Scientific Osteopathic Approach To Patients With The Metabolic Syndrome

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1. Introduction

The metabolic syndrome (MetS) (also called syndrome X) is seen in people that are:

- Overfed.
- Underactive.

Definition of the metabolic syndrome:

- By the International Diabetes Federation (IDF) (2006) (quote):
    - ‘The metabolic syndrome is a cluster of the most dangerous heart attack risk factors: diabetes and prediabetes, abdominal obesity, high cholesterol and high blood pressure.’

This syndrome is characterized by:

- High blood pressure.
- Altered blood sugar levels.
- Obesity.
- Low HDL and high LDL levels.
- Dysfunctional blood clotting.
- Proinflammatory status.
- Vascular dysregulation.
- Hormonal factors.

Figure 1 - The metabolic syndrome

The metabolic syndrome condition can/will lead to cardiovascular disease and diabetes type II and probably to some forms of cancer.

The prevalence of the condition increases after the ages of 40 and 50 years.

Between the ages of 50 and 60 years the prevalence increase to 40% in men and 35% in women.

Around 25% of the adult population have the metabolic syndrome worldwide and they are 3 times as likely to die from heart attack or stroke compared with people without the syndrome.

The risk to develop diabetes type 2 is 5-fold.

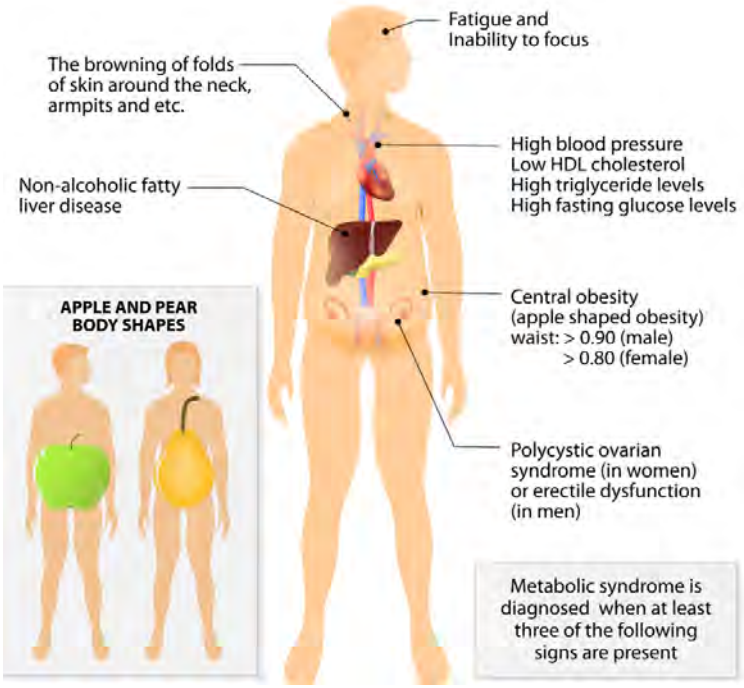

Figure 2 - Symptoms of the metabolic syndrome

Over the age of 60 years the prevalence in women is higher than in men.

The MetS is a major and escalating public health and clinical challenge worldwide.

Causes:

- Overweight with too much body fat (especially visceral fat) and too little activity predisposes development of metabolic syndrome.
- An irregular day/night rhythm is also associated with the development of metabolic syndrome.
- The exact etiology or pathophysiology of metabolic syndrome is not yet established, however, resistance to insulin stimulated glucose intake – something that is instigated by overweight and obesity – seems to be essential.
- More than 90% of patients with metabolic syndrome are also insulin resistant.

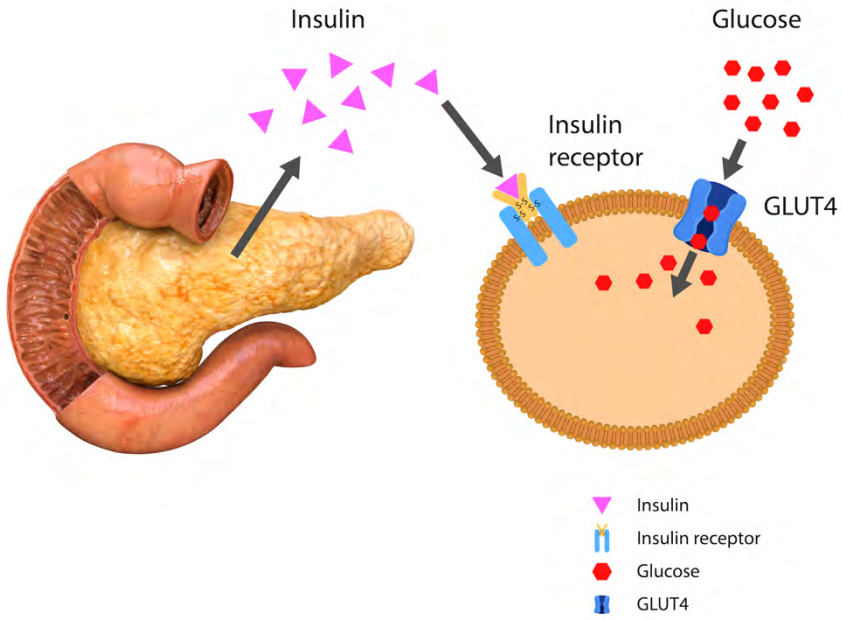

Figure 25 - Insulin unlocks the glucose channels

Type 2 diabetes occurs when glucose levels become higher throughout the day as the resistance increases and compensatory insulin secretion fails.

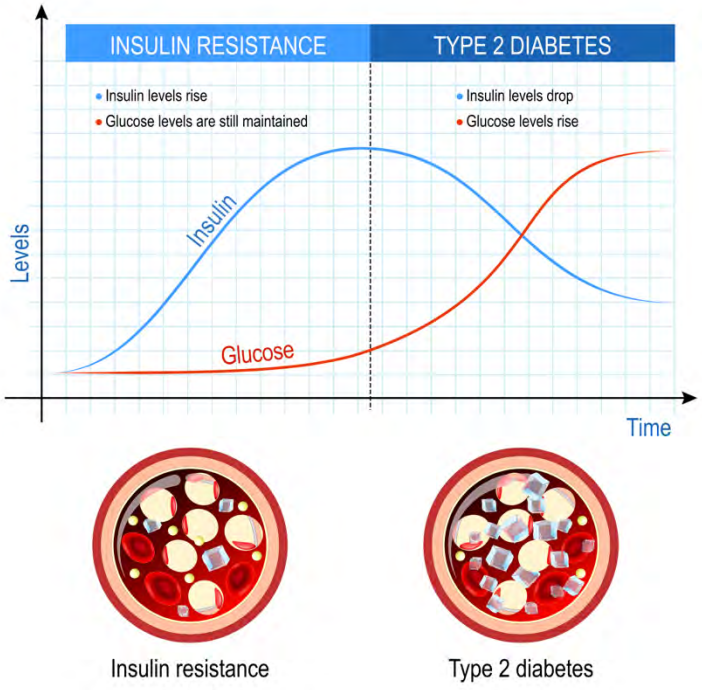

Figure 26 - Insulin resistance and diabetes type 2

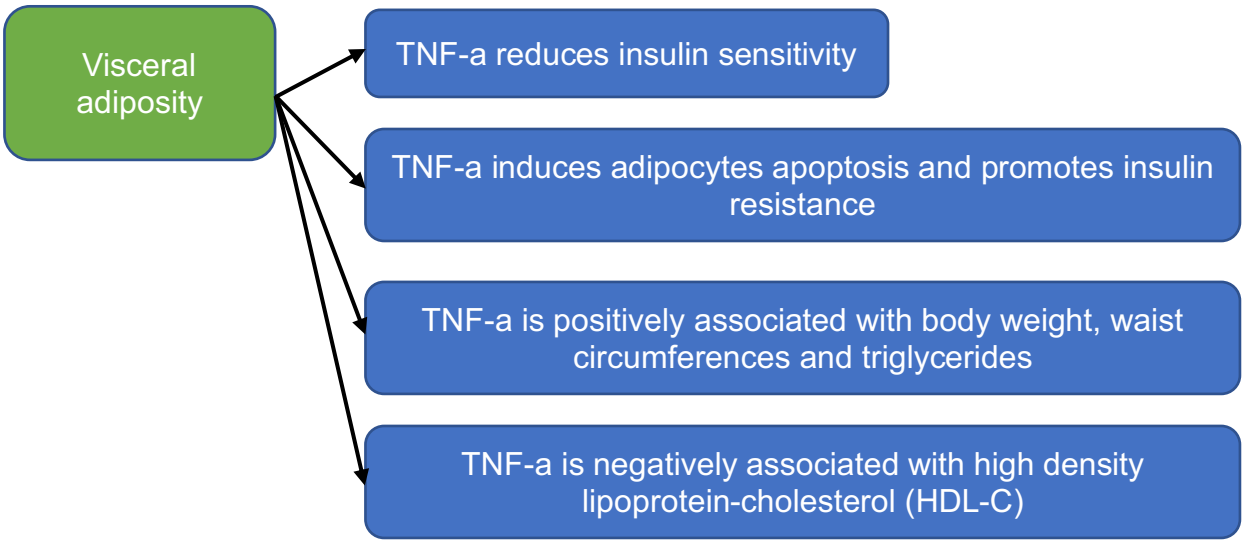

Figure 28 - Effect of tumor necrose factor a (TNF-a) (= cachexine)

Tumor necrosis factor (protein) or TNF-a is a paracrine and endocrine mediator in adipocytes.

It is a proinflammatory cytokine.

TNF-a is overactive in autoimmune diseases, sometimes also in cancer. The body then attacks body own cells.

In these cases, TNF-a blockers are prescribed for these patients with autoimmune diseases and/or inflammatory diseases.

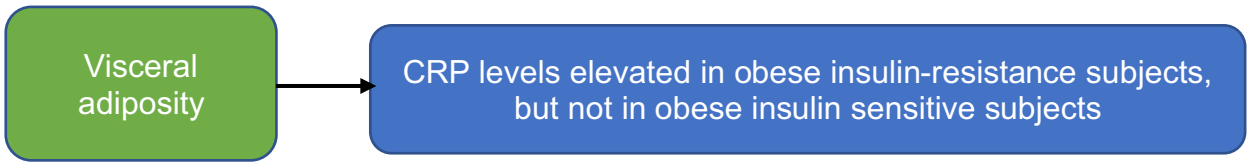

Figure 29 - CRP levels

CRP or C-reactive protein:

- The higher the CRP level in the blood, the more inflammation in the body.
- CRP is not specific and can be an indicator for many diseases (such as autoimmune diseases).
- Inflammation in the body triggers the liver to produce CRP.
- Predicts non-alcoholic fatty liver disease and metabolic syndrome.

It is the hypothalamus that controls activities such as:

- Maintenance of water balance.
- Regulation of body temperature.
- Control of appetite.
- The ventromedial hypothalamus depresses hunger.
- The lateral hypothalamus stimulates hunger.

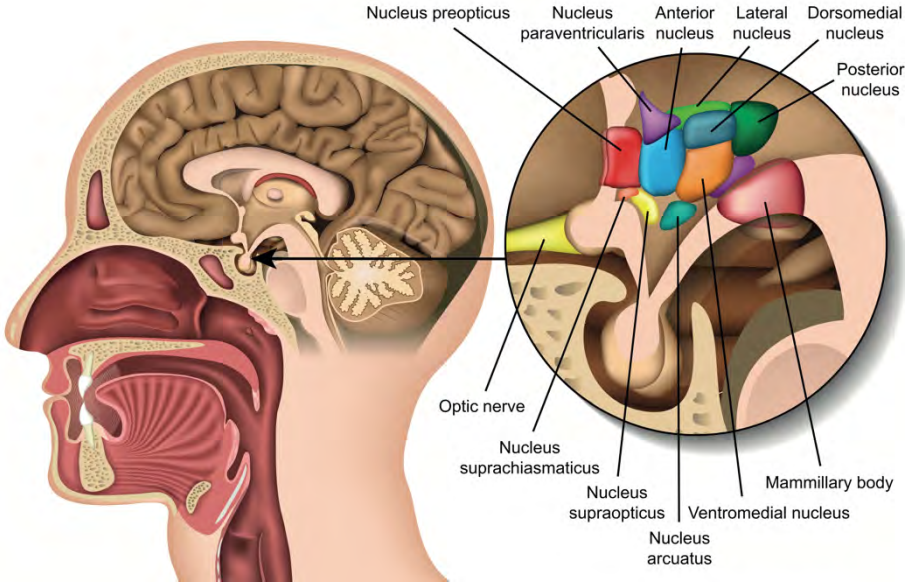

Figure 36 - Hypothalamus

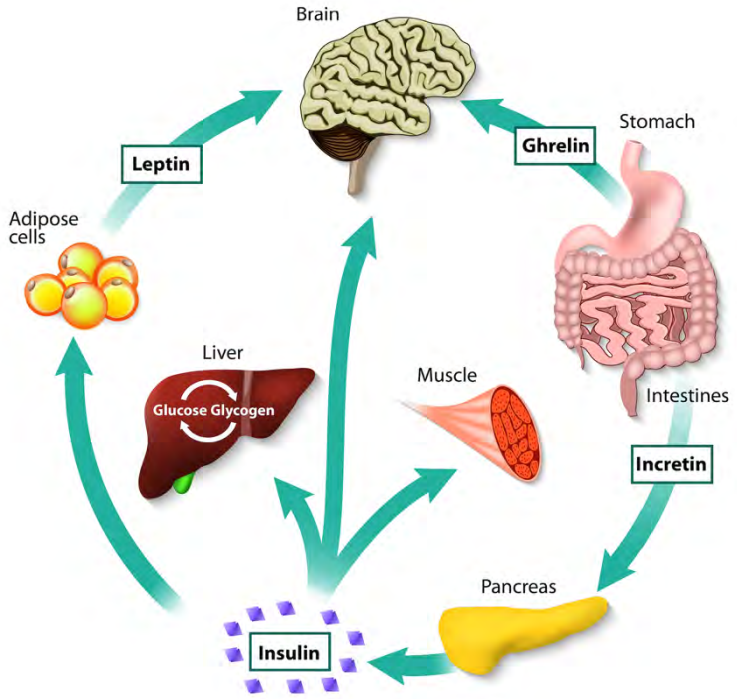

Figure 37 - Appetite and hunger

Lesions or trauma to the lateral part of the hypothalamus causes a lack of desire for food.

Lesions or trauma to the ventromedial nuclei of the hypothalamus cause that the person continuous eating until he or her becomes extremely obese.

Also, the amygdala and some cortical areas of the limbic system, coupled with the hypothalamus, are involved with feeding.

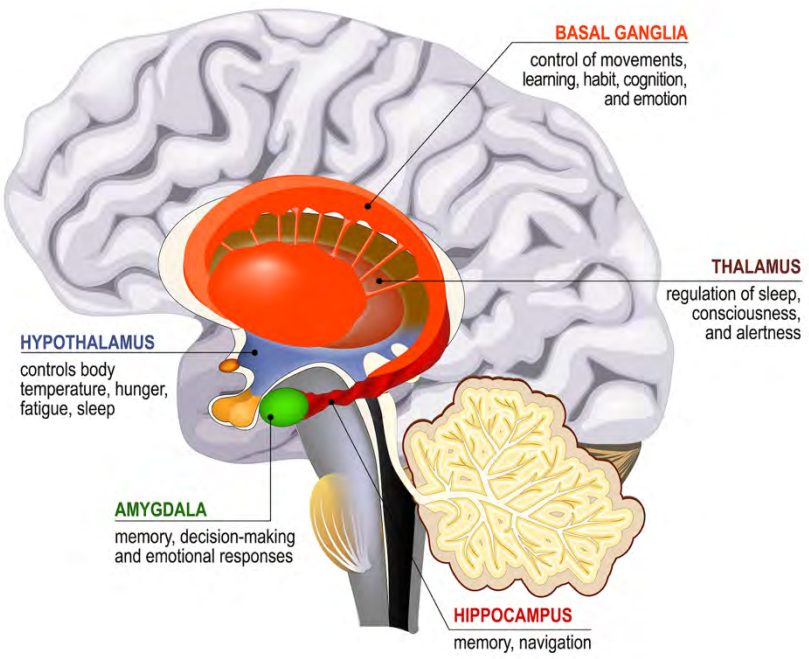

Figure 38 - Limbic system and amygdala

Lesions of the amygdala increases feeding.

Lesions in the cortical areas can as well stimulate as inhibit feeding activities.

Physiological influences on hunger:

- Empty stomach.
- Gastric contractions.
- Absence of nutrients in the small intestine.
- Hormones such as:
    - Ghrelin that is produced by the stomach fundus and by the pancreas.
    - Leptin produced by adipose tissue.
- Endorphines (pituitary gland and hypothalamus):
    - Desire for food by smell, sight or taste of food.
- Dopamine.

- **Orexin** is produced in the lateral hypothalamus and the production is stimulated by the reduction of blood glucose.
- **PYY – peptide tyrosine tyrosine** is released in the ileum and colon in response to feeding. It is secreted in the blood and it reduces appetite. Food fibers increase the speed of the transit of intestinal chyme into the ileum and colon to raise PYY. It is an anorexigenic hormone. A small amount is found in the esophagus. It inhibits the gastric motility and increases the water and electrolyte absorption in the colon.

Hormone	Production	Response
Orexin increase	Hypothalamus	Increases hunger
Ghrelin increase	Stomach	Increases hunger
Insulin increase	Pancreas	Increases hunger
Leptin increase	Fat cells	Decreases hunger
PYY increase	Digestive tract	Decreases hunger
Cortisol increase	Adrenals	Increases hunger

4. Neurohormonal Activation

4.1. Hypertension

Essential hypertension is often associated with obesity, glucose intolerance and dyslipidemia.

Hyperglycemia and hyperinsulinemia activate the renin angiotensin system (RAS) by increasing the expression of angiotensinogen, angiotensin II and the AT 1 receptor, which in concert may contribute to the development of hypertension in patients with insulin resistance.

Insulin resistance and hyperinsulinemia lead to an increase of the sympathetic nervous system. This results in reabsorption of sodium in the kidneys.

The heart will then increase its cardiac output and the arteries respond with vasoconstriction which results in hypertension.

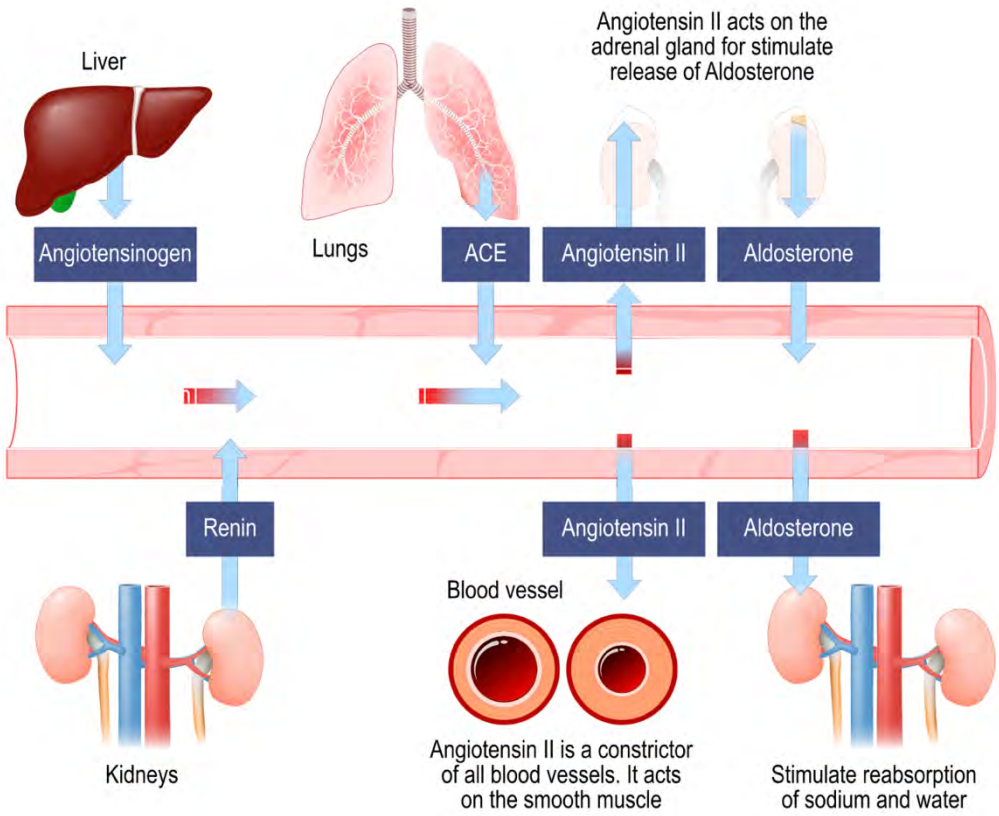

Figure 40 - Renin-angiotensin-aldosterone system (RAAS)

An increase in adipose tissue mass correlates with reduced adiponectin and higher leptin levels, which eventually enhance CVD risk.

4.3. Hypothalamic – Pituitary – Adrenal (HPA) Axis Activity

This axis is considered as the axis of the effect of stress on health, which increases with increasing HPA eradication activity, inflammatory indices.

In fact, an HPA-based disorder is associated with many risk factors for cardiovascular disease, such as:

- High blood pressure.
- High cholesterol.
- High triglycerides.
- Metabolic syndrome components.
- High heart rate.

Chronic stress and depression are both acute risk factors for cardiovascular disease, and the combination of these factors directly leads to the manifestation of metabolic syndrome components in adults.

The most important biological pathway in which negative and positive psychological factors may increase or decrease the risk of metabolic syndrome is the activity of the hypothalamic-pituitary-adrenal axis, which is considered as the axis of the effect of stress on health.

With increasing HPA axis activity, inflammatory markers also increase, which is associated with a variety of metabolic abnormalities contributing to metabolic syndrome such as obesity, hyperlipidemia, and hyperglycemia.

The stress triggers of today include:

- Money.
- Health.
- Economy.
- Deadlines.
- Relations (partners, children).
- Traffic.
- Trauma can cause Acute Stress Disorder (ASD) and PTSD.

Younger people feel more everyday stress (American Psychological Association).

4.4. Cortisol

Cortisol is important for health, but too much of it can weaken the body and cause a number of unwanted symptoms such as:

- Weight gain, mostly around the midsection and upper back.
- Also, sometimes weight loss.
- Acne.
- Thinning skin.
- Easy bruising.
- Flushed face.
- Moon face.
- Slow healing.
- Muscle weakness.
- Fatigue.
- Irritability.
- Difficulty concentrating.
- High blood pressure.
- Headache.
- Cushing syndrome.

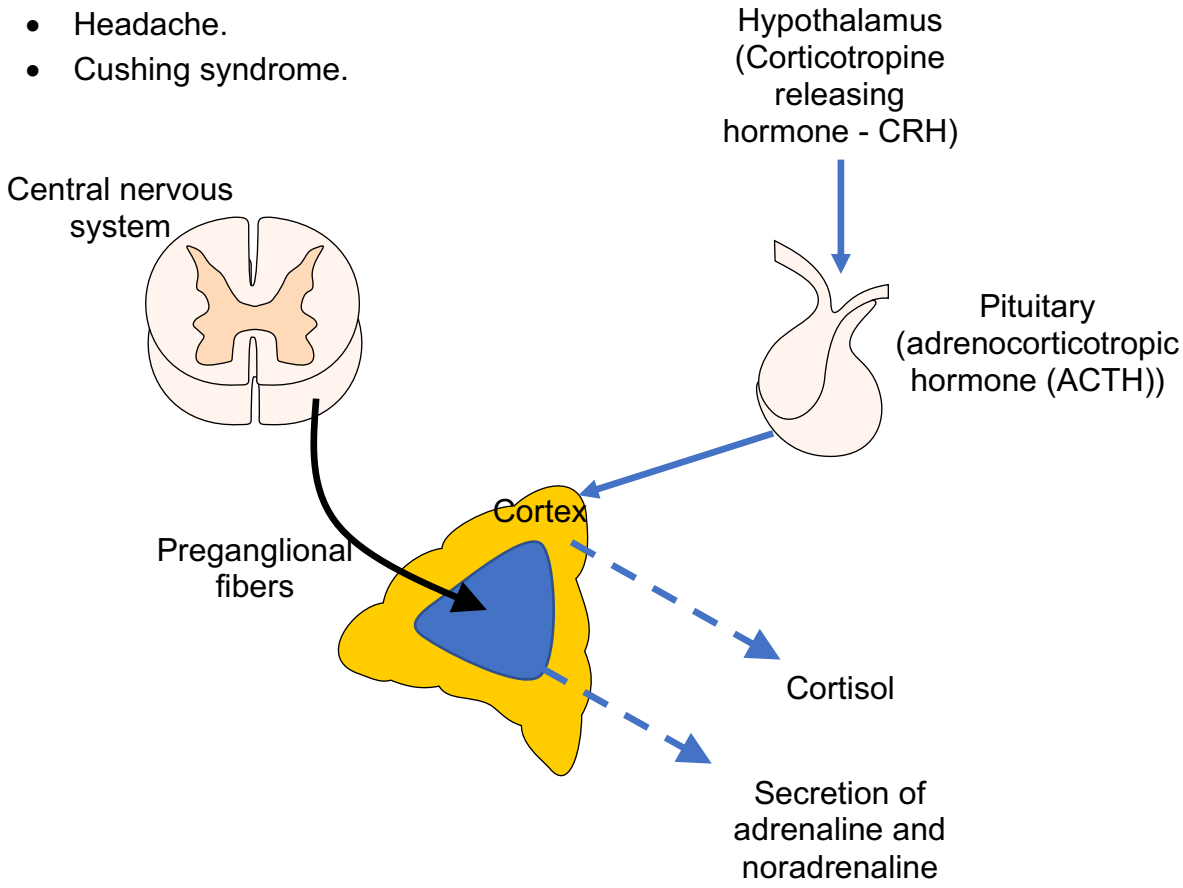

Figure 42 - Function of the adrenal gland

Normal values (according to Jackson & Pollard):

Age	Women	Men
20	17.7 %	8.5 %
25	18.4 %	10.5 %
30	19.3 %	12.7 %
35	21.5 %	13.7 %
40	22.2 %	15.3 %
45	22.9 %	16.4 %
50	25.2 %	18.9 %
55	26.3 %	20.9 %

Important data concerning diets

- There are many good diets, but it is more important to adhere to the diet than to choose a diet.
- Diets restricted in carbohydrate typically provide a rapid initial weight loss.
- A high-quality diet, rich in fruits, vegetables, whole grains, lean poultry, and fish, should be encouraged to provide the maximum overall health benefit.
- Important is to measure:
    - Weight and Body Mass Index (BMI).
    - 500 kcal restriction per day = ½ kg (1 lb) weight loss per week.
- Diet must be done together with 60-90 minutes of daily physical activity. High risk patients must first have a heart checkup. Physical activity can be jogging, swimming, tennis, gardening, walking, housecleaning...
- A fasting triglyceride value of <150 mg/dL is recommended.
- A weight reduction of >10% is necessary to lower fasting triglycerides.
- For rise in HDL cholesterol, weight reduction is an important strategy.
- For patients with the metabolic syndrome and diabetes, LDL cholesterol should be reduced to <100 mg/dL.
- Hypertension can be reduced with medication:
    - Best choice for the first antihypertensive medication should be an angiotensin-converting enzyme (ACE) inhibitor or an angiotensin II receptor blocker.
    - In all patients with hypertension, a sodium-restricted diet enriched in fruit, vegetables and low-fat dairy products should be advised.
- In patients with the metabolic syndrome and type 2 diabetes, aggressive glycemic control decreases cardiovascular risk.

Measuring the calories

There are many websites and apps to measure the necessary number of calories depending on:

- Age.
- Height.
- Weight (that has to be reached).
- Activity.

Example:

- A man.
- 50 years old.
- Height: 1.83 m.
- Weight: 110 kg.
- Activity: moderate exercise 1 to 3 times per week.
- To maintain that weight: 2.748 calories/day (= 100%).
- Mild weight loss (0.25 kg/week): 2.498 calories/day (= 91%).
- Weight loss (0.5 kg/week): 2.248 calories/day (= 82%).
- Extreme weight loss (1 kg/week): 1.748 calories/day (= 64%).

Calorie calculator example: https://www.calculator.net/calorie-calculator.html?ctype=metric&cage=50&csex=m&cheightfeet=5&cheightinch=10&cpound=165&cheightmeter=183&ckg=110&cactivity=1.375&cmop=0&coutunit=c&cformula=m&cfatpct=20&printit=0&x=40&y=15

To keep a low-calorie diet, the body will likely adapt to the new, lower energy environment, which can lead to a plateau in the progress.

Zigzag calorie cycling, also known as a ‘zigzag diet’, is a method of calorie consumption that can potentially help you overcome this plateau and get you back on track to meeting your goals.

Video 1 - General visceral palpation

Palpation of the liver and surrounding structures

The patient is sitting on the table.

The osteopath stands behind the patient.

He/she palpates under the right diaphragm.

Video 12 - Palpation of the liver

Possible palpatory findings:

- **Normal:** the liver tissue is not painful with palpation and feels soft and smooth.
- **Pathological:** small and hard + ascites = liver cirrhosis (+ associated symptoms).
- **Pathological:** painful = inflammation.
- **Pathological:** not painful but irregular: possible tumors or other trophic changes.
- **Pathological:** swollen in the posterior section = venous congestion.
- **Pathological:** completely swollen, ‘fatty’ consistency together with a positive palpation of the gallbladder = ‘dietary’ liver congestion (fatty deposits).
- **Palpation of the lesser omentum (right of the mid-line and posterior):**
    - **Normal:** clear resistance to palpation but not painful.
    - **Pathological:** too much resistance but not painful: retraction.
    - **Pathological:** very painful: inflammation or spasm of the biliary duct.
- **Palpation of the anterior edge of the liver:**
    - **Normal:** relatively sharp edge and not painful.
    - **Pathological:** the sharp edge is less defined in cases of liver congestion.

Rotation of the temporal bones

The patient is supine on the table.

The osteopath sits at the head of the patient.

The osteopath contacts both temporal bones.

Video 21 - Rotational correction of the temporal bones

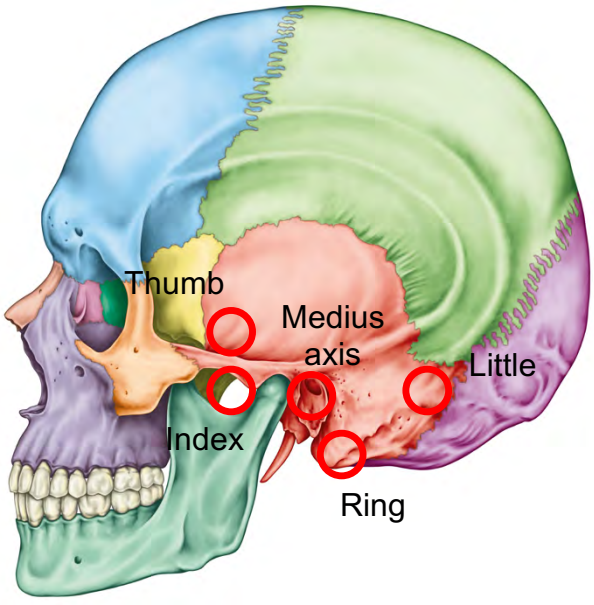

Figure 61 - Finger position on the temporal bone

Stretching the dura mater

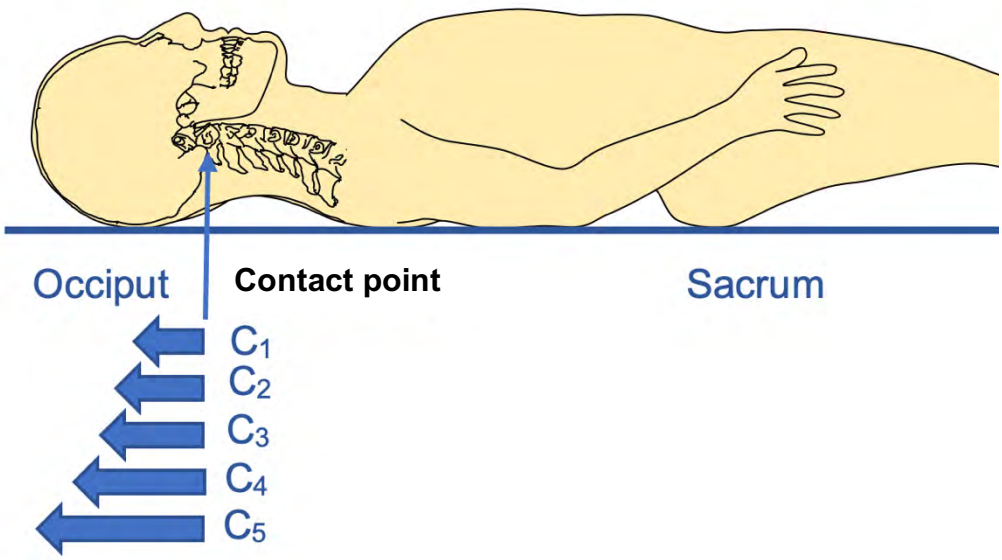

Figure 66 - Stretching the dura mater

Video 26 - Stretching dura mater

8.3.7. The Thoracic Region

In this region, the somatic dysfunctions are treated.

This has a positive influence on the sympathetic innervation of the related organs.

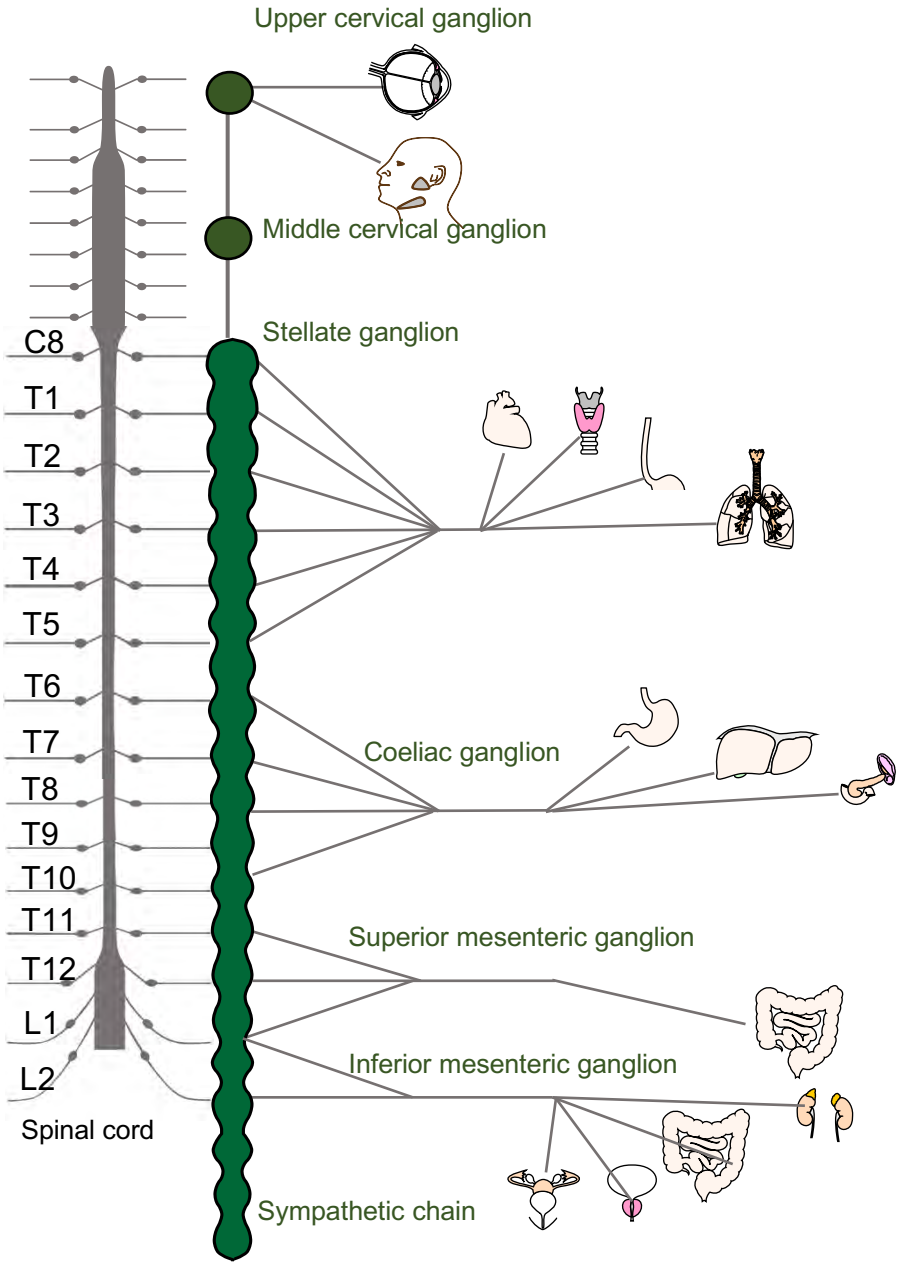

Figure 67 - Sympathetic nervous system

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ANNEX: The Perceived Stress Questionnaire (PSQ)

Date…….

Name……..

Gender…M…….F……..Other…….

Age……..

Instructions

For each sentence, circle the number that describes how often it applies to you in the last month.

Work quickly without bothering to check your answers.

	Almost never	Some times	Often	Usually
1. You feel rested	4	3	2	1
2. You feel that too many demands are being made on you	1	2	3	4
3. You are irritable or grouchy	1	2	3	4
4. You have too many things to do	1	2	3	4
5. You feel lonely or isolated	1	2	3	4
6. You find yourself in situations of conflict1.	1	2	3	4
7. You feel you're doing things you really like	4	3	2	1
8. You feel tired	1	2	3	4
9. You fear you may not manage to attain your goals	1	2	3	4
10. You feel calm	4	3	2	1
11. You have too many decisions to make	1	2	3	4
12. You feel frustrated	1	2	3	4
13. You are full of energy	4	3	2	1
14. You feel tense	1	2	3	4
15. Your problems seem to be piling up	1	2	3	4
16. You feel you're in a hurry	1	2	3	4
17. You feel safe and protected	4	3	2	1
18. You have many worries	1	2	3	4
19. You are under pressure from other people	1	2	3	4
20. You feel discouraged	1	2	3	4