



Pioniers in de paardenosteopathie

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Abstracts - English version

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Heart Rate Variability

Joke BATTEL

With the osteopathy we are aiming for homeostasis of the internal environment. Herewith the autonomic nervous system, consisting of the ortho- and parasympathicus plays the leading role. Through heart rate variability (HRV) we measure the input of the autonomic nervous system to the heart. The sympatho/vagal balance is expressed by the ratio LF/HF. The sympathetic innervation of the heart is mainly influenced by the ganglion stellatum and the segments C7-T5. The sympathetic system accelerates the contractions, elevates the power of contraction and dilates the coronary arteries, it is more active during effort and stress.

The parasympathetic influence to the heart occurs through the vagal nerve which guarantees a decreased heart rate and contraction power and more variation in the heart rate. This system predominates in a body at rest.

With HRV we measure the variation in heart rate at the moment. This variation causes the maintenance of the cardiovascular balance in a certain range and leads to adjusted responses to challenges.

A frequently or chronic shift of the sympathetic and vagal activity to more sympathetic and less parasympathetic productivity has large consequences for the health.

The objective of this thesis was to investigate the effect of an osteopathic handling on the sympatho/vagal balance by measuring HRV in the horse. In other words, (in which degree) can we influence the internal environment of the horse by osteopathy. HRV analysis happens through evaluation of different parameters. In this study the following parameters have been examined: ratio low frequent/ high frequent oscillations (ratio LF/HF), the standard deviation of the heart rate, the root mean square of successive differences (RMSSD) and the relaxation grade (RLX).

The hypothesis was that osteopathic handling can influence the sympatho/vagal balance. It was expected that the ratio LF/HF decreases after osteopathic handling. LF are the low frequent oscillations which are mainly influenced by the sympathetic nervous system. HF are the high frequent oscillations, mainly depending on the vagal activity. If this ratio decreases it indicates peace and relaxation while an increase would indicate tension/stress and pain.

The standard deviation shows the fluctuation in following heart rate intervals; this parameter is expected to be higher after osteopathic handling.

RMSSD is a touchstone which also represents the regulating activity of the vagal nerve. An increase of this value indicates more variation in heart rate. This is what we expect after osteopathic treatment. Finally RLX defines the relaxation grade, we expect that the horses will experience less pain and tension after the treatment by which this value also increases.

We made 3 measurements with 20 horses divided in 3 groups: one testgroup who had an osteopathic examination and handling, the controlgroup1 with whom we didn't do anything and a second controlgroup which has been brushed during 15 minutes. The first measurement counted as basic rule or reference value, the second measurement took place immediately after the handling and the third

measurement we made 5 weeks after the osteopathic treatment. This was to check whether an osteopathic handling has effect over this time period.

The ratio LF/HF and the standard deviation showed significant differences while RMSSD and RLX didn't differ significant.

All of the parameters developed as expected, from this we can conclude that we can influence the balance of the autonomic nervous system and thus the internal environment by an osteopathic treatment. We give an impulse from outside in order that the body is able to recover itself from the inside. Despite the limitations of this study we can still conclude that the influence of an osteopathic handling is demonstrated and proven in a scientific way and as objective as possible.

The sense of smell

Wieteke BEIJE

The sense of smell, otherwise known as the olfactory sense, is very important and has different functions. It can detect food or enemies and danger and influences social and sexual behaviour.

Taste is closely related to the olfactory sense. An olfactory dysfunction often involves a loss of taste. The olfactory sense and the sense of taste are important in the digestive system; they have a preparatory function by increasing the digestive juices such as stomach acid and saliva.

The olfactory system represents one of the oldest sensory modalities in the phylogenetic history of mammals. The system consists of different structures such as the olfactory epithelium, the olfactory nerve and the olfactory bulb.

In order to smell, the aromatic substance must make contact with the receptor cells in the olfactory epithelium, which is located at the cribiform plate of the ethmoid bone. The nasal cavity has a complicated structure with different nasal conchaes. These conchaes create an turbulent airflow towards the epithelium.

The olfactory epithelium consists of different types of cells, including the axons of the olfactory receptor cells, which form the olfactory nerve. The olfactory nerve terminates in the olfactory bulb and the olfactory tract. These cells project into the primary olfactory cortex, a small portion of the entorhinal cortex and the amygdala.

The primary olfactory cortex projects into the thalamus, which then projects into the associative cortex for perception. The olfactory system is the only sensory system that has direct cortical projections without a thalamic relay nucleus. This represents the primary importance of the olfactory sense: it allows the brain to respond immediately in dangerous situations.

Because of its relation to the hippocampus, the entorhinal cortex plays an important role in the memory of the olfactory sense.

The amygdala is part of the limbic system and has connections with the hypothalamus and therefore influences the emotions and sexual behaviour.

Besides these parts of the olfactory system, the trigeminal nerve and the vomeronasal organ are important structures. The trigeminal nerve provides sensory innervation to the posterior nasal cavity to detect noxious stimuli. Whenever the olfactory sense does not function properly, the trigeminal nerve can at least detect danger.

The vomeronasal organ is found at the base of the nasal cavity. Its main function is to detect pheromones and therefore it is important in sexual behaviour and reproduction. Horses use this organ by flehming.

There are different types of smell disorders which can be caused by traumata (for instance a blow to the head), infections, diseases in the nasal cavity or an inbalance of the hormonal system. The hormonal system can influence the olfactory sense either in a positive or negative way.

It is probably not possible to influence the olfactory smell directly by osteopathy. However, some conditions are necessary for the effective functioning of the olfactory sense such as good muscle function, a properly functioning immune system, to prevent or eliminate infections, and a well balanced hormonal system.

Osteopathy can contribute to creating these conditions. By restoring the arterial flow, improving the craniosacral rythm and by eliminating blockages in the body, the olfactory sense can manifest itself maximally.

The Hypothalamus as a centre of integration

Kris DE CEULAER

At the start of this work, my anatomical background influenced the creation of the first chapter where a detailed anatomical description of the brain was given. This chapter lays the anatomical basis for the rest of this thesis. It will provide a visual support that inhibits the necessity for the use of further anatomical descriptions in the upcoming chapters.

In the next chapter the integrative character of the hypothalamus was sketched.

The hypothalamus is an important coordination centre of all vegetative systems via afferent and efferent information out of all parts of the nervous system. Not only via anatomical links but also information captured from the blood and the cerebrospinal fluid play a major role in the information projection to the hypothalamus.

Afferent information is mainly provided via the formatio reticularis, the limbic system, the nuclei of the cranial nerves, the tegmentum, the senses, the cortex, the thalamus and the spinal cord. The most important information towards the hypothalamus was integrated previously in the formatio reticularis. Information from the spinal cord contains somatic and visceral sensory information and reaches the brain via ascending spinal tracts. Cranial nerves transport senses to the hypothalamus, which in turn influence the limbic system. This system is very important in emotions and their expression. The cortex and thalamus receive information from all over the body and the integrated stimuli are transported to the hypothalamus.

Regulation of temperature, hunger and thirst, the osmotic pressure, emotions and the hormone levels are some of the most important functions of the hypothalamus itself.

In this chapter it was attempted to create a clear view over the integrative function of the hypothalamus with aid of a lot of examples. Sensory input leads to emotions, which can be translated in behaviour as a result of ortho- or parasympathic stimulation.

The third chapter contains a short anatomical description of the surrounding structures such as the neurocranium with all afferent and efferent vessels.

The final chapter attempts to integrate the previous chapters and formulate a clear osteopathic approach. The most important ways to influence the hypothalamus are:

- Craniosacral therapy to influence the skull and the surrounding structures. This influences the PAM, which has a direct effect on the hypothalamus.
- Influencing the afferent information not only anatomically but also via the osteopath's behaviour and smell.
- Influencing all efferents mainly by optimizing blood current at the height of the hypothalamus-hypophyse axis and the receiving organs.

The thermographic approach of the equine osteopathic treatment

Fenella DOESBURG

The purpose of the study in this thesis was to examine the effects of an osteopathic treatment on a horse with the help of infrared thermograph images. The research-questions are:

- Are the hotspots and coldspots as seen in the thermograph images, appearing in the same locations as the blockades found in the osteopathic examination?
- What kind of blockades appear in the various equestrian disciplines and is there proof of specific blockade sites that appear in the different disciplines?

In this research twenty horses from various disciplines were examined. The disciplines were: dressage, show jumping, recreational riding, hunting and western-riding. The research was conducted at three different locations.

In a first session extensive thermographic data and images were collected in a closed, covered, indoor environment. Images were taken from all sides of the horses. Afterwards an osteopathic examination and treatment was performed. At least half an hour later, or later that same day, the second session of thermal images was obtained from all horses. The third session of collecting thermographic data and images was performed two weeks after the osteopathic treatment, on seventeen out of the twenty horses.

After the data collection process a statistical analysis was conducted. All results were collected and reviewed down and the average of the temperatures found in the study are noted as the mean \pm standard error of the mean (SEM). The lesion-regions are then linked to the temperature-differences in the various zones. The temperature-differences were ranked at session 1, 2 and 3, followed by a comparison between session 1 and 2 and session 1 and 3 compared with a Wilcoxon Rank test. Finally the lesion-regions were linked to the different disciplines and compared with a cross tab and Pearson chi square test.

The following conclusions can be drawn from the study :

- Hotspots en coldspots in the thermal images state the location of the blockades. By means of a statistical analysis a significant difference ($p < 0.05$) was found, in a couple of regions, comparing the three sessions (before, after and two weeks after the osteopathic treatment).
- The temperature outside the thermo neutral-zone of the horses, that ranges from -5°C up to 15°C , has a significant influence on the vascularisation of the extremities and therefore on de thermal images and their interpretation.
- Riding, or other kind of exercise, with a horse before examination has a orthosympathetic influence on de vascularisation of the horse. There will be a higher vascularization of the whole horse and therefore will result in a less pronounced outing of the blockades in the osteopathic examination. This effect also appears in the thermographic images. Making it more difficult, but not impossible, to find the blockades.

- The existence of a relation between the type of discipline practiced by the horse and the type of lesion found was determined. Some groups however were too small to gather conclusions.

Apertura thoracis cranialis

Heidi HUYSENTRUYT

The cranial aperture or thoracic inlet consists of the first thoracic vertebra, the first ribs and the sternum. Looking at the inlet from a cross-sectional angle, we observe many different structures.

First of all, there's a large amount of muscles which either originate or have their insertion points on the first thoracic vertebra, the first rib or the sternum. They're mostly muscles of the chest or back, abdominal or respiratory muscles or muscles of the throat. Furthermore there are a number of ligaments.

Looking in between these bony structures of the thoracic inlet, you'll also find an amount of neurological components such as the sympathetic trunk, the vagal nerve, the phrenic nerve and the brachial plexus. The only muscle that runs through the aperture in the same way as these neurological structures is the longus colli.

Apart from this, there are numerous arteries present, which supply blood to the forearm, the neck, the chest and the head region. Finally lymphatic vessels, venes, even the trachea, the oesophagus, the thymus and the lungs are all present in this thoracic inlet.

In the equine body, every fascia is connected with each other. Obviously the cranial aperture contains numerous fasciae, all interacting with one another.

Biomechanically speaking, the thoracic inlet, although limited in its movements, is a dynamic structure, influencing the thoracic part of the spine as well as the breathing mechanism.

Different approaches can be found when acting osteopathically. Blockades at the level of the first thoracic vertebra can lead to a dysfunction in innervation of the aforementioned muscles, which will bring them to an hypertonic state. All other bony structures such as the first rib and the sternum will also be inhibited in their functions, leaving the thoracic inlet short of movement.

The brachial plexus, which originates at the first thoracic vertebra as well as the last couple of cervical vertebrae, innervates through his branches the muscles of the thoracic limb of the horse. Irritation of this plexus may lead to an overload and misuse of the limb with disastrous consequences.

The stellate ganglion, located at the cervico-thoracic junction, can easily be brought in dysbalance through tension on the first rib.

Problems located through all the thoracic vertebrae can be sensed in the stellate ganglion due to the fact that all thoracic vertebrae contain preganglionic fibers which all give feedback to each other.

Furthermore, nervous fibers of the cranial cervical ganglion can also be influenced because of this entwinement with the stellate ganglion.

Blockades of the lower cervical vertebrae can cause problems of the scalenus muscle, the phrenic nerve and the brachial plexus. The scalenus will become hypertonic and will hold the rib in inspirational position. Also, various nervous and blood flow problems will occur through compression of the brachial plexus and axillary artery and vene. The phrenic nerve can cause respiratory problems when the blockade is located in the low cervical region. On the other hand, he can cause tension to

this region himself through means of a disturbed visceral afference.

Even the functions of the vagal nerve, the hyoid, the fasciae, the lungs and the thymus can be hindered when the thoracic inlet is obstructed. This interaction again, works both ways.

Although this aperture is small in size, every single structure, even the ones located at a considerable distance, can cause a problem to this inlet or vice versa.

That is why it is important to not only treat the disease of the horse, but to look at the horse as a whole.

Treat what you find and then leave the lesion alone !

The equine stomach

Chantal KURVERS

Horses have a stomach with a single lumen, this is called a monogastric stomach. In the equine stomach there are two kind of mucous membranes, first the non-glandular mucosa that changes in the glandular mucosa. Therefore, the equine stomach belongs to the monogastric complex type.

The innervation of the stomach occurs through the intramural plexus, which consists of the Meissner's plexus and the Auerbach's plexus. They are coupled through multiple nerves and exchange information. Since the intramural plexus is able to operate independently, the plexus is also called the enteric nervous system. The sympathetic innervation occurs through the paravertebral ganglia (sympathetic chain) and the prevertebral ganglia (celiac ganglion). The parasympathetic innervation occurs through the vagus nerve.

The peristaltic contractions are generated in the smooth muscles of the tunica muscularis. These contractions are regulated by the extrinsic influences of the intramural plexus and the autonomic nervous system. These influences are supported by the hormonal regulation.

The most important function of the stomach is to store food and to transfer stomach content to the small intestine at a rate that ensures high digestive efficiency. Food is kneaded by contraction of the stomach musculature and at the same time mixed with gastric juice. Gastric juice consists of gastric acid, pepsin, small amounts of digestive enzymes and water. The secretion of gastric juice is regulated by vagovagal and intramural reflexes and by hormones (acetylcholine, norepinephrine, gastrin, somato-statin, secretin, cholecystokinin and gastric inhibitory polypeptide).

In all pathologies of the stomach the blood circulation is of great importance. This is necessary for the supply of nutrients, hormones, buffers and oxygen and the removal of waste products and hormones. When the blood circulation is not correct a pathology can develop.

The sympathetic and parasympathetic balance is extremely important. A vagal over-stimulation leads to a rise in gastric acid. While an orthosympathetic overstimulation leads to a relative vasoconstriction. When a horse is in balance and the immune system functions correctly, all bacteria, viruses and parasites will be killed. If there is a dysbalance a horse is susceptible to these intruders.

A stomach problem can influence the rest of the body through 3 major pathways. First, there are multiple organs that are connected with the stomach through their location; the liver, the diaphragm, the spleen, the pancreas and parts of the intestines are relevant. Through this connection the visceral mobility, motility and peristaltic of the surrounding organs can be influenced.

Second, there are neurologic relations. Visceral sympathetic afferent information is transferred from the celiac plexus via the splanchnic nerves to the sympathetic chain. The rami communicans transfer the information to the lateral column (cornu laterale) of the spinal cord. If the afferent information is negative or disturbed, after some time the efferent information will also be disturbed. Hypertonic

epaxial muscles will arise. This can decrease the motion of the facet joints of the vertebrae. At long-term, vertebral blockages can develop. These can be found mid thoracic, at the end of the withers. From the celiac plexus there is a sympathetic feedback to the stellate ganglion. The stellate ganglion is connected to the cranial cervical ganglion through the ramus interganglionaris. Multiple branches leave from the cranial cervical ganglion to the entire skull. The cranial cervical ganglion lies under the wing of the atlas, therefore it can influence the occipito-atlanto-axial-complex (OAA-complex).

The parasympathetic innervation of the stomach occurs through the vagus nerve. The nervus vagus (N X) passes the jugular foramen together with the nervus glosso-pharyngeus (N IX) and the nervus accesorius (N XI). Disturbed visceral afferent information can influence the afferent and efferent information from N IX and N XI. This can cause a stiff neck, swallowing problems and production of saliva. The ramus jugularis is the connection between the N X and the cranial cervical ganglion. Unfortunately, little is known about the information that passes through this branch.

The phrenic nerve contains afferent information from the 'packages' of the viscera. Through this pathway a stomach problem can lead to low cervical blockages. Since the plexus brachialis arises from C6-T2, these blockages can lead to problems in the innervation of the front limb. The muscoli scaleni are innervated by the ventral branches of the last cervical nerves. Hypertonic muscoli scaleni can cause a restriction of the first rib. This can influence the underlying stellate ganglion.

Third, there are multiple fascial relations. By way of the omenta and the ligamenta a stomach problem can influence the diaphragm, the liver including the bile, the spleen and other parts of the intestines. Through the peritoneum, the fascia transversalis and the fascia iliaca a stomach problem can influence the diaphragm, all the other abdominal organs, the iliopsoas muscles and eventually the hind limb. Through the diaphragm, the fascia endothoracica and the pleura a stomach problem can influence all the organs and structures in the thorax. Through the fascia cervicalis a stomach problem can influence the skull, the hyoïd, the thyroïd gland and the cervical vertebra. Eventually also it can also influence the front limb. Also through the fascia thoracolumbalis, which is connected to the musculus latisimus dorsi and the musculus gluteus medius, both the front and the hind limb can be influenced.

All these visceral, neurologic and fascial relations also go in the other direction. Except for the phrenic nerve, which passes only afferent visceral information. Thus, a stomach problem can also be caused through these relationships.

The skin of the horse as an instrument for diagnosis and therapy in equine osteopathy.

Julia SCHLENZ

From an osteopathic point of view, the skin of a horse can be a very important organ for diagnostic and therapy for a diverse set of diseases. Using the skin for diagnostics, not only the symptoms, but the real causes can be revealed. Visual changes to the skin, characterized by size and appearance, can infer to the cause of the diseases. Olfactory analysis can give additional hints on the symptoms. By palpatory investigation, different problematic situations on and beneath the skin can be characterized, like changes in the connective tissue or in the fascia of muscles. Single fascia movements may be detected and thus biomechanical dysfunctions can be inferred without the need to see the horse in movement. After a complete examination, different palpatory techniques can be used as treatments, according to the symptoms and causes of the disease. Application of these techniques is not limited to be applied to the skin itself, but can also be used to treat the underlying structures. This way, the abstract and segmental changes of the skin can be treated.

The CSF in relation to PRM

Bianka VAN DE KLOMP

In this thesis I wanted to find out what the function of the cerebrospinal fluid (CSF) is and how the relation is between the CSF and the Primary Respiratory mechanism (PRM).

First the function of CSF and the structures inclosing the CSF are described.

Then the anatomy and the physiology of the choroid plexuses, which is the largest producer of cerebrospinal fluid, is described. Also the fysiology of the CSF and the choroid plexus is adressed.

After these chapters of anatomy, the function, the resorption and the route of the cerebrospinal fluid and the blood – brain and blood – liquor barrier is described.

Furthermore the primary respiratory mechanism is addressed. This section describes the frequency and the origin of the PRM. The relation between the CSF and the PRM is described and an alternative is given for the rhythmically contracting brain concept of Sutherland by the theory of Upledger and Vredevoogd (1983).

The CSF has an important role in the PRM and the cranium.

Because of the pressure change, the cerebrospinal fluid moves the sphenoid bone, which transfers the movement to the surrounding cranial bones and to the sacrum by the core link. According to Upledger and Vredevoogd (1983) the PRM has the characteristics of a semi-closed hydraulic system. This system is formed by the dura mater and its contents. The dura mater is essentially impermeable to the CSF which holds the dura mater. The rhythmic rising and falling CSF pressure in this semi-closed hydraulic system in turn causes the rhythmic movement of the PRM.

Finally the osteopathic vision, the treatment of the craniosacral system and the different structures which are influenced by, and have an influence on the CSF and the PRM, are described.

There are many surrounding structures which have an influence on the CSF and the PRM, such as the hypothalamus, the pituitary gland, the meninges, the mobility of the cranial bones, and the sacrum.

Indirectly the other structures from the body also have an influence on the CSF and the PRM, for example the afferent information from the viscera by the n. vagus, afferent information from the stellatum ganglia or through mechanical compensation from the spinal column.

This is why the surrounding structures, but also the other structures from the body need to be examined and when there is a disruption or a decreased mobility, these also should be taken into account in the treatment of the horse.

Realise that in the osteopathy we treat the body as a whole.

The equine liver from an osteopathic point of view

Manuela WEBER

Osteopathy, underlines its meaning by describing the development of the liver. The structure, shape and segmentation of the **liver**, its location and unique 'fixture' show us its huge diversity of connections to other organs. Every cell of the liver is connected to the sinusoid capillary system and the bile capillary system. The bile produced in the liver flows through bile canaliculus which merge with other bile ducts. Both ducts merge to the Ductus choledochus and find their way to the Papilla duodeni major within the duodenum. The blood supply is basically divided into two different sectors; the portal vein provides the liver and the arterial system the rest of the body. The venous blood rushes through the Vv.hepaticae. The lymphatic system of the liver is structured into a deep and a superficial system. The Plexus hepaticus is the vegetative neural innervation of the liver, the sympathetic fibers of the Nn.Splanchnici experience an interposition by the Ganglion coeliacum. The parasympathetic fibers are supported by the Nervous Vagus.

The horse does not own a functional gallbladder like the human being rather more its hepatic duct is integrated within the liver. The surface anatomy of the liver consists of parenchyma, mainly out of hepatocytes. It is covered by visceral peritoneum. This organ plays a major role in metabolism and has a number of functions in the body, including glycogen storage, fat digestion, decomposition of red blood cells, plasma protein synthesis, hormone production and detoxification. It is located below the diaphragm in the thoracic region of the abdomen.

The liver is responsible for a large part of amino acid synthesis; it performs several roles in carbohydrate metabolism. Especially glycogenolysis breaks down the glycogen into glucose with the help of special enzymes. Another important task of the liver is the gluconeogenesis, the way glucose is synthesized from certain amino acids or glycerol. Glycogenesis is the opposite of the glycogenolysis that means that glycogen is being formed from glucose, which is very important for the muscles. The liver is responsible for the mainstay of protein synthesis and metabolism. It produces coagulation factors that help to stabilize the injured animal. Lipid metabolism is important for the production of triglycerides and the synthesis of cholesterol.

Urea is a part of the urea cycle, either from the oxidation of amino acids or ammonia. Urea is found in the blood and is a component of urine, that's why it runs through the kidney. The oxidation pathway starts with the elimination of the amino by transaminase in the urea cycle. The small ammonia molecules are much smaller than its mobile form -the urea. Urea is basically neutral, through its high solubility in water it can be used as a vehicle to transport and excrete nitrogen. The liver is vital for survival, it supports mainly every organ. Many diseases that occur in the liver are accompanied by jaundice caused by high levels of bilirubin. This is a result of the high breakup of haemoglobin out of dead red blood cells. The liver normally removes bilirubin by excreting it through bile. Yellow eyes and a yellowish mucosa are well known signs. Generally **diseases** lead to a derangement of processes. An intense itch is caused when bilirubin deposits in skin. The loss of vitamins, minerals and important nutrition lead to excessive fatigue. The failure of creating albumin leads to a swelling of the ankles and the gastric functions shut down. It is important to watch out for feeding stuff that maybe a cause of these symptoms.

Spoilt feeding stuff is a sign of dysfunctions in the nervous system; it is accompanied by the loss of metabolic functions. The symptoms can lead to dysfunctions of the brain and its orders to the rest of the body.

Our hand is the most important icon; its function of a tool gives us the possibility to indicate disorders, especially changes of temperature and structural dysfunction of the motility of organs.

Osteopathy is the attempt to aid the body's own recuperative faculties. It is highly appreciated to help the animal patient to recover from illness and injury. It is a postural and occupational advice to help the recovery. Proponents of **visceral osteopathy** state that systems rely on the interconnection between the motions of organs and the body. Health should be stable; the idea is that the manipulation of the somatic system can affect the visceral system. Stability should interconnect between the blood, nerves and organs.

The idea of **cranial osteopathy** describes the rhythm that is operating in moving the plates of the skull. The observation helps to apply certain techniques that the plates of the cranium permit microscopic movement. The knowledge to work with this rhythm combines the activity and the function of the body with scientific improvement. The blockade of a suture can have an effect for the physics of the whole body.

The **fascia technique** is another way of treatment, it separates common muscle regions. This kind of treatment is indispensable and supports the metabolism of the body; it increases the lymphatic stream and supports the rush of the blood. It is especially effective for a mare that is dependent on a regular hormone influence. The system that keeps the fascia in order keeps a certain balance throughout the body; it is recommended that a certain balance is established between pressure, mobility and motility. If this balance is in disorder disturbances might occur faster than expected.

The horse is the ideal osteopathic patient; its vegetative neural system is very sensible and changes of balance show significant ways of reaction. Its large joints of the limbs for instance show a unique and simple construct. Any manipulation or disorder shows significant misbehavior.

Acidification in the horse

Marjorie WESTERHOF

In the first chapters of this work the anatomy, topography and physiology of the heart will be discussed.

Already in a very early stage during the embryonic phase the heart becomes functional. At birth it has to submit some dramatic changes to maintain its functionality in the neonate.

The heart is surrounded by pericardium and lies in the middle part of the mediastinum. It is attached by several ligaments and fascias with the diaphragm, the thyroid gland, the tongue-bone, the sternum and the vertebrae.

The blood supply of the heart comes from the coronary arteries originating from the base of the aorta. The coronary veins accompany the arteries and drain directly to the right atrium.

The innervation of the heart is complex and still not fully understood. The vagal nerve supplies the heart with parasympathetic information. The orthosympathetic innervation originates basically from the stellate ganglion and the first five thoracic vertebrae. Both systems function under the influence of higher centra, with the hypothalamus having the crucial role of coordinating these processes.

The reciprocal mechanism of cardiac control has long been accepted, but appears to be outdated. There are several connections between the ortho- and parasympathetic fibres. The exact function is not known, although it seems to take part in the fine-tuning of the heart function.

Peripheral neurons function under the influence of higher centra. But in the thoracic cavity local neuron circuits exist. Afferent information doesn't reach the spinal cord but provokes a local reaction. Some of the intrathoracic neurons even have a memory; they are able to influence the heart during multiple cycles after an aritmia.

The osteopathic relations with other tissues and organs are explained in the last chapter.

An optimal function of the heart can only be established when there is a normal mobility of the thoracic vertebrae, sternum and the first ribs. The diaphragm and the cranial thoracic inlet have an undeniable effect on the heart function.

The heart is connected with every living cell in the body through the blood vessels. Some organs however are highlighted because of their important influence on the cardiovascular system and vice-versa: the lungs, the liver, the thyroid gland, the kidneys and adrenal glands.

The atlanto-occipital articulation, the lower cervical vertebrae, the cervicothoracic and the thoracolumbar region are connected with the heart through the neurologic system.

Heart problems often originate from a dysbalance of the ortho- and parasympathetic system. Hypertension, tachycardia and other aritmias are a challenge for the osteopath.