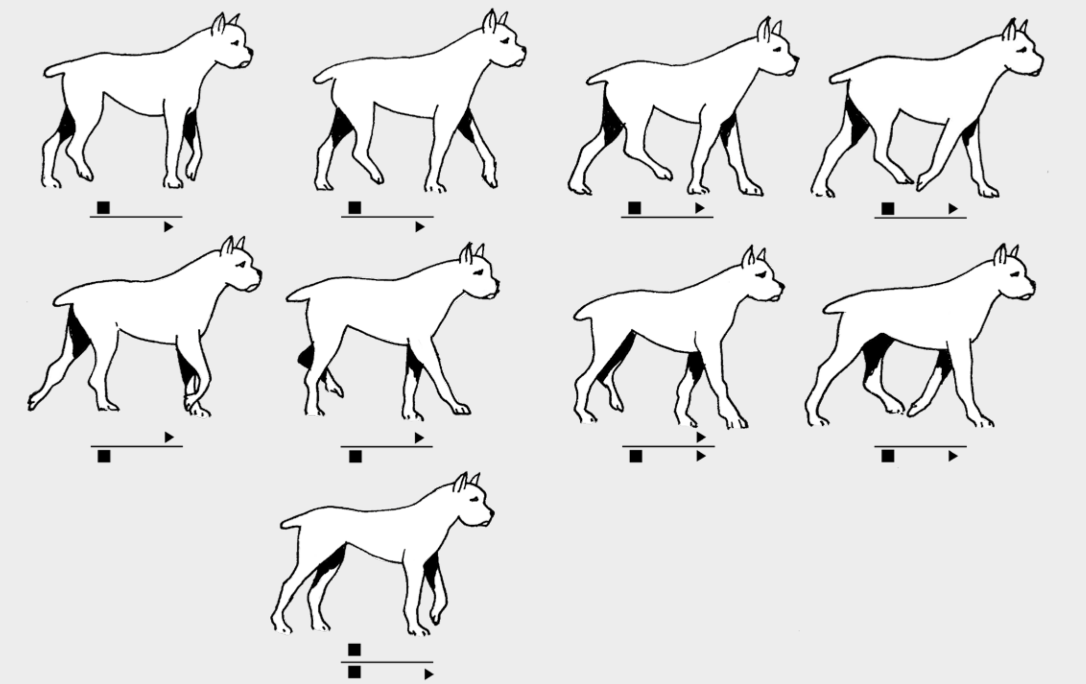

Fig. 9.1 Walk.

Fig. 9.2 Footfall pattern of canine in walk.

In walk, there are alternately two or three feet on the ground. Therefore, within a single stride eight different combinations are possible: four combinations with three feet on the ground, alternated by four combinations with two feet on the ground (the right and left diagonal pair and the right and left lateral pair).

Walk is a strenuous gait for the dog. Trot is the least strenuous. This is why you can see lameness better in the walk.

Amble (brisk walking pace)

The amble is a symmetric gait with a speed somewhat quicker than the walk. Both feet on the same side of the body move together, but not quite at the same time (like in the pace).

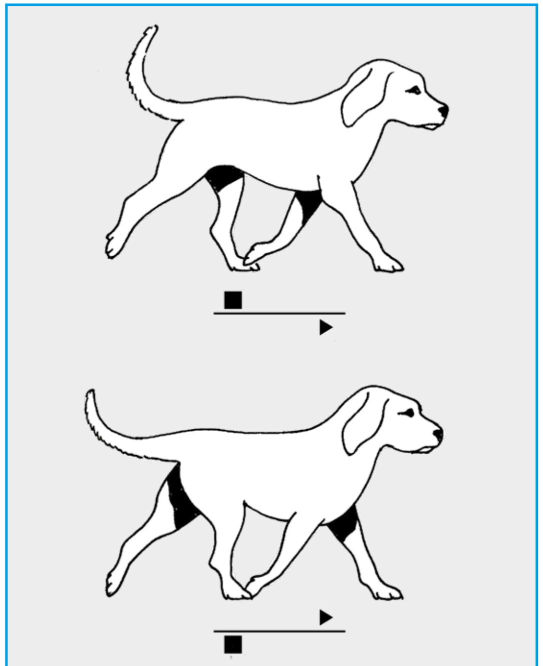

Fig. 9.3 Normal trot.

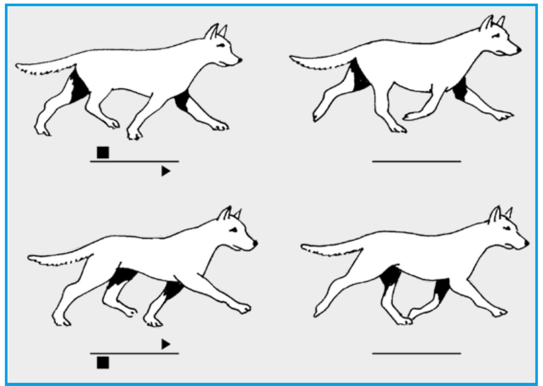

Fig. 9.4 Flying trot.

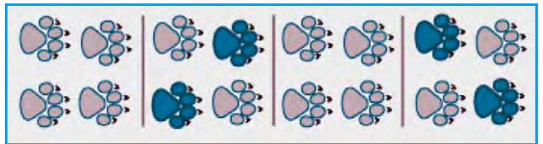

Fig. 9.5 Footfall pattern of canine in flying trot.

Trot

The trot is a symmetric gait in which the diagonal pair of limbs moves simultaneously. Contact with the ground is slightly more prolonged for the forelimbs than the hind limbs. In trot, two feet are usually on ground, though in flying trot a suspension phase is observed.

Dogs with a relatively short body and long legs have difficulty trotting, because their forelimbs and hind limbs come into contact with one another in the gait. To avoid this, they use a "crabbing" gait, bending their body slightly to one side so the forelimbs and hind limbs don't interfere with each other.

Compared to the walk, more movement of the joints and neck is observed in the trot.

TTA

TTA stands for Tibial Tuberosity Advancement. In this surgical procedure the tibial tuberosity is separated and advanced forward towards cranial. It is then attached with a plate and screws, and the space that is created is filled with a bone graft. Moving the tibial tuberosity changes the alignment of the patellar tendon.

Several forces play a role in the stifle joint. At the patellar tendon, the quadriceps exerts forces on the stifle joint (*Fq*), with these forces countered by other forces within the stifle joint (Fn and Ft) (Fig. 10.30). Because the patellar tendon does not form a 90 degree angle with the tibial plateau, the net result is that the tibia slides towards cranial with weight bearing. This is normally absorbed by the cranial cruciate ligament. The TTA changes the angle of the patellar tendon relative to the tibial plateau. After the procedure, *Fq* constitutes a 90 degree angle, so the tibia stays in place.

The recovery and rehabilitation period after TTA surgery is 8 weeks. Possible complications are the following: Anaesthesia-related risks, infection, poor wound healing due to too much activity. TTA cannot be used on dogs with a steep tibial plateau angle.

TPLO

TPLO stands for Tibial Plateau Levelling Osteotomy. The purpose of the TPLO is to also change the biomechanical characteristics of the stifle joint so that an intact CCL is no longer needed to prevent translation of the tibia. In a TPLO, a circular osteotomy is performed at the top of the tibia. The disattached segment is rotated to a more horizontal position with respect to the ground. The bone segment is held in place using a plate and screws.

The stifle joint is normally slightly flexed when standing. Therefore, in the standing position there is always a load on the CCL,

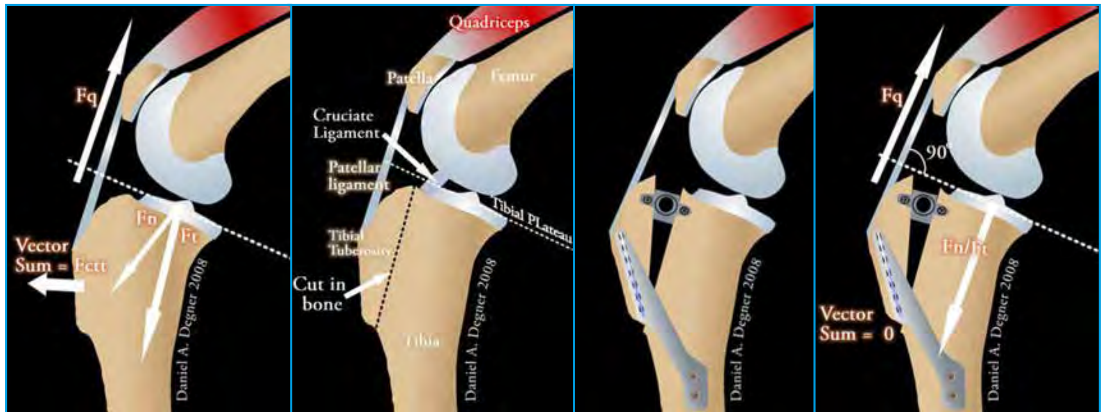

Fig. 10.30 Forces in the stifle joint before and after the TTA procedure in the canine. *Source: https://www.animalsurgicalcenter.com/tibial-tuberosity-advancement-tta. © Degner, Daniel DACVS.*

and progressive degeneration will take place. After the TPLO, the femur no longer slides over the tibial plateau and the leg can be used immediately.
Possible complications are the following: Anaesthesia-related risks, infection, poor wound healing due to too much activity. Furthermore, the change to the tibial plateau displaces the femur towards cranial, and thus closer to the attachment point of the patellar tendon. This increases the forces on the patellar tendon, which can lead to irritation and infection of the patellar tendon.

Sources

- https://www.animalsurgicalcenter.com/tibial-tuberosity-advancement-tta
- www.spireveterinarysurgery.com/tplo.html
- Boudrieau, R. J. 2009. Tibial plateau leveling osteotomy or tibial tuberosity advancement? Vet. Surg. J. 38(1): 1-22.

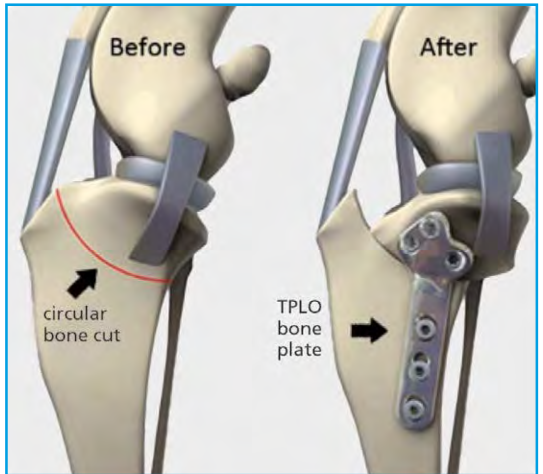

Fig. 10.31 The TPLO procedure in the canine. *Source: https://www.elizabethstreetvet.com/tplo--tibial-plateau-leveling-osteotomy-.*

Luxation and subluxation of joints

Luxation = Permanent dislocation of joint surfaces.

Subluxation = Joint surfaces still have some degree of contact.

Origin

- Several different forms are possible:
  1. Primary, due to trauma
  2. Secondary, due to pathological changes.
  3. Congenital
- It can be recurrent or fixed.

Examination

- Close inspection during assessment of the animal's locomotion.
- Congenital cases often present in the shoulder or hip.
- As a consequence of trauma, it can happen anywhere.
- Close inspection of the animal's movements.

Diagnostics

- X-rays, particularly after trauma. This is also to determine whether other trauma is also present.

Treatment

- Dependent on where the luxation or subluxation is. In principle, the treatment is reduction with stabilization, either with fixating bandages or a surgical procedure.

Treatment

- Conservative
  - Cage rest
  - At first, anti-inflammatory medication can be prescribed (NSAIDs or corticosteroids). No preference for corticosteroids has been demonstrated, see chapter 14 on medications.
  - If necessary, supplementary pain relief can be given, in the form of opiates or tramadol.
  - Physical therapy is also an option.
  - The prognosis with conservative treatment:
    - 100% recover if symptoms are mild (pain), though 50% experience recurrence within 1-36 months.
    - 50% recover if symptoms are more severe. Here too, there is recurrence in 30%.

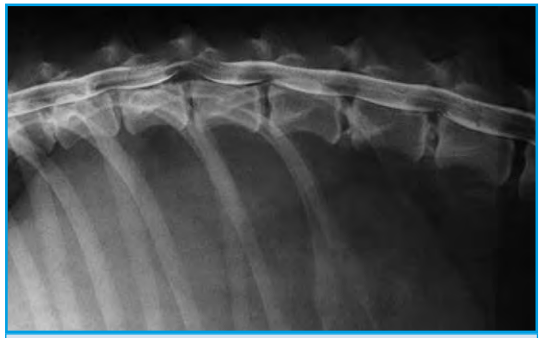

Fig. 11.5 Myelogram of thoracolumbar IVDD between T12 and T13. *Source: Aharon orthomanual veterinary medicine.*

Surgery

- Surgery is primarily elected if there is evidence of neurological impairment. Decompression through surgical intervention is then preferred. In addition, preventive fenestration of the adjacent intervertebral discs can be performed to prevent recurrence.[2]
- The techniques most frequently used are dorsal laminectomy and hemilaminectomy.

Table 11.3
Chance of recovery with conservative treatment and surgery.* *Source: Lecture Spring Days 2016, Simon Platt.*

Grade	Neurological status	Conservative treatment	Deep pain perception
I	Pain	90%	90%
II	Ambulatory, paresis	90%	90%
III	Non-ambulatory, paralysis	70%	90%
IV	Paralysis	50%	80-90%
V	Absence of deep pain sensation	<5%	Time dependent <24 hours 50% >48 hours <5%

* Comparative evaluations of recovery rates in animals receiving conservative and surgical treatment is not an entirely straightforward exercise. The criteria applied to indicate "recovery" are not uniform. One surgeon might consider "unassisted walking" as indicative of the 100% success of a surgical intervention, without the quality of the walking and the neurological "grade" of the recovery always being considered. Indeed, there is a big difference between neurological and clinical recovery, and none of the studies apply clear conventions on this. Orthomanual veterinary medicine distinguishes between clinical and neurological recovery. For example, neurologically speaking, an animal capable of all functions (such as running, urinating with one leg raised and playing), but with slightly delayed proprioception, is categorized as grade I. They are not considered fully recovered. Clinically, we do view these dogs as "recovered", but when conducting scientific study, orthomanual veterinarians apply the strictest criteria for recovery.

- Even if surgical intervention is carried out, a chance of recurrence remains.
  - With preventive fenestration 0-24%.
  - Without fenestration 3-42%.
  - Recurrence usually occurs within 36 months.
  - Recurrence usually occurs right next to the intevertebral disc (ID) that was treated during the operation. This can probably be explained by an increased instability of the vertebral column.

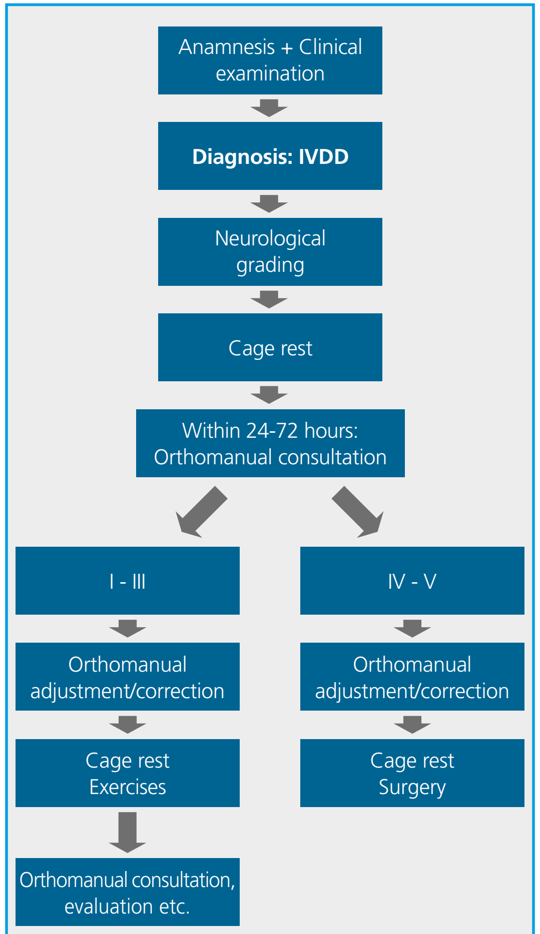

Fig. 11.6 Treatment protocol for IVDD according to orthomanual principles. *Source: Aharon orthomanual veterinary medicine.*

- The prognosis is dependent on the animal's neurological state before the operation.
- In cases where there is an acute loss of deep pain sensation (within 1 hour), time is of the essence. If possible, you want to be in the operating room within 12 hours. In all other situations, the time element is less important.
- In cases where pain perception is present, 86-92% chance of recovery.
- Without pain perception, 0-76% chance of recovery.
- Within 2-4 weeks, pain perception should have returned.
- Within 2-4 weeks, muscular strength should be restored to such a degree that the animal regains its ability to walk.

Orthomanual veterinary medicine

- In one session, if possible, the various misalignments are corrected. Follow-up assessments are done 2 weeks later, and at 3 months and 6 months.
- The first adjustment is followed by cage rest for two weeks, then if possible, exercise should be built up gradually.
- In addition, conservative treatment (supportive care) is provided.
- Recurrence is unusual. If it does reoccur, it generally happens only after a longer period of time has elapsed.
- The prognosis corresponds to that with surgery. Only for a full-fledged extrusion would surgical intervention provide a better prognosis.

Pathogenesis

- Atypical loading of the lumbosacral junction causes intervertebral disc degeneration. This leads to instability, which puts increased pressure on, among other things, the facet joints, leading in turn to ventral subluxation of the sacrum.
- To compensate for the instability, there is a proliferation of soft tissues, a thickening of the end plates and spondylosis formation.
- This then leads to constricted blood flow to the intervertebral disc and thus to further degeneration of the intervertebral disc.

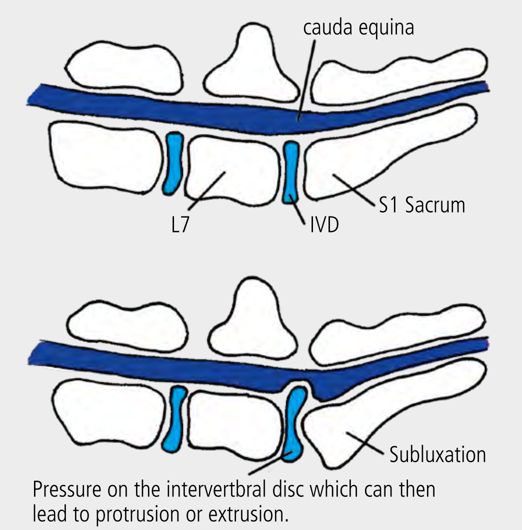

Fig. 11.8 The pathophysiology of degenerative lumbosacral stenosis (DLSS): abnormal movement within the lumbosacral junction. This leads to degeneration of the intervertebral disc (IVD), which in turn causes vertebral instability and ventral subluxation of L7 or S1. This produces additional pressure on the intervertebral disc which can then lead to protrusion or extrusion. This causes proliferation of bone and soft tissue, which ultimately leads to compression of the cauda equina. This is expressed through pain and neurological dysfunction.

- Over time, disc protrusion and inflammatory responses can be expected.
- Pain and loss of function are the result.

Features

- It is mostly seen in the larger breeds. A predisposition has been demonstrated in the German Shepherd.
- It is also seen in the Boxer, Rottweiler, Dobermann, Bernese Mountain Dog and Dalmatian.
- It is more common in working dogs.
- It is more common in males than in females.
- It is more common in older age dogs, with a peak at about 7 years of age.

Anamnesis

- Affected animals often have a history of lower back pain.
- There may also be lameness in one or both hind legs.
- The animal may be sore in the lumbosacral region; in rare cases, there is also automutilation.
- Affected animals have trouble rising, sitting and lying down.
- They are unwilling to jump! This is the main symptom.
- The tail is usually held low.
- There may be faecal and urinary incontinence.

Symptoms

- Pain at the lumbosacral junction.
  If necessary, this can be elicited by hyperextension of the lumbar vertebrae and hyperextension of the tail. However, this is an uncomfortable procedure and is usually unnecessary.
- Affected animals often stand with their haunches crouched, in squatting-like position.
- Sometimes one hind leg is lame, with the animal unwilling to bear any weight on it. This can be a symptom of nerve entrapment (L7-S1, radicular pain or root signature).
- The signs are often more orthopaedic than neurologic in nature, because the cauda equina is better able to withstand pressure than the spinal cord.
- But there may well be neurological signs:
  - Posterior ataxia
  - Urinary and faecal incontinence
  - LMN problems:
    - Posterior paresis
    - Muscular atrophy (due to lack of use and neurogenic muscular atrophy resulting from damage to the N. Ischiadicus).
    - Hyporeflexia of the withdrawal and cranial tibial reflexes.
    - Patella pseudo-hyperreflexia (due to diminished tension on the stifle joint flexors).

Fig. 11.9 Dog with radiating pain in the left hind leg due to DLSS. When standing, the dog holds the left hind leg off the ground. *Source: Aharon orthomanual veterinary medicine.*

Chapter 12.
Advanced imaging in spinal pathologies

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For sources in this article see list of literature (chapter 19).

Despite the great advancements in imaging, clinical and neurological examination remain the cornerstones of diagnosis of spinal problems. No complementary test replaces accurate neurolocalization and thorough clinical examination. Remember, we treat animals, not images. Nonetheless, diagnostic imaging can help us reach a specific diagnosis, localize a lesion and provide a realistic prognosis.

The most important imaging techniques are x-ray, computerized tomography (CT) (or CT myelography) and magnetic resonance imaging (MRI). CT and MRI are both far superior to x-ray. However, the latter is still widely used and recommended for general purposes, due to its ready availability.

Nonetheless, an x-ray can show only very apparent lesions, such as hemivertebrae, bone tumours or discospondylitis. Therefore, we usually need either a CT or an MRI to make a confident diagnosis.

Fig. 12.1 CT scanner

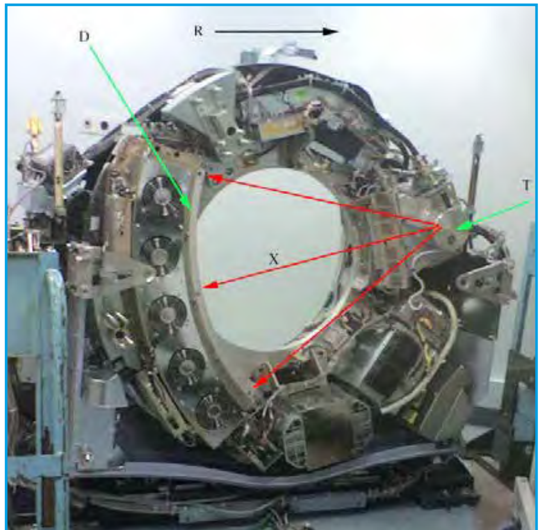

Fig. 12.2 CT scanner with cover removed to show internal components. Legend: T: X-ray tube, D: X-ray detectors, X: X-ray beam, R: Gantry rotation. https://en.wikipedia.org/w/index.php?title=CT_scan&oldid=931133973 (accessed 30 December 2019).

12.1 MRI and CT fundamentals

Both MRI and CT images are computer generated. The computer acquires and processes data to create a picture of a "slice" of the patient.

In a CT scan, the data is acquired by means of an x-ray tube that rotates around the patient. The tube is connected to detectors of the radiation passing through the patient's body. As in conventional radiology, x-rays that pass through the patient are attenuated according to tissue thickness and density. The computer uses the information provided by the detectors to create a black and white image (figure 12.1 and 12.2).

The attenuation coefficient (or radiodensity) of each tissue is represented in grey tone scale. This attenuation coefficient of radiation within the different tissues is expressed in Hounsfield units (HU). Thus, water has a value of 0 HU, the cortical bone of +3000 HU and air -1000 HU.

MRI, in contrast, generates images using magnetic fields and radio waves. A strong magnetic field causes all the protons in a patient's body to spin parallel to the field direction. If the magnetic field is disrupted, the nuclei recover their normal spin direction, producing radio signals which decrease over time as the result of two processes, known as T1 and T2 relaxation. These parameters differ depending on tissue composition. Soft tissue produces a wide range of radio signals, while bone generates very little differentiation. Computers use this variety of emitted signals to build an image, exploiting these differences to differentiate tissue.

There are two basic types of MRI: low-field and high-field. The difference relates to the magnet. Low-field MRI machines are usually open design and range from 0.2 to 0.6 Teslas (T) whereas high-field scanners are at least 1.5 T. Low-field MRI equipment is far more affordable, and positioning patients is easier. High-field MRI yields images of much greater quality, with thinner slice acquisition and faster scan times, thanks to the signal to noise ratio.

Hansen Type II

- In this type of disc disease, the herniated material is seldom clacified so CT scan will not usually show changes.
- With a 3D CT scan, misalignments (for example, in the lower back) may be very visible.
- CT myelography can provide extremely good information about the area and type of compression, perhaps as good or better than information from MRI (figures 12.7 to 12.11).
- According to orthomanual principles, chronic IVDD is usually associated with vertebral misalignments. On these, CT could potentially provide optimum information.

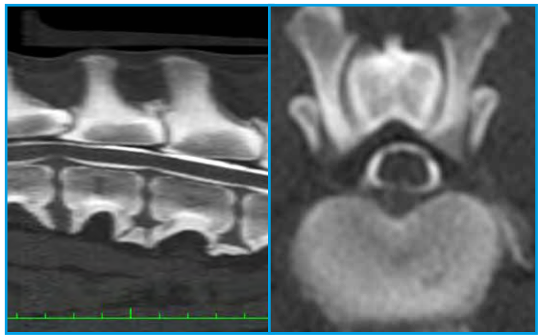

Fig. 12.8 Hansen type II - Disc disease myelogram.

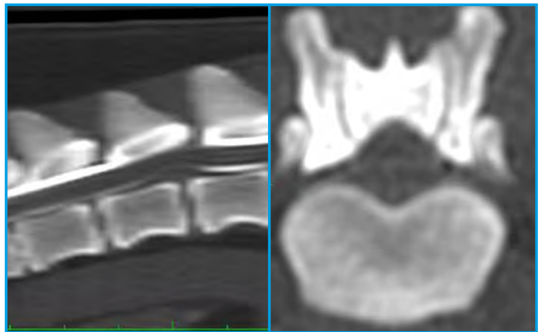

Fig. 12.9 Hansen type II - T13-L1.

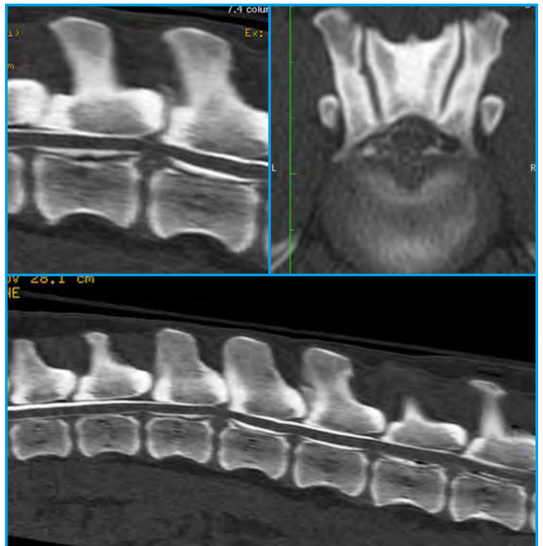

Fig. 12.7 Hansen type II - Disc disease myelogram.

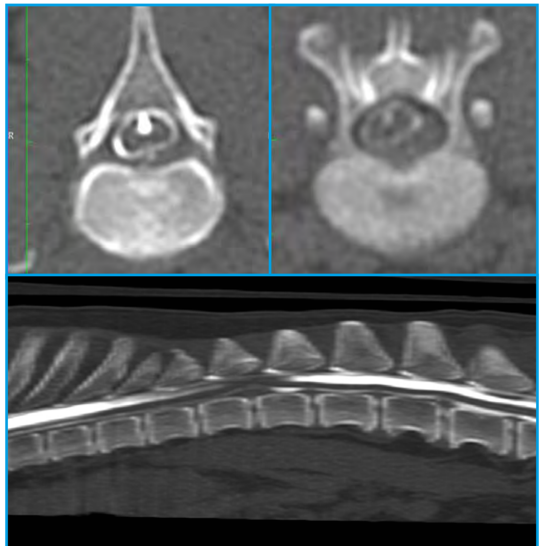

Fig. 12.10 Hansen type II - With syringomyelia.

Acute non-compressive disc disease, or high-velocity low-volume IVDD. Also commonly, though erroneously, called Hansen type III

- This disease is neither compressive nor does it involve calcified disc material. Therefore, MRI is the superior imaging technique, as it shows intramedullary changes and the involved discs.
- Nevertheless, the changes that can be seen using CT myelography will usually be enough to rule out compressive disorders; although with a CT scan, acute non-compressive disc disease would be impossible to differentiate from from ischemic disease (i.e., a fibrocartilaginous embolism). Treatment is similar in both cases (physical rehabilitation). The prognosis would, in both cases, greatly depend on clinical findings rather than imaging (figures 12.12 to 12.15).

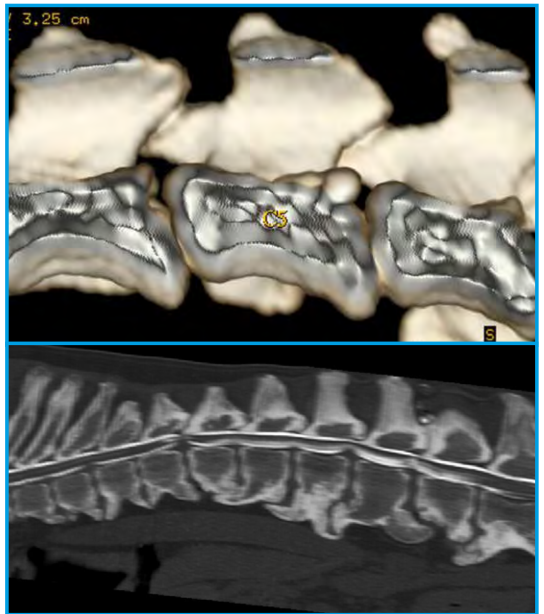

Fig. 12.11 Thoracolumbar disc disease.

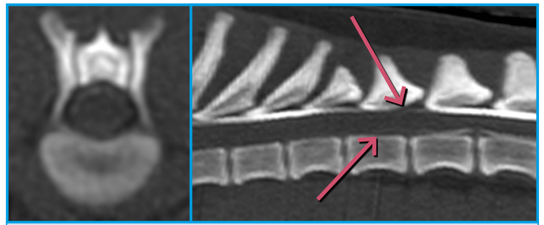

Fig. 12.12 Hansen type III - Reduction of subarachnoid space.

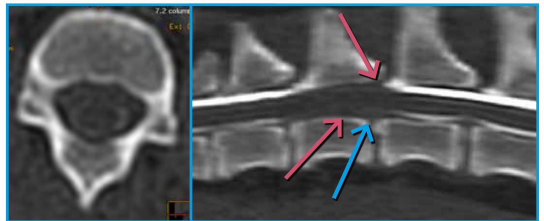

Fig. 12.13 Hansen type III - Reduction of subarachnoid space. *Blue arrow points to the disc herniation (tiny).*

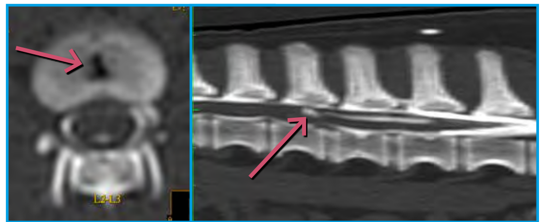

Fig. 12.14 Hansen type III - This is a type III with disc material that has gone through the spinal cord. Described in the ECVN meeting poster (page 290). In the transverse view, gas effect in the disc can be seen, beside the trajectory of disc material.

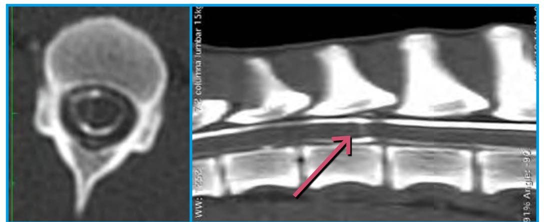

Fig. 12.15 Hansen type III, like fig. 12.14. This is a type III with disc material that has gone through the spinal cord. Described in the ECVN meeting poster (page 290). In the sagittal view, gas effect in the disc can be seen, beside the trajectory of disc material.

If changes in the joints have occurred, provide supportive joint care to the extent possible. In addition to a managed exercise regime and ergonomic advice this can include medication and/or a variety of different supplements and a special diet. This chapter describes the various medications that may be used and the component ingredients of supplements, alongside their effects on the body. Note that most research on the effects of supplements has been conducted in humans and not in dogs.

14.2 Medications

With contributions from I.M. (Inge) van Geijlswijk, PharmD, PhD

Many of the medications used for IVDD are pain relievers in the form of NSAIDs, tramadol or gabapentin. In addition, corticosteroids are sometimes given to animals with neck pain. This section describes the relevant medications.

Glucocorticoids

Pharmacological effects

- Anti-inflammatory: Suppression of prostaglandin synthesis, T-cells, histamine release and synthesis of proinflammatory mediators.
- Immunosuppressive: Fever reducing, leukocytopenia, suppression of immune system function.
- Anti-exudative and anti-allergenic: Stabilization of cell membrane integrity, modulation of response to histamine.
- Anti-toxin: Suppression of immunoreaction to cytotoxicity.

Pharmacological mode of action

- Suppression of cytokine synthesis.
- Inhibition of eicosanoid synthesis by suppressing phospholipase A2.
- Inhibition of antigen-antibody reactions and suppression of T-cells.
- Suppression of vasodilation, thereby counteracting oedema build up (modulation of histamine response, membrane-stabilizing effect).
- Suppression of macrophage function, suppression of histamine release macrophages (acts as anti-allergenic).
- Suppression of collagen and glucosaminoglycans synthesis (inhibits formation of extra-cellular matrix, but also suppresses wound healing).
- Suppression of osteoblast functioning (in the long term, osteoporosis can be considered a side effect).
- Suppression of cell proliferation.
- Suppression of endogenous corticosteroid synthesis.

In addition, other effects are the following:

- Influencing the metabolism: Stimulation of gluconeogenesis, protein degradation, increased glucose utilization, reduced sensitivity to insulin.
- Reduction of muscle mass due to protein degradation.
- Changes in fat storage, no longer in periphery, but in the neck, torso and face.
- Stimulation of Na retention and K excretion.
- Suppression of Ca absorption from the gut, promotion of Ca excretion via the kidneys.
- With long-term use, this can lead to osteoporosis.
- Positive inflow effect on the heart.

Cushing effect and anti-inflammatory effect are negatively correlated. The stronger the anti-inflammatory effect, the less the cushing effect.

Indications

1. Adrenal cortex insufficiency
2. Infection
3. Allergy, anaphylactic shock, endotoxin shock.
4. Asthma, allergic rhinitis
5. Cerebral oedema
6. Lymphoma
7. Immune system mediated disorders such as polyarthritis, immune system mediated haemolytic anaemia, inflammatory bowel disease and meningitis.
8. Tendovaginitis, periostitis
9. Hypercalcemia

Side-effects

- Immunosuppression
- Delayed wound healing
- Increased intraocular pressure
- Peptic stomach ulcer
- Suppression of endogenous cortisol synthesis.
- Myopathy
- Skin atrophy
- Osteoporosis
- Diabetes mellitus
- PU/PD

Contra-indications

- Immune deficiency, infections: Viral, mycoses, sepsis.
- Stomach ulcers
- Diabetes mellitus
- Osteoporosis, hypocalcaemia
- Glaucoma

Available products

- Dexamethasone (Dexoral®)
  - 0.5 mg
- Prednisone
  - 5 mg
  - 20 mg
- Moderin® = methylprednisolone
  - 2 mg
  - 4 mg

***Note:** The balance of glucocorticoid potencies and mineralocorticoid potencies of different therapeutic corticosteroids differ remarkably, and are expressed in relation to the potency of the natural (non-selective) cortisol.*

For glucocorticoid activity this is cortisol : predniso(lo)ne: methyl-prednisolone :

Back to the Clinic

A Practical Approach to the Veterinary Neurological and Orthopaedic Patient

Patient assessment is for clinicians, students and specialists a key task in itself. Every aspect of a patient consultation, from the general examination to more specialist orthopaedic or neurological examinations, requires a multidisciplinary approach.

For myself in my clinical work, and before that as a student, with a period as a lecturer in between, I encountered difficulties in patient assessment, as well as in diagnosing and planning practical and effective solutions to the complaints my patients were facing. This was not due to a lack of knowledge or insight, but because practically every subject was presented in a separate book or (now) website. We have separate books for fracture repairs, for neurology, for emergencies and for anatomy and internal medicine.

Now, at the head of a (mostly) referral clinic I felt the need for a practical book bringing together the most relevant subjects. Every small animal veterinary practice sees many neurological and orthopaedic patients, so we clinicians – from students with an interest in these topics to specialists – need an easy reference on anatomy, locomotor assessment and general neurological and orthopaedic examination, as well as rehabilitation, preventive education and advice for owners. This needs to be brought together and arranged in such a way as to provide the clinician grounded advice on whether surgery or a more conservative approach is needed and give direction on what to do and how to do it.

The current manual does all of this, with an important addition: an introduction and special emphasis on the Aharon Method of orthomanual veterinary medicine. The Aharon Method is an animal-friendly, cost-effective approach for treating neurological and orthopaedic patients and for preventive veterinary medicine.

D. C. Aharon, DVM

"A good manual which combines all aspects of locomotor disease diagnosis and management, in a practical manner... for both students and practicing veterinarians."

Z. Polizopoulou, DVM, PhD, Professor, Department of Clinical Studies, Faculty of Veterinary Medicine, Aristotle University of Thessaloniki

"A must-have for every clinician... Follow the described physical examination method and you won't miss a thing on your lame patient."

Birgit Derix, DVM

"An essential guide for those interested in or practicing orthomanual therapy. In addition to comprehensive coverage of this mobilisation technique, the book includes contributions from internationally acclaimed specialists on neurological and orthopaedic examination and interpretation."

Clare Rusbridge BVMS, PhD, DECVN, FRCVS

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