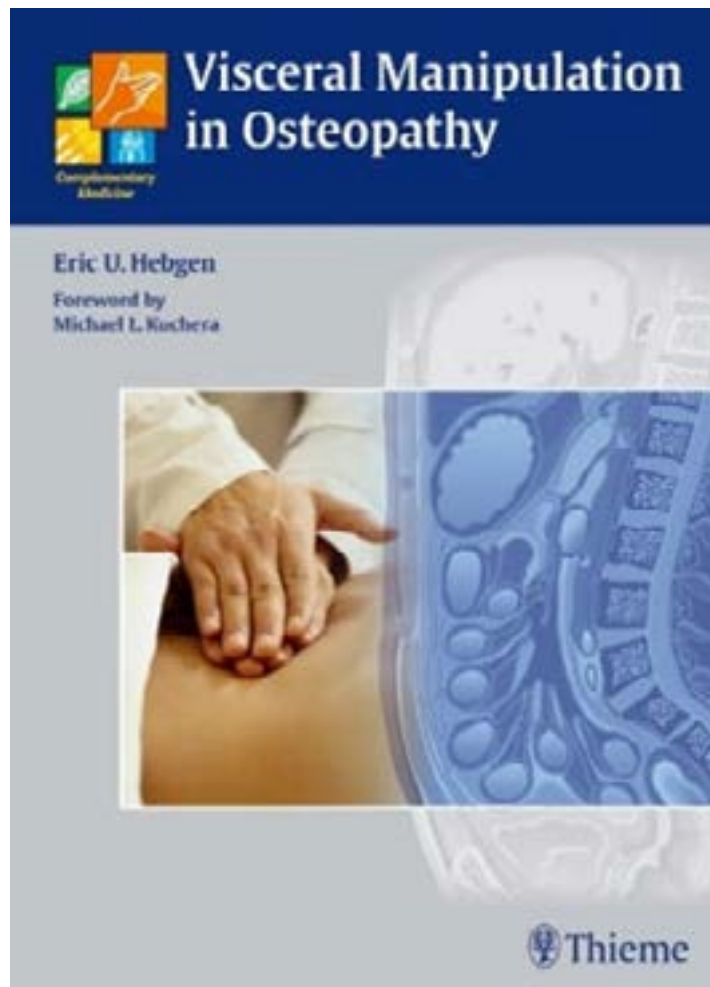




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**Visceral Manipulation in Osteopathy**  
A Practical Handbook  
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## Foreword to the English Edition

When asked to consider writing a foreword to *Visceral Manipulation in Osteopathy* by Eric Hebgen, DO, I was conflicted but intrigued. Leaving the next day to lecture in Australia, I had hoped to empty my plateful of writing projects on the long flight, yet treatment of visceral dysfunction was near dear to my heart (*no pun intended*). In the end, the title of Chapter 3 proved impossible to resist. I offered to examine the text and happily so.

The clear, uncluttered diagrams and dynamic pictures of osteopathic manipulative technique (OMT) immediately impressed me. Coupled with the publisher's spacious layout, *Visceral Manipulation in Osteopathy* was remarkably easy to read and "digest" (pun *intended* for a cooking analogy!). The author is an effective chef who has carefully balanced precise appetizers and chosen just the right amount in each entrée to nourish—but not overstuff—clinicians.

- **Appetizers:** In his first four chapters, the author pares down and deconstructs several key osteopathic approaches; treatments reflecting both European and American flavors. For complete recipes and their rationale, the reader should really return to the original texts; but for an overview or a quick trip down "memory-lane," the author handily summarizes terminology and many key concepts related to visceral treatment.
- **Entrées:** Having introduced ingredients (concepts and techniques) in the first four chapters, Eric Hebgen then

specifically serves up 18 additional organs in his wonderfully uncomplicated style. His simple clarity provides immense clinical practicality.

I would like to close this foreword by observing that in 1990 when we wrote our first text, *Osteopathic Considerations in Systemic Dysfunction*, we could not have imagined its impact. In later texts and editions, we continued to build upon the acknowledged work of our respected teachers and mentors (especially Korr, Denslow, Kimberly, Frymann, and Zink), just as they built upon the work of Sutherland, Chapman, Burns and others. As future texts synthesize improved, coordinated osteopathic approaches promoting health and visceral homeostasis, they will benefit from access to this text—I know our subsequent editions will.

Because of its clear explanations, quality graphics and intent to convey some of the contributions of the author's colleagues and teachers, I recommend you make this text part of your library. While it benefits from a number of practical OMT "recipes," in caring for patients I trust you will find that *Visceral Manipulation in Osteopathy* will be more than a mere cookbook.

Prof. Michael L. Kuchera, DO, FAAO  
(Author of *Osteopathic Principles in Practice*,  
*Osteopathic Considerations in Systemic Dysfunction*,  
and *Osteopathic Considerations in HEENT Disorders*)

## Foreword to the 3rd German Edition

During the 150 years in the history of osteopathy, numerous approaches have been developed.

Andrew Taylor Still, the founder of osteopathy, was far ahead of his times and formulated a number of thoughts that continue to enjoy unchanged validity for contemporary medicine and for osteopathy. It was his desire to warn and preserve the medicine of his times against overly radical specialization and mechanization. He advocated a holistic and individualized perspective in medicine.

For this purpose, he emphasized placing the patient at the center of the consultation. His ideal of medicine was to first do everything in one's power to activate the autoregulatory powers of the patient. It was only when the limits of autoregulation were reached that allopathy should get involved. His first yardstick for the healthy functioning of the human body was movement, in the largest sense of the word.

Eric U. Hebgen, the author of the present book, and his teacher Josi Potaznik have grasped the meaning of this philosophy. Especially in our modern world with its host

of stimulations and overstimulations, the osteopathic view of the patient is gaining new significance. It offers an extremely interesting approach, in the context of the viscera in particular. The decision to write this book was therefore not far-fetched. To create a comprehensive survey, Eric U. Hebgen has adopted and integrated much information from previous publications by different authors. This book is also rooted in the visceral instructions by Dr med Josi Potaznik, DO, who has collaborated in the development of visceral instruction at the Institute for Applied Osteopathy for a long time.

The present book serves not only as a general treatment of visceral manipulation, but also as a guidepost and textbook, describing the organs according to osteopathic criteria in their physiologic movement, defining movement disorders, and presenting pathologic effects.

*Werner Langer, DO  
Director, Institute for Applied Osteopathy  
Bitburg, Germany*

## Preface

It is my pleasure and honor to offer you this book, which was first published in Germany in 2003 as *Viszeralosteopathie—Grundlagen und Techniken*, now in its English translation as *Visceral Manipulation in Osteopathy*. The publication of an osteopathic book in the “mother tongue” of osteopathy, as it were, appears particularly significant to me. I hope that you will find suggestions and inspiration for your daily work.

The osteopathic manipulation of the internal organs is as old as osteopathy itself. Andrew T. Still's books show that he already treated the internal organs. He describes manipulations that primarily affect the organs through the circulatory system and aim at strengthening their self-healing powers. William A. Kuchera, DO, and Michael L. Kuchera, DO, compiled and refined these treatments in an outstanding book that was published in 1994. This traditional American treatment approach is part of this book, as is the reflex therapy according to F. Chapman, DO, an American osteopath who at the start of the twentieth century discovered the reflex points named after him and linked them to certain organs, as a result of which we know that treating the points improves the health of the organ.

European practitioners also began to manually treat the abdominal organs in the late nineteenth century. The Swedish gymnast Mårten Thure Emil Brandt (1819–1895), for example, developed a diagnostic and therapeutic method for treating the organs of the lesser pelvis. Thus, a repositioning technique for uterine prolapse is named after him, which is still used successfully today. Henri Stapfer, one of Brandt's students, further refined these methods. The French physician Frantz Glénard (1848–1920) also described visceral palpations and manipulations of different organs systematically during this time. In addition, he introduced a first visceral concept.

In the 1970s and 1980s, French osteopaths such as Jacques Weischenk, DO, in turn took on the known treatment methods and developed them further. And, finally, we have Jean-Pierre Barral, DO, to thank for the fact

that the visceral manipulation of the internal organs could be established as a part of osteopathy in Europe. He systematized and structured existing information, carried out his own studies, and published a visceral concept that has become the most widespread model in European osteopathy. In the present book, I have therefore devoted the largest amount of space to Barral's therapeutic approach.

Furthermore, the two Belgian osteopaths Georges Finet, DO, and Christian Williame, DO, also carried out extensive studies in the 1980s to investigate the mobility of the organs in relation to the movements of diaphragmatic breathing. On the basis of their research, they developed a fascial treatment of the internal organs that surely deserves more attention. In this book, I introduce one part of this treatment concept that I consider the most effective.

For many people, manual treatments of the internal organs initially appear strange, and they may ask why we should even push around on the abdomen at all. Thus, we should take into consideration the fact that the internal organs are affixed mechanically to each other as well as to parts of the locomotor system and are subject to the same physical laws as the rest of the body. If we therefore recognize them as part of the mechanics of the body and take into account the anatomical connections, we can see how a disturbance in the movement of an organ has an effect on other parts of the body. Bear in mind: I am referring here to an osteopathic dysfunction, as it occurs also in the locomotor system, and not to an illness of an organ, even though in such cases Andrew T. Still himself established the circulatory treatment method. Thus, I am firmly convinced that the osteopathic manipulation of the internal organs presents an enrichment of therapeutic skills. Anybody who has personally discovered them will never want to manage without them again.

Eric U. Hebgen, DO, MRO

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## Introduction

### Explaining the Concepts of Jean-Pierre Barral, Georges Finet and Christian Willame, William and Michael Kuchera, and Chapman

The following chapters offer a description of the osteopathic manipulation of the internal organs. I will introduce you to four treatment concepts that have one feature in common: all of them use the anatomy of the body as the foundation for the development of each particular concept. In the following paragraphs, I would like to explain the differences between these concepts.

The manipulation of the internal organs according to **Jean-Pierre Barral, DO**, is the standard method of visceral osteopathy in Europe. In this method, Barral views the organs from a mechanical perspective: organs form visceral joints with another organ or a part of the locomotor system, e.g., the diaphragm. Similar to joints in the locomotor system, the partners of a joint move against each other in fixed directions and ranges. To ensure that this movement is executed with as little friction as possible, the partners of a parietal joint are characterized by a smooth surface and by the synovium, which produces small amounts of joint fluid. Likewise, the organs have a smooth surface as their external surface is sealed off by a layer of serous skin. This layer is the peritoneum, the pleura, or the endocardium. Furthermore, we find a small amount of fluid in the serous cavities between the organs. The organs do not move against each other haphazardly but are subject to certain laws: they are fastened to each other and to the locomotor system by the mesenteries, omenta, or ligaments. This limits their range of motion. We also find this feature in the joints of the locomotor system. Ligaments permit and limit the extent and direction of movement.

Barral hence constructs his theory parallel to the parietal joints. His treatment techniques are also, to a large extent, informed by them. Similar to the parts of a joint, the organs are tested for their ability to move and directly treated to increase mobility, until a normal range of motion is restored. It is only his concept of visceral motility that follows a more energetic approach, which I will treat in more detail below.

**Georges Finet, DO**, and **Christian Willame, DO**, two Belgian osteopaths, carried out extensive radiograph- and ultrasound-supported studies in the 1980s, to examine the movements of the abdominal organs in relation to diaphragmatic breathing. In the course of their research, they discovered organ movements that follow certain rules. For the organs that they studied, they defined

movement directions and extents, which largely concur with Barral's results. In addition, they developed a treatment method to influence disturbed organ movements and were also able to control their method using X-rays or ultrasound waves. In contrast to Barral, who palpates the organs and moves them directly in his mobilizing techniques, Finet and Willame utilize the anterior parietal peritoneum in their therapy. By moving the peritoneum, they achieve a mobilizing effect without palpating the organ itself. They call their method fascial because the peritoneum is seen as fascia and connects all abdominal organs with each other. If you pull on one part of the anterior peritoneum, this also has an effect on a distant region, e.g., the peritoneum of the pancreas. You could compare the peritoneal cover to a balloon: if you push or pull on one part of the balloon, this pull spreads throughout the entire balloon and deforms it.

Ultimately, both treatment concepts succeed in restoring the physiologic mobility of an organ, with the only difference being that Finet and Willame do so a little less invasively. The indication for this method thus also extends to organs that, because of a disorder, should not be palpated and mobilized directly. In this book, I introduce what I believe to be the most effective technique from the treatment concept according to Finet and Willame, namely expiratory dysfunction. I consider it particularly successful because the mobilizing effect is herein achieved by the diaphragm in the context of respiration, meaning that the patient's body is thus carrying out the real "work" itself.

In the circulatory movements according to **William A. Kuchera, DO**, and **Michael L. Kuchera, DO**, the osteopath does not aim at contact with the affected organ, but rather analyzes which arteries, veins, vegetative nerves, and lymphatic vessels supply an organ and dispose of its waste, using special techniques to influence the circulation of the organ. In this technique, the mobilization of the organ is not of primary importance. This concept is thus an excellent complement to the mobilizing concepts of Barral and Finet/Willame. These manipulations are less invasive and far too little known in some countries. For didactic reasons, I have recorded the appropriate techniques for each organ, knowing full well that an exact separation of its circulation and therefore an isolated treatment of an individual organ is not possible. The techniques themselves are described all together in the general section of the book.

The fourth treatment concept is the reflex therapy according to **Frank Chapman, DO**. The Chapman points are a valuable diagnostic tool, can provide follow-up results after treatment with visceral manipulation, and

take advantage of the vegetative nervous system to influence the internal organs. Reflex therapy should be found in every therapeutic tool kit. The Chapman points have become highly valued tools for me.

These treatment techniques are supplemented by concise information about the physiology and clinical pathology of the individual organs. This information is not intended to be exhaustive but rather as a quick reference source in one's daily work.

While reading this book, you will encounter the term "central tendon" again and again. This is not to be confused with the "core link." That term is used in the English literature to refer to the connection between the base of the skull and the sacrum or coccyx via the dura mater. The central tendon, by contrast, refers to a fascial string that also runs through the body from the base of the skull to the pelvic floor, but is located anterior to the spinal column in the superficial and deeper-lying fascial layers of the body and does not include the dura mater. This fas-

cial continuum works together as a functional unit: if a dysfunction is present in the body that should be protected in a global chain of protection, the central tendon can collaborate in this effort. The ability to carry out a fascial contraction is therefore of great importance. The fascia contracts towards the location of the dysfunction, thereby contributing to the protection of this area. As the fascial organ coverings (peritoneum, pericardium, pleura) are integrated into this system, compensatory increases in tension are also found in this fascia. As circulation passes through the fascia, elevated fascial tension disturbs the circulation of the tissue behind it. In concrete terms, this means that pathologic tension in the central tendon disturbs the circulation in the organs and can be the trigger point for impaired organ function or result in a reduced ability of the organ to compensate for biological, physical, or chemical noxa. Restoring normal tension in the central tendon is hence of vital importance for undisturbed organ function.

## 10 The Pancreas

### Anatomy

#### General Facts

The pancreas is 14–18 cm long and weighs 70–80 g. It is a gland with exocrine and endocrine features.

#### Division

- head of pancreas with the uncinate process
- body of pancreas
- tail of pancreas
- pancreatic duct (Wirsung)
- accessory pancreatic duct (Santorini)

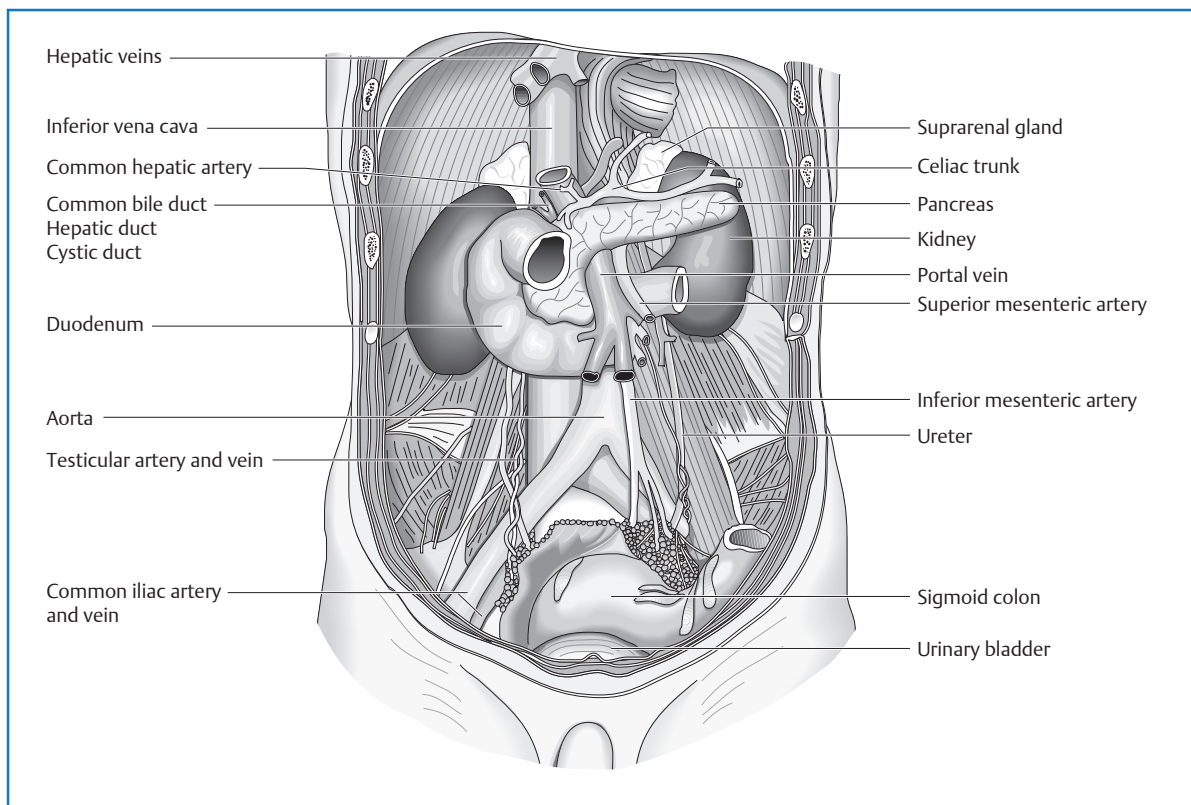
### Location

The pancreas is a secondarily retroperitoneal organ. It lies on the median line roughly at the level L1–L2, with the head lower than the tail: the axis of the body is inclined toward the upper left approximately 30° to the horizontal line.

The accessory pancreatic duct, if present, enters the duodenum 2–3 cm above the major duodenal papilla.

### Topographic Relationships

- duodenum
- L2–L3 (head of pancreas), covered by the right crus of the diaphragm
- common bile duct
- aorta
- inferior vena cava
- left renal vein



**Fig. 10.1** Topographic relationships of the pancreas.



- pylorus
- superior mesenteric artery and vein
- duodenojejunal flexure
- omental bursa
- stomach
- kidneys
- transverse mesocolon (divides the pancreas into a sub- and a supramesocolic part)
- transverse colon
- left colic flexure
- splenic vein
- peritoneum
- spleen
- lesser omentum
- portal vein

### Attachments/Suspensions

- organ pressure
- turgor
- attachments of connective tissue in the retroperitoneal space
- pancreaticosplenic ligament
- retropancreatic fascia (Treitz)
- transverse mesocolon
- duodenum

### Circulation

#### Arterial

- superior mesenteric artery
- gastroduodenal artery (from the common hepatic artery)
- splenic artery

#### Venous

- superior mesenteric vein
- portal vein (from the splenic vein and pancreaticoduodenal veins)

#### Lymph Drainage

- direct lymphatic connections to nearby organs (duodenum)
- via celiac lymph nodes to the gastric and hepatic lymph nodes on the left side of the body
- mediastinal and cervical lymph nodes
- pancreaticolienal lymph node and pylorus
- mesenteric and periaortal lymph nodes

#### Innervation

- sympathetic nervous system from T5 to T9 (sometimes also T10 and T11) via the major splanchnic nerve, with switching in the celiac plexus
- vagus nerve

#### Organ Clock

Maximal time: 9–11 a.m.

Minimal time: 9–11 p.m.

#### Organ–Tooth Interrelationship

For basic information, see page 34.

- First back tooth in the lower jaw, right side
- First molar in the upper jaw on the right side

### Movement Physiology according to Barral

#### Mobility

Due to the good fascial anchoring in the retroperitoneal space, it is impossible to detect a separate mobility. Nevertheless, the movements of the neighboring organs and the diaphragm cause pushing and pulling on the pancreas.

#### Motility

With a hand that rests on the projection of the pancreas on the abdomen (fingers pointing to the tail, thenar lies above the head), we can detect a wave from the heel of the hand to the fingertips during exhalation. During inhalation, the wave runs in the opposite direction.

### Physiology

The pancreas is a gland with exocrine and endocrine features. The endocrine parts, the islets of Langerhans, are distributed throughout the entire pancreas with accumulations in the body and tail. The cells in the islets of Langerhans produce the hormones that are responsible for regulating blood sugar: insulin, glucagon, and somatostatin.

#### Insulin

Insulin is synthesized in the  $\beta$  cells of the islets of Langerhans (approximately 2 mg/day) and lowers the blood sugar level by making the cell wall of each body cell permeable to glucose. In addition, insulin assists in the uptake of different amino acids into the cell.

In the liver, it initiates a variety of metabolic processes:

- glycogen synthesis and inhibition of glycogenolysis
- synthesis of lipids and inhibition of lipolysis
- inhibition of protein breakdown

## Glucagon

Glucagon is produced in the  $\alpha$  cells of the islets. It is the “insulin antagonist”: by promoting glycogenolysis and gluconeogenesis in the liver, it raises the blood sugar level.

## Somatostatin

The  $\delta$  cells synthesize this hormone. It suppresses the release of insulin and glucagons, and decreases digestive activity by reducing intestinal peristalsis and inhibiting the secretion of digestive juices. Its function is to maintain the glucose level as much as possible.

The **exocrine gland part** of the pancreas secretes juice into the pancreatic duct. As a result of its activity, approximately 1–1.5L of “abdominal saliva” thus reaches the duodenum per day.

This secretion consists of:

- bicarbonate to neutralize the acidic chyme from the stomach
- trypsinogen and chymotrypsinogen (enzymes for digesting protein)
- $\alpha$ -amylase (also present in the saliva of the mouth) for cleaving carbohydrates
- lipase (enzyme for cleaving fat)

The enzymes of this “abdominal saliva” are not yet activated in the pancreas. It is only after contact with bile or the enterokinase in the duodenal juice that they are activated and begin working. If this activation takes place in the pancreas, it results in autodigestion and the symptoms of acute pancreatitis.

## Pathologies

### Symptoms that Require Medical Clarification

- Icterus
- Pain in the depth of the upper abdomen with back pain in the area of the lower thoracic spinal column, radiating beltlike from the back to the front
- “Rubber stomach”

## Acute Pancreatitis

**Definition.** Inflammation of the pancreas with disturbance of exocrine and endocrine functions.

### Causes

- biliary tract disorders (40–50%)
- alcohol abuse (30–40%)
- idiopathic (10–30%)

Rare causes include:

- medications (diuretics,  $\beta$  blockers, glucocorticoids, antibiotics, nonsteroidal antirheumatics)
- trauma
- infections (mumps, Coxsackievirus)
- hypercalcemia (e.g., hyperparathyroidism)
- hyperlipoproteinemia
- papillary stenosis

### Clinical

- guiding symptom: severe upper abdominal pain, arising approximately 8–12 hours after a large meal or alcohol abuse, with pain radiating into the back and ringlike to the left around the torso
- shock

## Chronic Pancreatitis

**Definition.** Chronic inflammation of the pancreas is characterized by persistent or recurrent pain with usually irreversible morphologic changes in the pancreatic parenchyma and functional disturbances in the pancreas.

### Causes

- alcohol (70–90%)
- idiopathic (10–25%)

Rare causes include:

- anomalies in the pancreatic duct system
- hyperparathyroidism
- trauma
- abuse of analgesics

## Osteopathic Tests and Treatment

### Fascial Stretch of the Pancreas in Longitudinal Axis according to Barral



Fig. 10.2

#### Starting Position

The patient is in the supine position, legs bent. The practitioner stands on the patient's right side at the height of the pelvis.

#### Procedure

Place your left hand on the abdomen, with the fingers on the projection of the head of the pancreas. The right hand is placed with the thenar on the projection of the tail of the pancreas. Now apply gentle pressure posteriorly with both hands, compressing the superficial tissue on top of the pancreas. When you have reached the fascial plane of the pancreas, stretch with both hands simultaneously along the longitudinal axis of the pancreas and hold the pull until you notice a fascial release.

### Test and Treatment of Pancreatic Motility according to Barral



Fig. 10.3

#### Starting Position

The patient is in the supine position, legs stretched out. The practitioner sits by the patient's right side.

#### Procedure

The right hand of the practitioner rests without pressure on the projection of the pancreas on the abdomen—the thenar on the head, the fingertips on the tail. The forearm also rests on the abdomen.

During exhalation, you will notice a wavelike movement from the heel of the hand to the fingertips, during inhalation it is in the opposite direction.

#### Testing Sequence

Detect the motility motion and evaluate the amplitude and direction of the inspiratory and expiratory movements as well as the rhythm of the movement as a whole. If a disturbance is present in one or both aspects of the motility movement, treat the patient.

#### Treatment

Motility is treated indirectly by following the unimpaired movement, remaining at the end-point of this movement for several cycles, and then following the impaired movement to the new end-point.

You can also try to increase the range of the free movement (induction), afterward checking whether the limited movement direction has improved.

Repeat this movement again and again until the motility has returned to normal in terms of rhythm, direction, and amplitude.

## Fascial Technique according to Finet and Williame

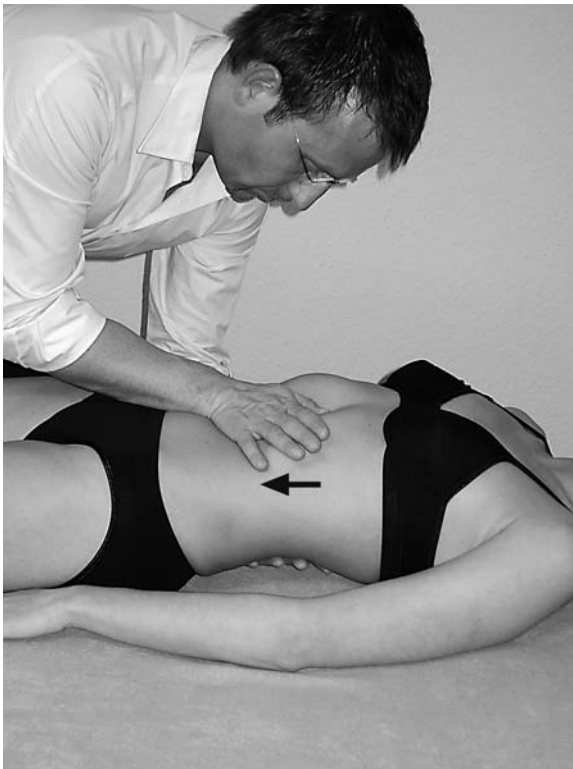


Fig. 10.4

### Starting Position

The patient is in the supine position, legs stretched out. The practitioner stands on the patient's right side.

### Procedure

Place your right hand on the projection of the pancreas with the heel of the hand on the head and the fingertips on the tail. Place your left hand on the posterior projection of the pancreas with the heel of the hand on the head and the fingertips on the tail.

### Treatment

During inhalation, pull caudally with both hands at the same time; during exhalation hold the position reached. Repeat this procedure until you have reached the end of the fascial movement. In the next exhalation, release the pull.

Repeat the whole treatment four or five times.

## Circulatory Techniques according to Kuchera

### Arterial Stimulation

- stimulation of the celiac trunk and superior mesenteric artery by working on the spinal column
- diaphragm techniques

### Venous Stimulation

- liver pump
- stretching the hepatoduodenal ligament
- diaphragm techniques

### Lymphatic Stimulation

- lymph drainage on thorax and abdomen
- diaphragm techniques

### Vegetative Harmonization

#### *Sympathetic nervous system:*

Stimulation of the sympathetic trunk T5–T9 by:

- rib raising
- inhibiting the paravertebral muscles
- vibrations
- manipulations
- Maitland technique
- stimulation of the celiac plexus
- diaphragm techniques

#### *Parasympathetic nervous system:*

Stimulation of the vagus nerve by:

- craniosacral therapy
- laryngeal techniques
- thoracic techniques (recoil)
- diaphragm techniques

## Reflex Point Treatment according to Chapman

### Location

**Anterior.** Intercostal space between ribs 7 and 8 on the right side, near the rib cartilage.

**Posterior.** Between the two transverse processes of T7 and T8, halfway between the spinous process and the tip of the transverse process; present only on the right side!

### Treatment Principle

Make contact with the reflex point. For this purpose, very gently place a finger on the point and press only lightly. Reflex points are often very sensitive, and it is therefore important to proceed with caution.

The finger remains on the point and treatment is by gentle rotations.

**Lateral.** Both halves of the lung.

In this space, we find a large number of important structures that are essential for the vitality of the entire body:

- heart with pericardium
- the major arteries and veins of the body:
  - aorta
  - pulmonary artery
  - SVC
  - pulmonary veins
- esophagus
- trachea
- main bronchi
- vagus nerve
- phrenic nerve
- sympathetic trunk
- thymus
- azygos vein
- hemiazygos vein
- thoracic duct

These organs and circulatory structures are linked to each other by connective tissue. This ensures good fixation in the mediastinum. However, sufficient mobility must be present to follow the movements of the torso, arm, and head and neck, e.g., the esophagus and other organs

must be able to stretch in a craniocaudal direction during a neck extension.

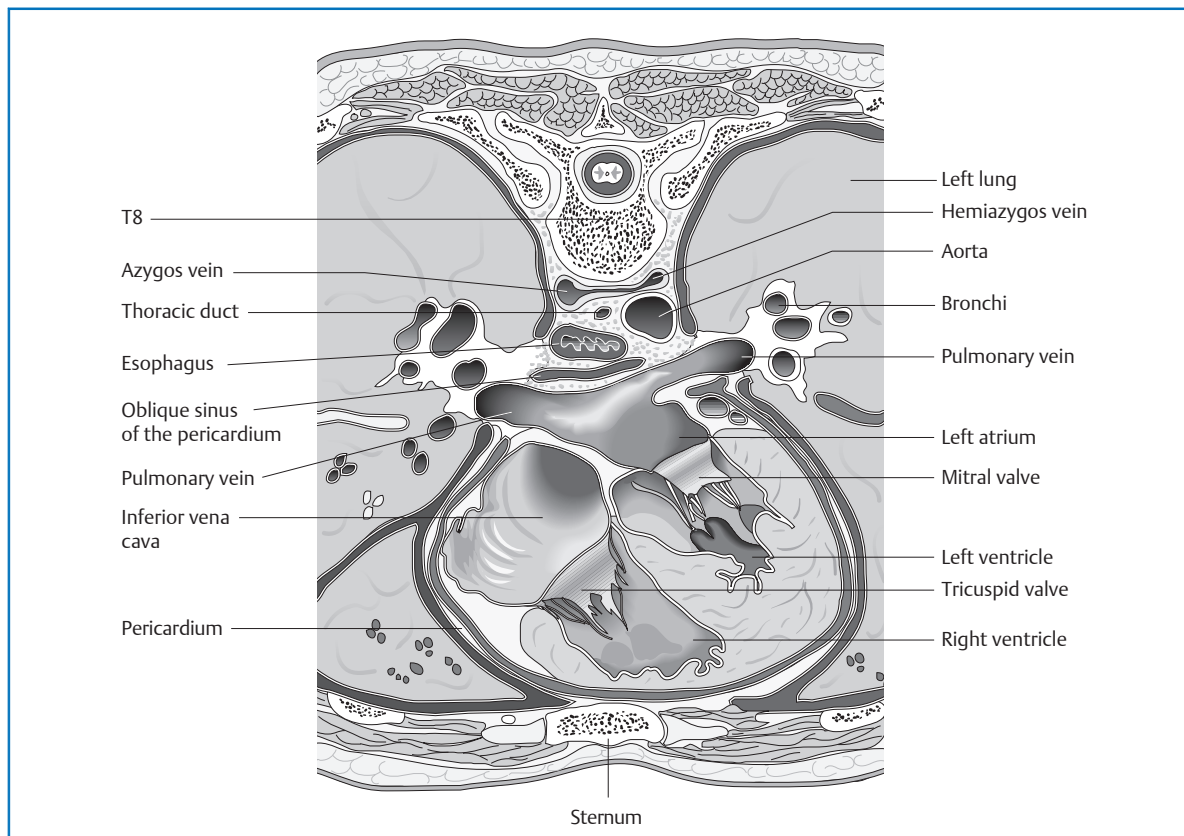
Another factor that requires mobility is the expansion of the lung and the movements caused by diaphragmatic breathing. The mediastinum thus experiences alternating pushing and pulling.

Lastly, heartbeats, in the sense of oscillations, also have an impact on the mediastinal structures.

Thus we can see that continuous, even if partly only minor, movements in this apparently motionless space affect the organs of the mediastinum. This fact is particularly significant for the blood flow back into the heart, which is influenced by the suction effect of respiration, and for the nerve structures that are stimulated in the osteopathic sense by this constant movement.

The mediastinum is tied into the fascial system of the “central tendon.” It constitutes the thoracic aspect of a fascial pull that reaches from the base of the skull down to the lesser pelvis. As a result, we can see fascial structural adaptations in the mediastinum that could lead to symptoms in the thorax but have their cause in a different location in the body.

As a result of the vital importance of the mediastinal structures, abnormal fascial pulls can lead to significant functional changes. Here, we might consider the vagus innervation or the clinical picture of a hiatus hernia.



**Fig. 17.6** Topography of the mediastinum: transverse view.

## Movement Physiology

Respiration is the motor for the regular movement of the thorax. An average of 12–14 breaths/min require the chest to expand and contract rhythmically in its sagittal and transverse diameters.

In biomechanical terms, we distinguish between two movement directions of the ribs: the rotational axis of the upper ribs that runs through the costotransverse and costovertebral joints lies almost parallel to the frontal plane—during inhalation, the result is mainly an expansion of the sagittal diameter of the chest.

The rotational axis of the lower ribs lies almost in the sagittal plane. By raising the ribs during inhalation, the result is thus primarily an enlargement of the transverse diameter of the thorax.

The central ribs have a movement axis that forms a 45° angle to the sagittal plane. Inhalations here lead to an expansion in the sagittal and transverse diameters.

In the sternum, the movement of the ribs causes a rise cranially and an increase in the distance to the spinal column—the sternum moves anteriorly and superiorly during inhalation. Movements therefore occur in both the sternocostal and the chondrocostal joints.

In the chondrocostal junction, the rib cartilages experience a torsion that is of great significance for the elastic and passive return of the thorax from the inhalatory position to the respiratory rest position.

Inhalation is a process that is directed by respiratory muscles: easy respiration involves the diaphragm and the scalene and intercartilaginous muscles. These extend—as described above—the chest in its sagittal and transverse diameters; the diaphragm increases the thorax diameter caudally and raises the lower ribs.

The contraction of the diaphragm causes a movement caudally while pushing the abdominal organs inferiorly and anteriorly. The movement anteriorly results from the soft abdominal wall, which does not provide active resistance against the displacement of the abdominal organs during inhalation.

In easy respiration, exhalation is a passive process, directed by the elastic restorative force of the thorax.

In deep inhalations, additional muscles assist in the expansion of the thorax. These accessory inhalatory muscles include the:

- external intercostals
- serratus posterior superior
- serratus anterior
- greater pectoral
- smaller pectoral
- sternocleidomastoid
- erector muscle of the spine

Deep inhalations cause an extension in the spinal column, as a result of which the extensors of the spinal column can also be included indirectly among the inspiratory muscles.

Forced exhalations likewise involve further accessory expirators:

- abdominal muscles (internal and external oblique, rectus abdominis, transversus abdominis)
- internal intercostal muscle
- subcostal muscle
- transversus thoracis
- serratus posterior superior
- latissimus dorsi

## Physiology

### ■ Physiology of the Heart

Here, we describe the mechanical heart action of the left heart. The same processes take place in the right heart.

#### Systole

##### Contraction Phase

- ventricle is filled with blood
- phase starts when the contraction of the ventricle starts

As a result of the contraction of the ventricle, intraventricular pressure rises. When this pressure is greater than the pressure in the atrium, the AV valves close (the semilunar valves are still closed). Tendinous fibers and papillary muscles prevent the AV valves from blowing through into the atrium. The surfaces of the individual flaps are greater than the opening to be closed. By broadly juxtaposing the edges of the flaps, closure of the valve is ensured even when the ventricular size changes. In the ventricle, no change in volume occurs, but only a reshaping of the ventricle into the form of a ball (= isovolumetric contraction). All muscle fibers change their length actively or passively.

Duration of this phase: 60 ms when the body is at rest.

##### Ejection Phase

This phase starts when the pressure in the left ventricle is greater than the diastolic pressure in the aorta (80 mmHg). The semilunar valves open and pressure continues to rise until it reaches the systolic blood pressure value (approximately 120–130 mmHg). Finally, the ventricular contraction is released and the pressure drops back down. When the pressure is lower than the aortic pressure, the semilunar valve closes and systole is thereby concluded.

During rest, approximately half the contents of the ventricle (130 mL) is ejected (= stroke volume).



### Test and Treatment of the Costoclavicular Ligament according to Barral



Fig. 17.8

#### Starting Position

The patient is in the supine position. The practitioner stands on the side to be treated.

#### Procedure

Palpate the costoclavicular ligament for sensitivity.

To treat, apply frictions or inhibitions to the sensitive areas until the pain has disappeared. Pressure on the sensitive areas should therefore be just strong enough to barely cross the pain threshold. Treatment success can then be evaluated sufficiently.

### Compression and Decompression of the Clavicle Along the Longitudinal Axis according to Barral



Fig. 17.9

#### Starting Position

The patient is in the supine position. The practitioner stands on the side to be treated.

#### Procedure in Compression

With the lateral hand, hold the acromial end of the clavicle between the thenar and hypothenar. With the medial hand, hold the sternal end of the clavicle in the same way. Place the fingers of both hands on top of each other over the clavicle.

#### Testing Sequence in Compression

Compress the clavicle simultaneously with both hands. Take note of intraosseous and fascial tensions as well as of sensitivity to the compression. In a second step, translate the clavicle laterally and medially.

#### Treatment in Compression

Translate the clavicle mediolaterally.

For an additional treatment option, you can apply fascial unwinding to the clavicle under compression.

You can conclude treatment with a recoil: increase the compression for one or two breaths during exhalations and maintain during inhalations. When you have reached the greatest possible compression, abruptly release it at the start of the next inhalation.

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