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The osteopathic influences on the walk

Kirsten BECKER

The osteopathic influences on the walk of the horse are to be shown with a theoretical and practical analysis. The effects of the osteopathic treatment of the horse are to be outlined as impacts on the horse's motion sequence.
The first section gives a general description of the walk. After this a short anatomical composition of the frame as part of the musculoskeletal system is given. The analysis of the most important muscles and their function is laid out with the aid of a very detailed description of the horse's walk. Further, the influence of the inner organs and of the tissus on the musculoskeletal system is defined.
In the middle section of this paper the osteopathic treatment approach is illustrated and the exercise of influence on the walk is clarified. With this the neurological interrelationship and the effect of the vegetative nervous system is explained.
Finally the practical examination is described with the aim to measure the influence of the osteopathic treatment on the walk. For the examination two groups of horses were analysed, one group acted for analysis purposes and the other as a control group. For each horse, three measurements were undertaken. The analysis group was osteopathically treated immediately after the first measurement. The control group was not treated osteopathically at any time. The actual measurements consisted of measuring the distance between the two marks on one side of a stride and the time duration of the stance phases of the hindelegs.
The results of all three measurements were compared to each other and the results of the analysis group were compared to the results of the control group.
A clear difference in the measurement results of the analysis group could be detected, whereas there was only minimal variation in the control group.
This leads to the conclusion that an osteopathic treatment influences the walk of a horse.

The fascia thoracolumbalis in equine movement

Monique Brinkmann-Reijnders

When it comes to lameness and back problems in horses, myofascial structures are usually one of the last structures to receive attention.
This thesis showed that the fascia thoracolumbalis, which covers the back muscles, has significant influence on the movement of the horse. The fascia thoracolumbalis has many valuable properties which can increase performance and decrease the risk of trauma.
The fascia thoracolumbalis plays a role in supporting the spine and back muscles, suppleness and stability, saving energy and transmitting forces and last but definitely not least, it plays a role in coordination.
The important principles in osteopathy, 'a body is a unit' and 'structure and function are related', are playing an important role in the architecture of the body but also in the structure of the fascia, and on a cellular level. The different levels will influence each other. A problem on a cellular level will change the structure and a change in structure will influence the architecture of the body. The consequents are a change in function. The trauma can start on any of the mentioned levels.
The fascia thoracolumbalis is influenced by, and can influence, the many fascial and muscular relations it is in continuation with.
This structure should be paid attention to! It is the osteopath who learned techniques in order to 'communicate' with fascia to realize good functioning of this structure and of the entire body.

The diaphragm, more than a respiratory muscle

Ruth Cohen

Primarily the purpose of this thesis is to explore the connection between the diaphragm and structures in the thoracic cavity, neck- and headregion of the horse. Looking for a most disturbing factor for diaphragm activity is a secondary purpose.

The diaphragm is a dome shaped musculotendinous plate. The diaphragm consists of a central tendon and a muscular part which can be subdevided into the pars sternalis, pars costalis and pars lumbalis. There are three openings in the diaphragm:

- The hiatus aorticus with the aorta, azygos nein and thoracic duct
- The hiatus oesophagus with the oesophagus and the two vagus nerves
- The caval foramen which forms the passage for the caudal vena cava

The crus sinister and crus dexter, formed bij the lumbar part of the diaphragm, create an arcade. This is called the lumbocostal arch and here passes the m. psoas major, m. psoas minor, the sympathetic trunk and the splanchnic nerves.

The nn. pphrenici and the intercostal nerves take care of the innervation of the diaphragm. Vascularisation comes from the a. thoracica interna.

Autonomic activity is regulated in so called brain centers. Here coördination of afferent and efferent impulses takes place. Overall these centers are referred to as the reticular formation. Here there are groups of respiratory neurones which form a complex network from where breathing impulses are given.

The horse has a so called two-phase breathing mechanism (8-14 x p/min.). The first phase is a passive inspiration and expiration, the second phase an active inspiration and expiration.

The diaphragm is primarily linked to breathing. Except its huge part in the breathing mechanism it has other functions. The transport of lymphatic fluids is partially dependent of rhytmic pulsation from de surrounding structures. The diaphragm initiates these movements. Also the fasciae find their attachements on the diaphragm (e.g. the endothoracic fascia). It has visceral connections through ligaments and seperates and relates the thoracic and abdominal cavities to eachother. Through the endothoracic and cervical fascia there is a connection with the pericard, thyroid gland, hyoid and OAA complex. Even the tongue and ear can be related to the diaphragm, also through the fascia.

In embryology the tongue, neckmuscles and muscular part of the diaphragm develop from the first four pharyngeal arches. In time, when these structures get their shape, function and topographical situation, the diaphragm as it were comes undone from the neckmuscles. It may be assumed that connection through fascia is formed here.

Through the sternum tension can be given to the pericard. Both find their attachement on the sternum. Some authors believe there is a more direct attachement between the diaphragm and pericard through the phernicopericard ligament. The parietal pleura is connected with the diaphragm through the endothoracic fascia. As a result of tension in the cervical fascia, the hyoid can experience tension also. This traction can have a negative influence on the temporal bone and through the m. occipitohyoideus and m. rectus capitis lateralis have a negative inluence on the OAA complex.

There can also be found a fascial connection between the diaphragm and the meninges. Perhaps this is far-fetched, but from the osteopathic view every structure is connected to eachother it might be possible.

It is not clear if fascial tension can cause a disfunction a the thyroid gland. The cervical fascia wraps around the thyroid gland but it is more likely that poor vascularisation is a primary cause of the disfunctioning of the thyroid gland. Poor vascularisation is possible if the cervical cranial ganglion

disfunctions and sends out disturbed messages through the nerves which innervates the arteries of the thyroid gland.

Because the diaphragm has so many attachements, it has a major influence on the body and vice versa. If a blockade is found in the cervical, thoracic or lumbar region it can be the cause of a less functioning diaphragm. If hypertonicity of the psoasmuscles occurs also the diaphragm can find itself more tense. Tension in the region of the psoasmuscles can cause a disturbance of the ventral chain. Because of the close co-operation between the dorsal and ventral chain it is assumed that hypertonicity or hypertrophy from the dorsal chain has its influence on the ventral chain.

Many factors have their influence on the diaphragm. It is not possible to appoint one factor which is most responsible for disfunctioning the diaphragm. Tension from the surrounding structures seems to be the major factor in influencing the breathing pattern. This might cause faster accidation of the body.

Some connections in this thesis may be a bridge too far. But in the osteopathic sphere all structures are connected to eachother, a couple of connections, which can be discussed, are treated in this thesis.

If one overviews all the connections as mentioned in this thesis, it is clear that the diaphragm definitively is more than just a breathing muscle.

An osteopathic view on Vitamin E deficiency.

Ingrid DE BOELPAEP

Vitamin E is a necessary nutrient that can't be made by the horse itself and therefore should be present in his feed. A deficiency of this vitamin can cause different diseases, because due to his non-specific metabolic function as stabilizer of the cell-wall, it has an important role in reproduction, immunity, nerve and muscle function. In horses, especially the skeletal muscles are sensitive for a deficiency of vitamin E. This comes to expression in a number of neurogene and myogene muscle diseases.
Systematically low values of vitamin E are seen in Equine Motor Neuron Disease, a neuromuscular disease, where the ventral motorneurons are affected. In this illness other values such as glucose, iron and copper can also be disturbed. However no consistency is found in these values and therefore no clear conclusion can be made. An initial malabsorption syndrome could be at the basis, but this is only seen in a limited number of cases. It is more logic to believe that besides the central nervous system, other organs can also suffer from oxidative damage due to vitamin E deficiency.
Exertional Rhabdomyolysis is also put in relation with a shortage in vitamin E, but here less evidence has been found. It is however not illogical to believe that free radicals produced during training, can cause oxidative damage to the muscle cell membrane and therefore muscle stiffness appears quicker. Other important factors are excessive training and administration of too much carbohydrates and sugars in the feed.
The principal source of vitamin E (tocoferol) for horses is fresh pasture. It has however been noticed that also horses with sufficient access to pasture can show a deficiency of tocoferol. This demonstrates that the bioavailability of the vitamin and the absorption capacity of the horse play also an important role.
Due to the hydrophobic character of vitamin E, it is a big challenge for the body to obtain a good absorption, transport and tissue distribution. These processes are much related to these of lipids and lipoprotein homeostasis. For a good absorption and digestion, an optimal functioning of small intestines, liver and pancreas are needed. When there is a pathology in one of these organs, it could have a negative effect on the bioavailability of vitamin E.
An osteopathic treatment can contribute to an optimal functioning of the gastro-intestinal system and can through the arterial rule see to a good distribution in the blood, so that the vitamin reaches where it is needed and is also removed in time. Due to the holistic approach, the osteopath looks at the complete horse. Relations with other organs and tissues are also very important and therefore the principal "treat what you find" stays, as always, applicable.
Food supplements are often recommended to compensate a shortage of vitamin E. They always contain synthetic sources of vitamin E, which consists of a mixture of less active isomers of tocoferol. Furthermore, esters are added to increase the stability of vitamin E. They however, decrease the absorption of the vitamin. There is also no unequivocality in the recommended dose and so it is not easy to know the correct amount to be given. It should also be noted that in vitro, high concentrations reverse the antioxidative effect into an oxidative effect. But because they contain less active isomers and have a less good absorption, I do not think that there is danger of surdosage of vitamin E with the administration of food supplements. Of course you have to keep in mind that they overload the liver.
From this, it can be concluded that food supplements can't replace the natural active source of vitamin E (d-α-tocoferol) and that it remains important for the horse to have sufficient access to fresh pasture. This also allows the horse to have regular movement, what reduces the change for stiffness in the muscles.

The thoracolumbar juction

Anke GEUTEBRÜCK

The thoraco – lumbar junction, as seen in my thesis, is concenning the 16. thoracal vertebra until the 2. lumbar vertebrae.
In the nervous system, the n. genitofemoralis, n. iliohypogastricus and the n. ilioinguinalis will appaer from the spinal cord. hypersensibility in their dermatomes can suspekt a blocked vertebra in this region.
In o.s. – innervation, nerves wich control the kidney's, the glandula adrenalis as well the intestinum tenue and the colon, are important. Also the genitalapparatur in the horse canbe affected by leasions in the TLJ – area.
In the case, also the lever, attachted to the diafragma muscle, will give an important visceral relation, over the crura, into the psoas muscle and the fascia iliaca.
In the TLJ, minimal forces in the muscular, as well the fascial tissues, create a great movement in this area. There for, movement in the sagital plane (Ext.-Flex) and the horizontal plane (Lat – Flex), will cause a fine movements, wich can be seen as those of a " sinus – curve ".
In general movement of the horse, there is a biomechanical connection between the T.L.J. and the forelimb.
In this case, the F.T.J. can affect the T.L.J. over those fascial structuren in a biomechanical way.
Active contractio in fascial tissue can be made over the myofibroblast. In this way,
literature discribes an active contraction in the F.T.L.
Some viszera, such as the jejunum, ileum, caecum, ren and the ovaria's, are ateched to the boney structures in the F.T.J. All these ligaments and meso's are directly connected to the fascia iliaca and the m. psoas major. The fascia iliaca find it's origin in the lig. arcuatum, related to the arcades of the psoas muscles and the area of the ventral psoas muscle. From cranial to caudal the fascia iliaca will cover the psoas muscles until their inseration on the trochanter minor ossis femoris. In this way, also the fascia renalis, fascia transversalis and sacro – iliacal joint will be invoved in relation of this psoas muscle.
The F.T.L. is inserted in the dorsal vertebral side to the lig. supraspinale. This ligament is further connected, over the lig. intraspinale, the lig. flavum, to the arcus vertebrae.
Lots of muscle and fascial tissues can be related to the T.L.J. Segmental innervation will be given to the m. obliquus ext., the m. obliquus int., m. transv. abd., m. serratus dors.,m. quadratus lumb., paravertebral muscles and the fascia glutea.
Related muscles in the T.L.J. are the m. latis. dorsi, m. glut. med., m. seratus dors. and the m. splenius.
Important connection in the T.L.U. – region will be caused by the m. psoas major, innervated through out the L1 – L2 vertebral region.
There is also an important connection over fascial tissue. the fascia iliaca and the F.T.L. are forming an important plate in whole this region. This connection in related muscle – funktion will be formed by the m. latissimus dorsi, m. glutaeus medius and the m. longissimus. In general, the gait – pattems in the

horse depend on the possibility's of flexion – movement in the hind – limb, over the m. psoas major, as well the posibility to move in the total thoraco – lumbar region.(Problems out of the efferent and afferent n. system in relation to the major conductive flexor muscle)
In this case, it might be logic that every visceral afferent problem in this area can affect normal movement in relation to the psoas muscle and so affect every normal movement in the horse. Never the less, although the all round consideration of being an important biomechanical component, and because of it'swaya strength, the psoas muscle seems not to be the only player in biomechanical dysfunction of this T.L.J. – area.
The importance of dorsal strenght, an described in the F. T. L. and as well because the some innervation area's out of the spinal cord. It's might be very much possible that the F.T.L. will reflect in his tissue, and so in the T.L.J., the conditions of every visceral relation. The F.T.L. is in this case called " the mirror" of visceral functions and movement !

The equine cecum in comparison to the canine cecum and the importance of this organ from an osteopathic point of view

Sarah Katharina Kaum-Nathaus

In the framework of the educational course for animal osteopathy offered by the International College for Research on Equine Osteopathy (ICREO), the thesis bearing the title “The equine cecum in comparison to the canine cecum and the importance of this organ from an osteopathic point of view” was written. As the title suggests the thesis is concerned with various aspects regarding the equine and canine cecum. The anatomy, physiology, embryologic development and a variety of frequent pathologies associated with the horse’s and the dog’s organ are described. In addition, important structures related to the equine and canine cecum as well as an osteopathic interpretation of these relations are presented.

As to this aspect, visceral, neurologic and fascial connections have to be distinguished. Great relevance is ascribed to biomechanic relations of the cecum, both in the horse and in the dog. Finally, several osteopathic treatment techniques for horses and dogs suffering from cecal problems are outlined. Furthermore, the potential for treatment of other structures via the cecum is emphasized.

At first sight, a striking difference in size is noticed when comparing the anatomic structure of the equine and canine cecum. Whereas the horse’s cecum is an organ of considerable extension, the canine cecum – because of its small size – might falsely be regarded merely as an insignificant ‘diverticulum’ of the colon.

The Bone Metabolism

Roos KOETER

Although for centuries bones have been used as a symbol of death, bone is certainly not dead tissue. Under a microscope it is clearly visible that bone tissue includes many holes and passage ways surrounded by live cells. In addition many blood vessels and nerves are present. These would not be present if, together with the bone cells, they would not form a functional system.

The functions of bone tissue are various. Bone tissue has a body support function, a protective function, a body shaping function, an attachment function for muscle and ligament tissue, a locomotion support function by forming joints, a tissue producing function of red blood cells and last but not least a storage depot for calcium and phosphate.

In order to execute all these functions a properly functioning metabolism is essential. Bone metabolism depends on local pressure-induced stimuli and hormonal and neurological influences.

Bone tissue is influenced by many different hormones. During development and growth, thyroid, growth and sex hormones mostly effect bone. Hormones also play an important role in bone calcium metabolism. Approximately 99% of all body calcium is stored in bone tissue as calcium phosphate. The free calcium plays an important role in various functions such as impulse transfer in nerve synapses, muscle contractions, sensitivity to stimuli of cells, secretion processes and blood clotting. Calcitriol, parathyreoïd hormone and calcitonine play an import role in the uptake and release of calcium in bone.

Neurological influences on the bone are directed through the orthosympathetic nervous system. Orthosympathetic nerves transfer impulses to the blood vessels of bone tissue and also to the bone cells as such. Binding of leptine, NPY and NMU in receptors of the hypothalamus result in inhibition of bone formation.

Bone metabolism is influenced directly by the orthosympathetic system and indirectly through the various hormone producing organs and glands.

Segmental symptoms of the skin and subcutaneous connective tissue of the horse

Annemarijn LAAN

The exterior of the horse reflects the interior, and the appearance of the horse offers us a lot of information which we can use for osteopathic diagnostics.
Segmentation has its origin in the early embryological development, when the mesoderm segments itself into somites. A somite exists of a segment of the neural tube, and to each segment belongs a part of the skin (the dermatome), a part of the muscular tissue (the myotome), a part of the skeleton (the sclerotome) and a part of the viscera (the viscerotome). Each somite is connected to the embryological spinal cord trough its own spinal nerve root. This connection stays unaltered troughout further life, although most organs will change their position radically during further embryological development.
Throughout segmental reflexes an exchange of information takes place within one segment, with interaction between the autonomous and somatic nervous system, thus enabling negative afference from one part of the segment to cause hyperactivity within the whole segment.
This way internal problems can become manifest at the surface of the body, causing symptoms such as pain, hypertonia, decreased skin nutrition and sympathetic symptoms, such as a disturbed sudomotion, vasomotion, pilomotion and increased fascial tonicity. The skin and the subcutaneous connective tissue reflect the condition of the whole segment and this provides us a lot of information.
It is essential to comprehend the somatic and autonomic innervation of the body to be able to interpret segmental symptoms. The discrepancy between the autonomic and somatic projection on the surface of the body, the great divergence, overlap and individual differences in segmental innervation cause too much complexity to be able to judge the condition of a segment based on a single symptom.
A single finding has no real diagnostic value; only the combination of several symptoms enables us to speak of segmental diagnostics. Segmental examination of the skin and the subcutaneous connective tissue can be used as a guideline during the osteopathic examination, in addition to the examination of mobility of the spine, the craniosacral examination and the examination of visceral motility.

An osteopathic view on the relationship between crib-biting and stomach ulcers

Jessica REURICH

One of the most visible symptoms of chronically reduced well-being in horses is the appearance of abnormal behaviour or stereotypies. Horses which develop stereotypies are found to be maintained under conditions in which they have trouble sustaining themselves. A stereotypy can ,however, also manifest itself as cicatric behaviour. Stereotypic behaviour generates endorphins. An example of stereotypic behaviour is crib-biting, whereby the horse grasps an object with its teeth, repeatedly seeming to suck up air and making a characteristic sound. Though for a long time it was assumed that the air that ends up in the oesophagus is also being swallowed, recent research has indicated that only a very small part of the air appears to reach the stomach.

Weaning at too young an age or incorrect weaning of the foal, the design of the stable, the type of bedding, the quantity and type of feed and the number of times that feed is provided, the type of training, social isolation, etc. are possible causes for starting to crib-bite.

During the last few years much research has been done into the physiological impact of crib-biting. There is increasing evidence that crib-biting results in a reduction in the agitation of the horse, primarily evidenced by a lowering of the pulse-rate during crib-biting. In addition to the influence on the heart-rate, it is almost certain that crib-biting results in a release of endorphins. Furthermore, there seems to be a connection between crib-biting and problems with the stomach. Feeding large quantities of concentrate seems to have a direct relationship to the incidence of starting to crib, as concentrates cause an acidification of the stomach. Crib-biting may also induce saliva production, which would subsequently reduce the raised acidic level.

The best treatment for crib-biting likely consists of giving the horse enough possibilities to forage (pasture) and permitting crib-biting somewhere with specific material covering the crib-biting location. Because of the indications that crib-biting is linked to stomach problems, it is recommended to first check the stomach for possible ulcers when a horse is found to start crib-biting. The possible link between cribbing and the stomach is central of this thesis.

The stomach is a very important part of the digestive tract. Cranially, the stomach borders on the diaphragm and the liver, wheras caudally it borders on the intestines. The stomach of the horse is of the monogastric complex type, since there is a non-glandular mucosa in the first part of the stomach that transitions to the glandular mucosa further towards the end. In the stomach, proteins and starch are broken down. The main function, however, is to store food and to transfer the stomach contents to the small intestine at a rate that ensures the highest digestive efficiency.

The stomach is equipped with a complex intramural neural network. This intramural plexus is engaged by local reflexes whereby the stomach wall reacts to direct stimulation. The sympathetic innervation of the abdominal organs is managed by a chain of paravertebral ganglia, also called the sympathetic chain, and by prevertebral ganglia (celiac ganglion). The parasympathetic innervation of the stomach happens through the vagus nerve. Besides afferent information of the stomach through the vagus nerve, afferent signaling also occurs through the phrenic nerve.

There is a marked prevalence of stomach ulceration in domestic horses; over 50% of the horses is suffering from stomach ulceration. Stomach ulceration is caused by an imbalance between the sympathetic and parasympathetic nerve system. The intensity of training is a primary risk factor. Diet and medication are also known for their influence in the development of stomach ulceration. Bacteria may also play a role.

Cribbing and stomach ulceration can influence the rest of the body through a diversity of relations. A deficiency in the blood circulation can cause harm to the stomach wall. When the stomach wall is damaged it can cause the development of stomach ulcers. A visceral problem of the stomach can cause a vertebral blockage of the thoracal segments T5 to T12 through the celiac plexus, splanchnic nerves, sympathetic chain and cornu laterale. From the celiac plexus there is a sympathetic feedback to the stellate ganglion, which can result in vertebral blockages of C7 – T1. Via the ramus

interganglionaris, this can also influence the cranial cervical ganglion (CCG) and subsequently have an effect on the blood flow in the head and on the occipito-atlanto-axial-complex (OAA-complex). In addition, visceral afferent information of the stomach can cause blockages of the lower cervical vertebra through via the phrenic nerve.

Cribbing horses can develop osteopathic laesions at the OAA-complex and in the lower cervical vertebra. The tensing of the throat muscles causes a flexion of the OAA-complex and an extension at the lower cervical vertebra. This means that cribbing may have an influence on the stellate ganglion and indirectly on the GCC. Blockages of the lower cervical vertebra can also cause problems in the plexus brachialis, the phrenic nerva and de scaleni muscles.

A blockage of the OAA-complex can influence the blood supply to the pituitary gland and the hormonal system, vagal effferent information to the organs, the hyoid, thyroid gland and the bones of the skull.

The primary respiratory mechanism (PRM) can be influenced by blockages in the facet joints of the vertebra through the ligaments around the vertebrae, by negative sympathetic feedback to the stellate ganglion through the GCC and by stress on the OAA-complex. Lower cervical blockages have a negative influence on the PRM via the dura mater. It is almost certain that cribbing leads to the release of endorphins. Cribbing likely stimulates the PRM via the hyoid by tensing the three throat muscles activated by cribbing causing a higher endorphin release .

A stomach problem can influence other organs because of the visceral relation of the stomach to other organs. The liver, the diaphragm, the spleen, the pancreas and parts of the intestines are relevant because of their direct visceral relation to the stomach. Movement of the diaphragm during breathing has a great effect on the mobility of the stomach. A blockage at the level of the cervico-thoracic transition can, amongst other possible effects, lead to a disruption of the phrenic nerve and musculi scaleni. As a result, cribbing may also influence the diaphragm.

Stomach problems and cribbing can have a hypertonic effect on the fascia cervicalis in the neck by causing disruptions in the OAA-complex and in the cervico-thoracic transition. This can have an influence on the skull, the hyoid, the thyroid gland, the cervical vertebra, the PRM, and finally also potentially on the shoulder and the front limb. Furthermore, stomach ulcers can lead to blockages in the lower cervical vertebra and thus influence the fascia cervicalis as a result of the phrenic afferent information.

In a horse suffering from stomach problems, blockages of the facet joints in the segments T5 to T12 can arise that can influence the fascia thoracolumbalis via the vertebral ligament connection, subsequently influencing the locomotion of a horse . Via the peritoneum a stomach problem can have an effect on the diaphragm. Due to the direct adjacent proximity of the organs, a stomach problem can have an effect on other abdominal organs too. Through the relation of the fascia transversalis with the fascia iliaca, a stomach problem can influence the psoas muscles. Because of the relation between the diaphragm and the stomach, a stomach problem can have an effect on the fascia endotharacica and the pleura and thus on the organs in the thoracic cavity.

This thesis shows that there are a lot of relations between the different structures of the body that (could) play a role in cribbing and stomach problems. Due to the variety of similar relations, it seems logical to assume that there is a link between cribbing and the stomach. What this link is exactly, is difficult to determine. There is a link in the disturbed afferent information of the stomach when problems arise (stomach ulcers) causing a blockage of the OAA-complex. This blockage can have an influence on the PRM and therefore influence the function of the hypothalamus and pituitary gland. This causes fewer endorphins to be released by the hypothalamus. Since stomach problems can lead to a sensation of pain, both around blocked vertebra as well as in the stomach itself, there is a higher demand for endorphins. Cribbing has a positive effect on the PRM because of the tension in the throat muscles which have a connection with the hyoid. This causes the hypothalamus to release more endorphins. Finally, the hypertonic throat muscles can possibly cause blockages at the OAA-complex leading to a negative effect on the PRM. However, it is still unclear as to whether the hypertony of the throat muscles really is a resultant effect of crib-biting.

The Atlanto-Occipital-Joint

Johanna ROTH

The thesis "The Atlanto-Occipital-Joint" discusses the effects of a blockade of the Atlanto-Occipital-Joint on the body, and which body dysfunctions could be the reason for a blockade of the Atlanto-Occipital-Joint.

Therefore we first look at the anatomy of the joint, its bones (the Os occipitale and the Atlas), its biomechanics and the structures around the joint.

At this we can see that the Atlanto-Occipital-Joint has got fascial links to the Thyroid Glands and to the Cardia as well as muscular links to the Hyoid and to the shoulder- and neckmuscles.
A higher tonus in the Atlanto-Occipital-Area influences the function of the PRM via the Dura mater as well as via fascial and muscular tension.
In particular we have to mention that a blockade of the Atlanto-Occipital-Joint limits the flex- and extension movement of the sacrum through the fixation of the Dura mater to the Atlas.
The Ganglion cervicale craniale is also influenced by a blockade of the Atlanto-Occipital-Joint because of its close position and its connections to the joint.
The Nervus Vagus as well as the Orthosympathetic System and the Hormone System are under the influence of the Ganglion cervicale craniale.
The Ganglion cervicale craniale can furthermore have an influence on the production of the Liquor cerebro spinalis.

The massive amount of connections of the Atlanto-Occipital-Joint to the different kind of structures of the body can also cause a blockade of the Atlanto-Occipital-Joint by an organic trouble somewhere else in the body.

For diagnosing the Atlanto-Occipital-Joint we can use palpation and mobility-tests of the Atlanto-Occipital-Joint. Testing of close related structures to the Atlanto-Occipital-Joint, like the Hyoid, can secure or concretise the diagnosis.
A blocked Atlanto-Occipital-Joint can be treated by mobilisation, a Jones Technique or a Listening of the Atlas.

To treat deeper lying structures like the Meningen or the Lamina of the Fascia cervicalis techniques like the distraction of the Atlas can be used. Should there be any tension left in the region of the Neurocranium after this treatment, fascial techniques of the Cranium like a lifting or listening of the Os parietale can be used.

Treating the Atlanto-Occipital-Joint is only a part of the osteopathic treatment of a horse and sometimes it's even not necessary. It becomes an important part of the treatment if there are primary blockades of the Atlanto-Occipital-Joint or the treatment of the rest of the horse did not solve the problems.
The treatment of the Atlanto-Occipital-Joint can also be an entrance for the osteopathic treatment of a horse with significant problems of the Nervus Vagus, for example a horse with an acute colic.

It's a fact in every osteopathic treatment:

Less is more!

How the front third of the thoracal spine influences the front legs

Daniela SCHREPFER

Following the principle of „form follows function and function follows form“ the interplay between the functional anatomy and the sympathetic regulation is the central item of this thesis. It focuses on the front legs whose sympathetic regulation derives from the Cornu laterale of the front third of the thoracal spine. Deviations from the healthy balance in the autonomous regulation can cause symptoms like lameness or stumbling whose reasons will not mainly be found in the legs themselves. Blockades and restrictions of the first third of the thoracal spine and disturbances of the Ganglium stellatum constrain the sympathetic information flow. A heightened muscular tonicity, an increased fascial tension, a reduced blood circulation and drainage, heightened sensitivity, piloerection and local sweating are possible effects. Through time the effects on the tonicity of muscles and fascia as well as the blood circulation and drainage can lead to predispositions for a variety of front leg problems. Human intervention in the horses motion patterns can cause blockades and restrictions. The various impacts have a different effect according to the type of horse and individual physical features. A current diagnostic finding can result from a loop of reactions, whose starting point is sometimes hard to locate. It can be an effect out of the web of the sympathetic regulation process, pain, compensation, structural alteration or reactions from other areas of the body. By the reactions from other body parts the open question stands to which extent radicular phenomena of the lower cervical spine originate in pseudo radicular phenomena of the first third of the thoracal spine.

This is an overview of the influence of the first third of the thoracal spine on the front legs. In the concrete case an adequate treatment should be applied under consideration of these various aspects.

A description of the thoracolumbar junction in the dressage horse, concerning the osteopathic relations.

Sheila SILADJI

The aim of this thesis was to confirm the following hypothesis:
"The thoracolumbar junction plays a key role to reach the ability for collection in the dressage horse."
Therefore it is necessary to give a widespread anatomical overview about this central part of the vertebral column of the horse. The biomechanical approach to statics and dynamics allows an overall picture about the anatomical relations, due to the importance and central role of that point. By describing the dynamical processes, it becomes obvious, that the thoracolumbar junction is mostly essential for transmitting the propulsion from the hindquarters to the front. The psoas muscles, which are attached to the thoracolumbar junction, are responsible for the transmission of the power from the hindquarters to the vertebral column. The degree of kyphosis and lateral flexion of the thoracolumbar vertebral column, can be interpreted as a sign for biomechanical functionality in that area, what is shown by stepping wide under the body. The step length is dependent from the mobility and flexibility of that part of the vertebral column and in particular from the psoas muscles.
Coming from the activity of the hindquarters we can make the relation to the dressage horse. What makes the dressage horse trained up to the S-class level so special?
The ability for collection is the essential point. Crucial for riding is to reach the "true" collection, what is possible only with a seriously educated horse and rider. Concerning the horse, it means the maintenance of the flexibility in the lumbar vertebral column. The classical way of training is described in this
thesis respective the scale of education, under consideration of the biomechanics. For progressing in the education it is most important that no blockades in the thoracolumbar zone occur.
There are a range of biomechanic problems that are discussed and their osteopathic consequences. For example, a number of organs which are in contact with that zone. The current state of the diaphragm and psoas muscles influences the related organs.
Directly in contact to the psoas muscles are the kidneys, the caecum, radix mesenterii and the female sexual organs, attached by the ligamentum latum uteri. The diaphragm itself is in contact with the lungs, liver, spleen, stomach, pancreas and colon ascendens. The thoracolumbar junction is a central point for most of the internal organs, therefore disturbances can be transmitted.
External parameters, such as the exterior of the horse have an influence on the total development as well as the rider and the saddle. The saddle is the communicater between the rider and the horse. Normally the saddle lies on Th9 until Th18, whereas the rider is sitting mostly on the thoracolumbar junction, what could have bad influences on that structure.
Classical dressage means the education of the horse under considering and in accordance to the medical and osteopathic knowledge and mental health of the animal. In relation to the thoracolumbar junction many visceral relations can be found, whose functionality can be affected by too many stress. In this area, each factor from a chain of lesions can influence the whole metabolism of the organism and the quality of the hindquarter movement of the dressage horse. Such a lesion chain contains a combination from lesions such as the visceral organs, muscles, fascia, bones and nerves.
Summarized it can be postulated that the hypothesis was confirmed by this work. When training and educating a dressage horse, with the aim of *true collection*, the thoracolumbar junction has an essential influence. This was shown in different osteopathic approaches and descriptions in this thesis. On the way to top-class sport, osteopaths and riders should absolutely work together, to support the athlete horse. This is also my personal intent as an osteopath and rider.
Always consider:
"The dressage was created for the horse and not the horse for the dressage!" (Stodulka)

Osteopathic view on the Portal Vein and the Porto-caval anastomoses

Ilse STUYTS

Circulation

The circulatory system consists of two components, the cardiovascular system and lymphatic system. The cardiovascular system is subdivided into an arterial and venous circulation. For the arterial circulation is the main artery the aorta, the main veins of the venous circulation of the body are the vena cava cranialis and caudalis, and finally the portal vein is the main vein draining the venous blood from the digestive system.

Vena Porta

From the embryology of the portal vein arises from the venae vitellinae. The portal vein in the fetus has a unsignificant role, when the fetus comes into the world and the neonatal phase starts, the portal vein is starting to functionate. During the fetal blood circulation is not, but along the liver carried by the ductus venosus.

The portal vein is an abnormal blood vessel in his structure. It is composed of several layers as each vessel, the tunica intima, the tunica media and tunica adventitia. However, the tunica intima of the portal vein contains no valves. The absence of these valves are partially composed by the muscle wall, the tunica media, which is larger developed in the portal vein compared with other large veins. The tunica adventitia of the portal vein has proportionately more nerve endings than other veins. This will quickly noticed changes in blood pressure and the body can adjust to accommodate it by increasing muscle contraction or porto-caval anastomosis final formation.

At the height of the second lumbar spine escapes the base, the digestive side of the portal vein. Then he passes the cranial portion of the duodenum and liver to the omentum minus. Together with the hepatic artery and bile duct he enters the liver, forming the Trias Hepatica. In the liver the portal vein is divided into a ramus ramus dexter and a sinister. This split is evident in the dog, unlike the horse where there are multiple anastomoses between the two rami present.

The caudal, digestive, side of the portal vein, of the horse, is built up from three blood vessels, the vena lienalis, the inferior mesenteric vein and superior mesenteric vein. The vena lienalis is formed by the venae pancreaticae, the venae gastricae brevis and the vena gastro-omentalis sinistra. The vena lienalis provides the venous blood supply from the pancreas and stomach. The inferior mesenteric vein is built from the vena coelica sinistra, venae sigmoidea and the vena rectalis superior. The inferior mesenteric vein provides drainage of venous blood from the colon and rectum. Finally there is the venous drainage from the small intestine, the caecum and the cranial portion of the colon, performed by the superior mesenteric vein.

There are also some blood vessels that come directly into the portal vein, this are the vena cystia, the venae gastrica dextra and sinistra, the vena prepylorica and the venae para-umbilicales.

In dogs, the portal vein is formed by the confluence of the mesenteric vein and vena gastrolienalis. The vena gastroduodenalis and, in some cases, the vena gastrica dextra enters the vena porta too.

Venae cava cranialis and caudalis

The vena cava cranialis and caudalis ensure the drainage of venous blood from the limbs and torso to the right atrium of the heart. The fetal ductus venosus flows also in the vena cava caudalis. The vena cava cranialis of the horse, consists of the jugular veins to join together in the short trunk and bilateral jugular vein subclavius. Usually the azygos vein flows directly into the right atrium, but sometimes it also flowes into the vena cava cranialis.

At the dog the vena cava cranialis is formed by the vena mesenterica and the vena gastrolienalis. The vena cava caudalis receives venous blood from the vena iliaca externa and interna and from the tail veins. Further additions in the course of the vena cava caudalis are the unpaired median sacral vein, the vein on the right testicularis / ovarica, the venae lumbales, the vena renales and on the right-side the vena suprarenalis dextra. Just below the liver the venae hepaticae and the venae phrenica inferior enters.

Digestion

The portal vein is responsible for the venous drainage of nutrient-rich blood from the digestive system. The organs that belong to the digestive system are the esophagus, stomach, small intestine (duodenum, jejunum and ileum), colon (colon and caecum), liver, pancreas and spleen. The digestive system between the dog and the horse has substantial differences. The digestive system in the horse is focused on digestion and fermentation of grasses, whose main ingredient are carbs. In dogs, the focus is on on the digestion of meat, which has proteins and fats as the main ingredient. This leads to differences in the size of the stomach, the length of the bowel and the development of the caecum.

Caval and portosystemic shunts

At the time when the blood pressure in the portal vein is too high, a result of a decrease in blood flow to the liver, but a regular supply from the digestive system, the body takes action. At that time, the body is searching for a way to make sure that the digestive-blood reaches the body-circulation. This can lead to the formation of porto-caval or porto-systemic shunts. The porto-caval shunts are acquired during life, porto-systemic shunts can be congenital and acquired.

Congenital porto-systemic shunts are malformed in embryology, blood vessels from the digestive system are directly connected to the caval system. These shunts don't start from the portal vein into the venae cava, but are connections between the venae cava and the venae gastrica, vena lienalis and the venae mesenterica cranialis of caudalis. It is also possible that diversions from existing blood vessels between the aforementioned blood vessels occur. The body forms new blood vessels but doesn't use existing blood vessels, which may even change the direction of bloodflow!

Symptoms of porto-systemic shunts in the liver are hypoplasia of the liver, liver discoloration of the ooze of transsudaat arising from possible congestion streets with pseudo-lobulatie and liver fibrosis. External symptoms of congenital shunts are; vomiting (sometimes diarrhea), fatigue, excessive drinking and urination, retarded growth ("straggler" of the nest), hepatic encephalopathy, drooling, clumsiness drinking, difficulty swallowing, "drunken gait" , frequent falling, compulsive movements, apparently blind, apathetic and lazy.

Porto-caval shunts are direct connections from existing blood vessels between the portal vein and the venae cava. The blood vessels that might be used are: the veins of the esophagus, the vena azygos, the para-umbilical veins and the superior rectal vein. Symptoms of porto-caval shunts are and sensitivity of the esophagus, eventually leading to risk of esophageal bleeding, acidification of the paravertebral muscles, sensitivity of the abdominal wall, hitting the stomach, dilation of capillaries around the navel (visible only in some dogs) , anal gland inflammation, itching anus, haemorrhoids and sometimes difficulty with defecation.

Osteopathic relationships

The adaptation of the body to an altered circulation of the portal vein, through the formation of porto-caval of porto-systemic shunts is subject to multiple influences. For example blockades of the facet joints, the diaphragm, the psoas-muscles, fasciën, ortho-and parasympathetic innervation of the digestive system, thyroid, the PAM, hormones and stress levels affect the emergence and impact of these acquired shunts.

Conclusion

Osteopathy looks at the body as a whole, where all structures and tissues have an influene at their surrounding. The "arterial" rule is one of the basic pillars of osteopathy, which means that everything depends entirely on the arterial supply and venous drainage of blood to all bodycells.

At the moment, there is a change in perfusion of the liver due to the formation of porto-caval or systemic shunts, this affects the functioning of both the liver and surrounding structures and tissues. Porto-caval or porto-systemic shunts are therefore a sign of the existence of a changed situation around the liver, but that doesn't mean the rest of the body shouldn't be considered. Treating portocaval

or porto-systemic shunts is certainly an indication of osteopathy, what one shouldn't forget that the body needs time to adapt. A porto-caval or porto-systemic shunts doesn't arise in one week, and is therefore aren't solved in one week!

Ileus

Sara TORFS

Equine ileus is a serious and complicated disease. Gastrointestinal motility, specially small intestinal motility, is decreased. Fluid accumulation and secondary small intestinal and gastric distension causes discomfort in the horse, followed by dehydration, shock and sometimes gastric rupture. Ileus is associated with a poor prognosis, even with intensive treatment.

Ileus is a multifactorial disorder. It can occur after colic surgery (postoperative ileus) or develop without a known underlying cause. Two important pathogenetic pathways are known. The first is a *neurologic inhibition* of intestinal motility. This can be initiated by painful processes in the abdomen or elsewhere, by intestinal distension, traction to the mesentery and other unknown causes. At the level of the enteric nervous system – Meissner's and Auerbach's plexuses in the enteric wall – the intestinal motility is inhibited by local reflexes. Spinal and vagal afferent stimuli will cause disturbances of the ortho- and parasympathetic nervous system. An autonomic disbalance, with an orthosympathetic overload, causes further deterioration of intestinal function. This will decrease intestinal motility and secretions and the blood supply is also impaired. Besides the enteric and autonomic nervous effects, there is also a cerebral influence on intestinal function. At this level, stress is an important factor.
The second important pathogenetic pathway is *intestinal inflammation*. Various stimuli can activate a population of residential macrophages in the intestinal wall, which is followed by a neutrophilic influx. Pro-inflammatory and cytotoxic mediators are released and other inflammatory cells are attracted to the site. The associated damage to the muscular layers and nervous plexuses will impair intestinal function. Inflammation also has neurologic effects. Certain inflammatory substances will act as inhibitory neurotransmitters. Receptor populations in the intestinal wall will also change. All of this results in a neurologic inhibition of motility.
The inflammatory pathway is typically slower than the neurologic pathway, but its effects will linger on much longer.

Medical treatment for ileus focuses on prokinetic and anti-inflammatory therapy. General supportive care is crucial to correct secondary metabolic disturbances and decompress the stomach. However, current treatment results are disappointing.

Osteopathic treatment for ileus is a totally new point of view. A prophylactic treatment shortly after colic surgery might help prevent the development of ileus. Curative treatments must

always be combined with veterinary care. The highest success rates will probably be in horses with merely functional disorders.
The key points of osteopathic treatment for ileus are restoration of the autonomic disbalance, correction of blockades that can directly or indirectly disturb intestinal function, visceral treatment of the intestinal system itself and other organs that can effect it. Of course these are general recommendations, it is important to always treat all lesions that are found.

Theoretically, osteopathy can be a useful addition in the treatment of ileus. Evaluating the practical results of osteopathic treatment would be very interesting.

The lower airways

Elke VAN DEN WYNGAERT

Gas exchange is the main function of the lower airways. But this is not their only function. They form an important defense mechanism for pollutants. They take part in the acid-base regulation and thermoregulation and they produce surfactant needed for lowering the surface tension of the alveoli. Lung problems are frequently seen in horses. If there is no bacterial or viral infection found, environmental elements are often seen as a cause of inflammation and allergic reactions.

Defend mechanisms in the lower airways are the mucociliary transport apparatus, respiratory immunoglobulins, alveolar macrophages, a dense network of lymphoid tissue and the immune response.

Trachea, bronchi and lungs are autonomicly innervated by the pulmonary plexus, which is a part of the cardiac plexus. The parasympathetic innervation is vagal. The sympathetic part arrives from the last cervical and the first five to six thoracals. Sympathetic function is bronchial dilatation and a decrease in secretion of mucus, needed to keep the lungs clear for flight reactions or exercise.

The vagal nerve also functions as a protection mechanism. Inhalation of irritants or choking stimulates a cough reflex. When there is a sudden inhalation of pollutants, the vagal nerve will cause a bronchial dilatation with an increased production of mucus. This way, pollutants can't penetrate into the lung tissue and are rapidly removed.

The excitatory- and inhibitory nonadrenergic, noncholinergic system is another part of the autonomic nerve system. The eNANC system is a local system which inflicts a neurologic inflammation with inflammatory mediators that cause bronchospasms and an increased production of mucus. The iNANC system lies in the motor neurons of the vage nerve and is an inhibitor of inflammation. Good functioning of these systems guarantees optimal protection of the lower airway tissues. Hypothesis

Disbalance in the autonomic nervous system can lead to reduced defense in the tissues. Blockade in the cardiac plexus area will suppress vagal function through sympathetic overreaction. Persistent stress also can have these consequences. This will lead to a downward spiral of irritation and inflammation and even more triggering of receptors which causes even more inflammation. It is possible that sympathetic overreaction suppresses the iNANC system.

The functioning of other organs also interferes with airway function. Heart, liver, kidney and bowels might be of important influence. Dysfunction of these organs can lead to hypertension and possibly effusion of fluids and/or waste products into the lung tissue. This causes triggering of receptors and again inflammation. Some organs are fixed by means of ligaments to the diaphragm. Tension and restriction in movement are transmitted. This is why in the osteopathic treatment the whole body of the horse is examined and treated.

Heaves in horses is possibly due to dysbalance in the autonomic nervous system. This leads to weakening of the tissues and a horse prone to develop airway problems. Irritating dusts and pollutants can easily inflict inflammation and – when persisted- lead to tissue damage and structural changes. Autonomic dysbalance may explain why not all horses in a same stable climate develop this illness.

The Thyroid gland

Carla VAN NUNEN

The thyroid is an endocrine gland located near the first three rings of cartilage at the dorsolateral side of the trachea. The main function of the thyroid is the regulation of basal metabolism.
The first chapter deals with the basal metabolism. It describes the importance of homeostasis, the maintenance of a constant internal environment, and the role of the nervous system.
Chapter two describes the anatomy and the location, relations with muscles, fascia and bones, blood circulation and innervation. Chapter three and four outline the embryology and histology.
The fourth chapter shows that the thyroid regulates more than just the basal metabolism. The primary function is the production of three hormones - T3 (triiodothyronine), T4 (thyroxine or tetra iodine thyronine) and thyreocalcitonine (calcitonin) - that influence the whole body.
T3 and T4 are both hormones that affect the metabolic activity of the cells and in addition are important in growth and development of the fetus and the child, they contribute to the regulation of reproductive functions and strengthen the action of adrenaline and noradrenaline.
The hormone calcitonin together with the parathormone from the parathyroid, regulates calcium metabolism. Calcium plays an important role in maintaining healthy bones and joints, it plays a role in the functioning of muscles and nerves, structure of teeth, cell division, fertilization, and blood clotting.

The production and release of thyroid hormone is determined by the concentration of TSH in the blood produced in the anterior pituitary. Like most hormones in the pituitary, the TSH level is controlled by the hypothalamus, in this case by the production of TRH. In case of overproduction of T3 and T4 the production of TSH is discouraged via a negative feedback system.
In the first chapters it becomes clear which structures in anatomy and physiology are involved in the function of the thyroid. Based on these structures chapter five discusses how they can be involved in an osteopathic treatment if you want to exert influence on the function of the thyroid.
It is striking that pathological thyroid problems are not common in horses, which means that thyroid dysfunction based of abnormal blood values is not often diagnosed. This does not mean a thyroid problem can be ignored just because there is no measurable dysfunction. It is important for an osteopath to relate symptoms to the different function of various organs and structures, the blockages and restrictions that the osteopath detects and treats in such way, that the self-regulating ability of the body can cause a restoration of the homeostasis in the body.

Canine Bladder Problems

Ricette VAN OOIJEN

The bladder is a pear shaped organ for the storage and release of urine. The ureters carry urine from the kidneys to the bladder and the bladder empties through the urethra. The bladder wall consists of four layers: the mucosa, the submucosa, the muscularis and the serosa. The bladder wall contains smooth muscle tissue; the M.detrusor. Anatomical there is no internal sphincter, but functionally there is. Bladder and internal sphincter are controlled by the autonomic nerve system. Also there is an external sphincter which is controlled by the somatic nerve system. The bladder is connected to the pelvis and abdominal wall by three ligaments. One medial ligament from the ventral aspect of the bladder to the umbilicus and two lateral ligaments which connect the lateral surfaces of the bladder to the lateral pelvic wall. The lateral ligaments contain the Aa.umbilicalis and the ureters. The urinary bladder is supplied by cranial and caudal vesiculair arteries which arise from the Aa.umbilicalis. The V.vesicalis caudalis takes care of the total venous drainage of the urinary bladder. The lymphatic drainage of the bladder runs through the medial iliac lymph nodes and in the dog also through the internal iliac lymph nodes.

Two functional states of the bladder must be distinguished: the storage phase and the emptying phase. During the storage phase visceral afferent neurons
will be activated by bladder distension. These neurons activate the ortho-sympathicus (N.hypogastric) at the site of the lumbar spinal cord (L1-L4) which relaxes the bladder and constricts the internal sphincter. At the same time the sacral parasympathetic innervation to the M.detrusor is inhibited.
As the bladder volume increases the pressure reaches the treshold of the visceral afferent mechanoreceptors in the wall of the bladder that respond to distension. This makes impulses go to the pontine micturition centre and the cerebral cortex which makes the animal aware of the full bladder. Also afferent sensoric information is sent to the cerebellum.
The storage phase can voluntarily or involuntarily be converted into the micturition phase. The cerebral cortex influences the medulla oblongata and the medulla oblongata influences the spinal cord. Activation of the pontine micturition centre causes inhibition of sympathetic activity (N.hypogastricus) and the somatic efferent neurons (N.pudendus) and a stimulation of parasympathetic activity (N.pelvicus). This makes bladder emptying to occur.

Problems in the functioning of the bladder are often expressed as incontinence.
Either because the bladder can't contract which causes overflow, or by the inadequate functioning of the sphincter mechanism of the bladder.

From an osteopathic point of view it is important to see the bladder in relation to its surroundings. Form and function of the bladder will be determined by this.
There is a functional relation with the kidneys through the ureters (the afferent part of the urine) and the vagina through the urethra (the efferent part of the urine). Visceral relationships exist between structures that lie in contact with each other in the abdomen. The bladder rests on the symphysis pubis and when filled also on the ventral abdomen. In the abdomen the bladder is also in contact with rectum, jejunum, colon descendens and the uterus in the bitch. By their location in the abdominal cavity these structures influence each other and it is important that they are free to move along each other. In the pelvic cavity the bladder has contact with the M.obturator internus (internal hip muscle). Hypertonia of this muscle causes disbalance in the hip joint. This way chronic bladder problems can cause degenerative changes in the hip joint.
Fascial relations are determined by the connective tissue structures the bladder is directly or indirectly linked with. Because the fascia is continuous throughout the whole body, tensions in the fascia can cause problems in a structure at a distance. The bladder is connected to the pelvic wall by the lateral ligaments.
By this there is a relation with the fascia iliaca and therefore de M.psoas and SI-joint.
By the connection of the bladder with the kidneys there is also a relation to the fascia iliaca. The medial ligament of the bladder runs from caudal to the umbilicus, whereas the ligamentum falciforme of the liver runs from cranial to the umbilicus. Thereby the liver and bladder are fascial related. By the liver there is also a connection to the diaphragm. Osteopathically it is important the bladder is not restricted in its natural movement by adhesions (for example due to abdominal surgery) and fascial tension.

In addition to the functional, visceral and fascial relationships, the following segmental regions are important:
- L2-L5, the orthosympathetic innervation of the bladder.
- S1-S3, the parasympathetic innervation of the bladder.
- The thoracolumbar junction, because of the suspension of the bladder at the level of the iliac fascia and thereby the relation to the M.poas.

Craniosacral techniques can be used to influence the higher centres that control the bladder function.

A normal bladder function depends on proper anatomical relationships and a coordinated interaction between nerve system, bladder and urethra.
In this context, osteopathy with its variety of techniques can be a useful contribution to the treatment of bladder dysfunctions.

Sleep and wakefulness in horses

Denise VAN DER MADE

The sleeping pattern of horses consists of several short cycli per day that occur mainly during the night. They alternate with periods of wakefulness. The environment plays an important role in sleeping behaviour. Horses are extremely adaptable when it comes to their sleeping patterns. A horse sleeps two to four hours a day, which is beneficial for a large prey animal that eats grass with a low nutritional value. Sleep consists of three stages that occur in a fixed order. The first stage, *drowsiness* or *deep restfulness*, is the transition phase between wakefulness and sleep in which the brain activity synchronizes. During the second phase, *slow wave sleep* or *deep sleep*, brain activity is very low. Next, brain activity rises to a level that is similar to the level that is seen during alertness and belongs to the third phase of sleep, the *REM-sleep*. Sleep firstly occurs in the foetus in the third trimester of pregnancy. The contribution of REM-sleep to the total amount of sleep decreases during a horse's life. This is one of the clues that shows the possible role of REM-sleep in brain development and learning. Dreaming occurs during REM-sleep and is probably a facilitator of learning. Allowing rest to neurons is a possible function of slow wave sleep. In this time neurons can, among other things, renew their stock of glucose. The horse can endure drowsiness and a part of its slow wave sleep in a standing position, because of its passive stay apparatus. The horse loses its muscle tonus during REM-sleep, which demands laying down to endure this phase of sleep. The herd plays an important role in a horse's safety. A horse will not lie down when he does not feel safe enough. When REM-sleep deprivation has lasted for a long period it can result in partial collapses. This sleeping problem, that is secondary to another problem, is called 'equine sleep disorder' and should not be confused with a sleeping disorder called narcolepsy.

It is important for the transitions between sleep and wakefulness that the tuning of the norm value for homeostasis is rhythmic as well. Every cell in the body has its own rhythmic gene expression, controlled by a primary biological clock located in the nucleus suprachiasmaticus in the hypothalamus. This clock registers environmental cues and transits this information to other tissues. Light is the most important zeitgeber for the clock, but food and training are also factors that influence it. The zeitgeber light is also used to direct the pineal gland when to excrete a hormone called melatonin. In case of horses, melatonin is not related to sleep. It is found to be responsible for a couple of functions that are attributed to sleep, based on the results of investigations with other mammal species.

The formatio reticularis receives all ascending information and it projects it to the entire cerebral cortex during wakefulness. The most important neurotransmitters to facilitate wakefulness are acetylcholine, norepinephrine, serotonin, histamine and hypocretin. The neurotransmitter adenosine accumulates when brain activity is high during wakefulness. This results in an increased amount of slow wave sleep during the next bout of sleep, among others because of increased activity of the nucleus preopticus lateralis in the hypothalamus. The REM-sleep is controlled by the peribrachial area in the pons. For every physiological feature of REM-sleep there is another brain area that is responsible for it. The neocortex and the hippocampus probably store memories during REM-sleep.

To achieve balanced transitions between sleep and wakefulness it is important to pay extra attention to certain items of osteopathic treatment. Thanks to treatment of the OAA, influence can be exerted on the blood stream to the brain, the innervation of the plexi choroidei and the parasympathetic innervation of, among others, the heart and lungs. In order to fall asleep it is important that the frequencies of heart beat and respiration get at a lower level. To accomplish this it can also be needed to treat the area of the withers that the orthosympathetic innervations of heart and lungs originates from. Moreover, the tract from the nucleus suprachiasmaticus to the pineal gland passes the area of the withers. Furthermore, it is important to pay special attention to the locomotion system of the horse. When the movement possibilities of the horse's front legs or hind legs have been disturbed, it might be difficult for the horse to lie down to get some REM-sleep. Treatment of the organs of the digestive tract may be important with respect to the resorption of nutrients for the production of neurotransmitter and other chemicals that are involved in controlling sleep and wakefulness. Cranial-sacral therapy may bring some rest to the horse. It can also promote the drainage of LCS, which optimizes the environment of neurons. In an osteopathic application a hypothetical connection can be made between yawning due to sleep deprivation and stomach problems. It might be assumed that the resorption of nutrients to produce adenosine plays a central role in this matter.

The Salivary glands

Marcia VELDBOER

As already indicated in the introduction, well functioning salivary glands are very important for the digestion of a horse. Under the influence of saliva, food will become soft and humid, what makes swallowing easier. There is also a digestive activity in the mouth influenced by saliva. In the equestrian, when riders use a bit, it is very important that a horse's mouth is humid enough.
When salivary glands do not work properly, it can lead to pathological conditions. Examples are: swallowing and breathing problems and the developing of a dry mouth, a fistula or a tumor.
This thesis makes plausible that some osteopathic treatments and techniques can exert influence on the functioning of the salivary glands as part of the visceral system.
In order to demonstrate this influence, primarily there is a description of the anatomy of the major and minor salivary glands. These are the gl. parotis, mandibular and sublingualis, and several smaller glands namely gl. buccalis dorsalis and ventralis.
Comprehensively, the blood flow of all these glands is being discussed. The artery external carotis plays a major role.
It examines the influence of hormonal secretion by the pituitary and adrenal glands.

Also, the relationship between the major salivary glands and lymph nodes (mandibular, parotic and retropharyngeal) is described.
Then this thesis describes the composition, formation and function of salivary glands. Explanation is given about the difference between serous saliva, saliva that has mucin and mixed saliva.
In addition, there's extensive attention to the different functions of this fluid.
Research results are presented, which show that the amount of swallowing movements will not be affected by the use of any type of bit.
As for the neurology, there is an explanation that says that salivary glands are both ortho-and parasympathetic innervated. Roughly can be explained that the parasympathetic nervous system is responsible for producing large quantities of watery saliva. The sympathetic stimulation actually means, that there is a vasoconstriction occuring, making the salivary glands and ducts be squeezed and empty. Sympathetic stimulation makes the saliva with mucin.
Interesting is the explanation of osteopath Marion Wickert. She tells about the relationship of the autonomic nervous system and horseback riding. She mentions the importance of riding in a way, when the ortho-and parasympathetic nervous system are both in a kind of balance.
Useful is also the chapter that deals with diseases of the salivary glands. Both the causes and pathologies are discussed extensively.

The last chapter finally gives attention to the central question of this thesis.
In the statement is further emphasized the importance of being in balance both the ortho-and parasympathetic nervous system for proper saliva rate in horses.
At the end of the last section, there is focus on the main treatments and techniques available to the osteopath. Explanation is given of how an osteopath can influence the flow rate in a horse. Important is the parietal, visceral and cranio-sacral system, constantly interacting with each other.
The osteopathic techniques must ensure that the mobility of the three systems described are being repaired, or are in best possible performance.
This is to ensure that the self-healing ability of a horse towards a disturbed flow rate can best take place!

The lungs in equine osteopathy

Mariska VERSTEEG

Introduction

My curiosity for pulmonary problems in horses arose when I was younger and I rode my own pony. In the first chapters of this thesis I will outline the anatomy, embryology, histology, physiology, neurology, breathing mechanisms and pathology of the lungs. In the chapter 'Osteopathic philosophy of the lungs' the relationship is made between the other internal organs and the osteopathic connections are explained.

I have chosen to conduct an applied research methodology because, to my knowledge, no other research to date has been undertaken concerning the role of osteopathy in the treatment of pulmonary problems in horses. The goal of my research is to determine the effectiveness of the osteopathic treatment in horses suffering pulmonary problems before, immediately after and four weeks after the intervention period. The determinants are the heart and breathing rate.

In total sixteen owners and their horses were included in the study. The heart and breathing rate of the included horses where measured at varying times in order to formulate a conclusion regarding the effect of osteopathy on the pulmonary problem.

Research question

The central research question is: what is the influence of osteopathy on the heart and breathing frequency of horses with a lung problem? Additionally, what role can osteopathy play concerning the treatment of horses with pulmonary problems?

Method

Sixteen horses participated in this study. The horses were randomly allocated in an intervention group, a control group with lung problems and a control group without lung problems. The horses in the intervention group received the osteopathic treatment, the horses in the control group with lung problems were brushed and the healthy control group received neither.

The heart and breathing rate was measured in all groups before, immediately after and four weeks after the intervention. The measurements were taken during rest and after a 10 minute trot on a long line. Also the owners filled in an intake and evaluation form where, amongst other items a NRS score was registered.

The data was subsequently analysed using SPSS18®. A mutliple repeated measures ANOVA-test was used to analyse the effect of the treatment on heart and breathing rate in relation to the time difference between the groups. Tukeys Post hoc test was used to interpret the difference between the intervention group and the control groups. A Wilcoxon matched pairs signed rank test was conducted on the NRS data in order to determine the difference prior and post intervention.

Results

There was no significant difference in the heart and breathing rate between the groups and over time. There was however a significant decrease in the NRS score over time.

Conclusion

No significant effect of an osteopathic treatment was found on the heart and breathing rate of horses with pulmonary problems. The NRS-score decreased significantly after the treatment. On the basis of my observations it appeares that the horses where primarily troubled with the motility of their stomach and liver and blockages in their lower thoracic spine. This could indicate that lung problems are secondary to problems in other organs.

Stress

Sophie ZWAGER

One of the most complete definitions sounds as follows:
"Stress is the result of the interaction between the organism and the surroundings. It is the combined action between the environmental factors and threats and the possibility of the individual to meet them. (Schruers en Willige, 1983)".
Cannon was the first physiologist, who described the fight-flight reaction and introduced the term 'emergency reaction'. Hess introduced the term 'ergotropic response' a few years later, with which he also meant the emergency reaction. Around 1950 Selye described the 3 phases of the general adaptation syndrome. This syndrome contains 3 phases, which contain several hormonal and neurovegetative responses, which can be provided by the body to maintain the homeostasis.
The first phase is known as the alarm-phase, the second as the resistance-phase and the third as the exhaustion-phase.
Within the schooling for human osteopathy, these 3 phases will be interpreted as follows;

1. Normal stressreaction; short of nature. The body is easily capable of switching between a more ergotropic tuning and a more trofotropic tuning.
2. Ergotropic reversal; the stressreaction in the body continues. The body finds itself in a more ergotropic tuning and has difficulties to return to a more trofotropic tuning.
3. Adrenal insufficiency, there is an impossibility of the body to adapt to the persistent stressor. Sometimes also described as a 'burn-out'.

That arises the question, if the interpretation of the model of Selye by the IAO is also suitable for appliance in the equine field.
A certain answer to this question is only possible to provide, with more specific research. Within this thesis I assumed there is a third phase possible, but I didn't presume, based on clinical experience, that it would be in the same appearance as in the interpretation of the human osteopathy taught by the IAO. Probably the horses will show symptoms which are somewhat different from the human symptoms.

To understand the effects and development of stress and to be able to place them in a practical osteopathic frame it is necessary to understand the functioning of the primary involved structures.

The primary involved structures are:

- The hypothalamus as regulation-centre
- The formatio reticularis which is responsible for the main part of the toneregulation of the muscles.
- The hypofyse, which is tightly connected with the hypothalamus and plays an important role in the secretion and synthesis of hormones.
- The adrenal gland, which is responsible for the two of the most important hormones during the stressreaction; adrenalin and cortisol.

Their function and mutual interactions provide the possibility to react properly on influences from the environment.

Selye introduced the division of stress into so called 'eustress and distress'. Where the thin line is between eustress and distress, will be different for each individual. The empirically proven law of Yerkes and Dodson, can provide insight in the relation between stress and performance.

If eustress changes into distress, does it mean that the individual is no longer capable of adapting to the demands of the environment, without meeting negative consequences. The mutual interactions and balance between the involved structures in stress, seemed to be affected and disturbed, which cause a range of problems. Which symptoms or phenomena do occur is individually determined.

A number of stress related symptoms and phenomena are physiologically clarified and put in an osteopathic frame.
Next to that, 10 horses which are active in (international) competition are osteopatically examined and treated. The results of the examinations are exposed in a diagram, to show the prevalence of the found osteopathic injuries.
The most occurred osteopathic injuries are as far as possible placed into a stress related frame.

In my opinion the role of the osteopath is to provide a balance in the body of the horse, so it has the ability to adapt optimally on the demands of the environment. In such a manner that the horse experiences less or no negative consequences.