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RĪGA STRADIŅŠ UNIVERSITY
INSTITUTE OF ANATOMY AND ANTHROPOLOGY

XXVIII Student International Conference of

MORPHOLOGY SCIENCES

11 May 2023, Rīga

Abstracts Book

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Characteristics of the Masseter Muscle: Anatomy, Size and Hypertrophy

Noy Atiya, Faculty of Medicine, 4th year
Supervisor – *Dr. med.*, Associate Professor Dzintra Kažoka

Introduction. The masseter muscle is one of the most important mastication muscles located lateral to the ramus of the mandible. There could be unilateral or bilateral enlargement of the masseter muscles affecting males and females (*Sannomya et al.*, 2006). It is most common to be bilateral and the most prone groups to develop this disorder are Asian descent, predominantly males (*Se-Min et al.*, 1989). Some authors associate it with the habit of chewing gum, congenital and functional hypertrophies, temporomandibular joint disorder, and emotional disorders (*Rispoli et al.*, 2008). Moreover, this disorder is characterized not only by a "square" face, which is a cosmetic problem but might also cause pain, headache, muscle stress, trismus, bruxism, and protrusion of the mandible (*Agrawal et al.*, 2011).

Aims. The aims of this study were to focus on anatomical structure and sizes of masseter muscle according to literature databases and practical dissections. In addition, it indicates the difference between types of masseter muscle hypertrophy, and discusses the prevalence, symptoms, and possible causes, according to the review of the literature.

Materials and Methods. The 1st part was dedicated to the digital measurements of the width, length, and diagonals of both right and left human masseter muscles. The virtual dissection table "*Anatomage*" was provided by the Department of Morphology at the Institute of Anatomy and Anthropology. The 2nd part was an anatomical review of medical literature in human anatomy and physiology which was used for the detection of the masseter muscle structures and sizes. The 3rd part was the clinical classification of masseter hypertrophy by types, symptoms, and prevalence. It was clarified by broadly searched literature databases, including *PubMed*, *Google Scholar, NCBI, ResearchGate*, and *Sciencedirect.*

Results. The lower facial contour is determined by the bony structure of the mandible covered by soft tissue (skin, subcutaneous tissue) and masticatory muscles. *M. masseter* is a quadrant mastication muscle that arises from the zygomatic arch and inserts into the inferior part and angle area of the ramus

of the mandible. It has 3 layers (superficial and 2 deep layers) in comparison to the previously stated bilayer muscle (*Mezey et al*., 2021). It is the strongest muscle based on its weight. The size of the muscle (including length, width, volume, cross-sectional area, and thickness) in females is distinctly smaller than in males (*Benington et al*., 1999). Anatomically, most of the masseteric thickness is along the inferior portion of the mandibular ramus, where the facial contour normally tapers.

This condition might run in certain ethnic groups, more common in Asian males (*Kumar et al.,* 2012). According to the digital measurements, which have been done in the previous point, Asian males have the biggest differences in comparison to other virtual bodies. The measurement of the width (left and right) of the Asian male was 42.09 mm and 37.12 mm, and the length (left and right respectively) was 72.48 mm and 71.54 mm. In the case of Asian women, the measurement of the width (left and right) was 27.19 mm and 28.78 mm, and the length (left and right) was 48.86 mm and 50.7 mm. These measurements point to significant differences between the genders of the same ethnicity.

Unilateral or bilateral masseter hypertrophy is characterized by an increase in the volume of the muscle mass. According to *Kebede et Megresa* (2011), there are two types of masseter hypertrophy: unilateral and bilateral. It is also possible to classify hypertrophy as congenital or familial and acquired due to functional hypertrophy (*Rispoli et al*., 2008).

Conclusions.

1. The human masseter is an important muscle of mastication that plays a pivotal role in different functional activities of the jaw.
2. In this study, Asian males have the biggest differences and the asymmetrical representation of the two sizes of the masseter muscles in comparison with Asian females.
3. Changes of the muscle fiber size and composition, which in turn will increase the strength of the muscle and the resistance to fatigue, may be a result of intensive use of this skeletal muscle.
4. The previous point represents clinical evidence that is known like the founder effect and genetic predisposition of the muscle hypertrophy in Asian males.

Anatomical Study of Thoracic Intercostal Nerves and Its Role in Intercostal Neuralgia

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Introduction. Intercostal neuralgia is a pathological medical condition that involves neuropathic pain, e.g., sharp, shooting, or burning in quality, originating from the intercostal nerves, which run along the spaces between the ribs (*Fazekas et al*., 2022). This condition is often caused by the irritation, compression, or damage of one or more intercostal nerves. Each intercostal nerve travels anteriorly along the corresponding intercostal space, between the internal intercostal muscle and the innermost intercostal muscle, and supplies sensory and motor innervation to the intercostal muscles, skin, and other structures in the chest and abdominal wall. Intercostal neuralgia can result from various factors such as trauma to the chest or ribs, surgical procedures in the thoracic area, infections such as shingles, nerve damage due to underlying medical conditions such as diabetes or multiple sclerosis, inflammation of the intercostal nerves, and compression of the nerves by adjacent structures such as herniated discs, spinal stenosis or tumors.

Aim. The study aimed to investigate the anatomical characteristics of the intercostal nerves, including their location, relationships, distribution patterns, innervation targets, and roles, to better understand their involvement in intercostal neuralgia.

Materials and Methods. A human cadaver for the study was provided by the Laboratory of Anatomy of the Department of Morphology of the Institute of Anatomy and Anthropology, Rīga Stradiņš University. The dissection process involved the use of specialized tools, such as scalpels, scissors, and forceps. To dissect intercostal nerves, a midline incision was made along the sternum and costal margin to expose the intercostal muscles. These muscles were then carefully dissected away from the ribs to locate the intercostal nerves, which run along the inferior margin of each rib. The dissection was continued posteriorly to locate the intercostal nerves. All available intercostal nerves were dissected, but for measurement was used data from Th2–Th6. A measuring tape was used to measure the length of the intercostal nerves. The distance between the ribs and the width of the intercostal nerves were measured with a plastic ruler.

Results. In the backside, the intercostal nerves entered into the intercostal spaces lying between the parietal pleura and the posterior intercostal membrane. They, then moved forward, lying beneath the intercostal arteries and veins in

the subcostal groove where each intercostal nerve was numbered. The anterior divisions of the second, third, fourth, fifth, and sixth thoracic nerves, and the small branch from the first thoracic, were confined to the walls of the thorax and were named thoracic intercostal nerves. The anterior divisions of the seventh, eighth, ninth, tenth, and eleventh thoracic intercostal nerves were continued anteriorly from the intercostal spaces into the abdominal wall. The twelfth (subcostal) thoracic nerve was distributed to the abdominal wall and groin. The distance between adjacent ribs, known as the intercostal space, was typically between 2 to 3 cm wide in most adults but in this study, it ranged from 1.1 cm to 2.6 cm.

The length of intercostal nerves varied from 20.7 cm for the 2nd to 36.6 cm for the 6th on the left side. But on the right side, the length of intercostal nerves varied from 21.1 cm for the 2nd to 36.1 cm for the 6th. The width of the intercostal nerve from its visible course in the backside was 3.0–4.0 mm, but the width of the intercostal nerve from the sternum side was 1.4–1.5 mm.

The intercostal nerves arise from the somatic nervous system and it explained why damage to the internal wall of the thoracic cavity can be felt as neuralgia localized in this region.

Conclusions.

1. The intercostal nerves play a critical role in the development of intercostal neuralgia, a chronic pain condition caused by damage or irritation to these nerves.
2. Thoracic intercostal nerve dissection is a useful technique for investigating the pathophysiology of intercostal neuralgia and for developing better surgical and pain management strategies to treat this condition.
3. Future research could focus on identifying the precise mechanisms by which the intercostal nerves are damaged or inflamed, as well as identifying the factors that contribute to the development of intercostal neuralgia.

Measurements of the Bony Orbit Dimensions

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Introduction. By definition, the bony orbit or orbital cavity is a skeletal cavity in the skull formed by seven bones. When the optic nerve (CN II) traverses from the brain to the eye and face and vice versa, it passes through a series of foramina and fissures in the bones that combine to form the orbit. The eyeballs as well as other periocular contents are shielded by the orbital bones. The contents of the orbit may be affected by a fracture, which may also compress nearby nerves or muscles. Bony orbit measurements are significant in forensic science, ophthalmology, plastic surgery, neurosurgery, and maxillofacial surgery in addition to determining ethnicity, gender, and age in anthropometry.

Aim. The aims of this study were to make measurements and analysis of the width, breadth, biorbital and interorbital distance, and orbital rim perimeter, to calculate the orbital index (OI) and orbital opening area.

Materials and Methods. The Laboratory of Anatomy of the Department of Morphology of the Institute of Anatomy and Anthropology provided 23 human skulls (46 orbits) of unknown sex and age, as well as the Vernier caliper with 0.01 mm accuracy calibrated in millimeters used for measurements and thread for measurement of orbital rim perimeter. Skulls with craniofacial malformations and fractures were excluded from the study. There were made following measurements: orbital height, orbital breadth, orbital rim perimeter, and interorbital and orbital distance. Orbital index (OI) and the orbital opening area also were calculated. Measurements were recorded and expressed Means ± Standard Deviation and range (Min value – Max value of each measurement).

Results. The orbital margin, also known as the orbital rim, was the base of the orbit. The orbital opening's margin was a superficial structure. The average height and breadth of the left orbit were 31.23 ± 0.01 mm and 37.96 ± 0.01 mm, accordingly. The right orbit's average height and breadth are 30.91 ± 0.01 mm and 37.74 ± 0.01 mm, respectively. In the left eye, the average orbital rim perimeter in the left eye was 122.30 ± 0.01 mm, whereas, in the right, it was 121.55 ± 0.01 mm. In the left eye, the mean orbital opening area was 971.63 ± 0.01 mm^2, while in the right eye, it was 956.72 ± 0.01 mm^2. The average orbital index (OI) of the left and right eyes, were 79.05 ± 0.01 mm and 78.89 ± 0.01 mm, respectively. The interorbital distance was 18.72 ± 0.01 mm on average. The biorbital distance was 94.75 ± 0.01 mm on average.

Consequently, orbital normal values were important parameters in the assessment and diagnosis of cranial-maxillofacial injuries or inaccurately performed repairs, as well as in morphometrical and anthropometrical research.

Conclusions.

1. The differences between left and right eye heights and breadths measurements were connected to the embryological development of the skull or bony orbits aging, or to the differential growth of the two sides of the brain with the dominance of the right side.
2. In each orbital cavity, the breadth is usually greater than the height, and the relation between both of them is evident by the orbital index.
3. In the current study, the overall mean of OI indicated that orbits belonged to a microseme category, which was defined as an orbital index lower than 83.
4. These parameters, especially the OI, can be applied during forensic and anthropological investigations of unknown individuals for determining gender and ethnicity.

Characterization of Antimicrobial Peptides in Cleft Soft Palate

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Dr. med., Associate Professor Dzintra Kažoka

Introduction. Cleft palate is one of the most common congenital malformations and it is even more prevalent when combined with cleft lip. Its effects have been linked with not only changes in anatomical structures and physiological functioning, but also with psychological and social issues later in life. And although the pathophysiology of orofacial clefts has been studied previously, the role of antimicrobial peptides in postnatal cleft soft palate tissue protection is yet to be determined.

Aim. To research the appearance and distribution of specific antimicrobial molecules in cleft affected soft palate.

Materials and Methods. The tissue material was obtained from soft palates of 8 children aged 4 to 12 years undergoing veloplasty procedure. The inclusion criteria were mixed dentition age, diagnosis of cleft palate and indication for plastic surgery, whilst the exclusion criteria were genetic syndromes, chromosomal

abnormalities and immunodeficiencies. In addition, control samples were gathered from 5 subjects aged 40 to 60 years without orofacial clefts and inflammation. The obtained tissues were then immunohistochemically stained for HBD-2, HBD-3, HBD-4, LL-37 and slides were examined by light microscopy. Mann–Whitney U test and Spearman's rank correlation coefficient were used to calculate statistical differences between patients and controls as well as to determine correlations between studied factors.

Results. Statistically significant differences between patient and control samples were observed for HBD-2 and HBD-4 in connective tissue with mostly moderate positive cells for these factors in patients, whilst epithelium showed the difference in HBD-2 with patients having around few positive cells. Variation from moderate to numerous LL-37 positive cells was observed in patient and control tissues. Spearman's rank correlation coefficient revealed very strong positive correlations between patient epithelial and connective tissue HBD-3 and HBD-4, whilst a strong positive correlation was noted for HBD-2 and HBD-4 in connective tissue.

Conclusions. The elevation of antimicrobial peptides HBD-2 and HBD-4 implies that these factors are involved in activation of innate local immunity which could be due to the changes in soft palate tissues caused by clefts. The correlations between studied factors (HBD-2, HBD-3, HBD-4 and LL-37) observed in cleft affected epithelium and connective tissue prove their synergistic activity in the morphopathogenesis of the pathology.

Anatomical Aspects of Topography and Clinical Significance for Operative Management of the Kidney Stones

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Faculty of Medicine, 2nd year
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Introduction. Kidney stones are a common condition that affects millions of people each year. In the year 1979 in Germany 0.12% of the people older than 14 years had kidney stones, 21 years later in 2000 this was 0.72% (*Romero et al.*, 2010). Kidney stones are more common in men than in women, and the risk increases with age.The highest incidence of kidney stones is seen in individuals

between the age of 30 and 60. There is evidence to suggest that the incidence of kidney stones varies by geography, with higher rates seen in certain countries, including the United States, Australia, and some European countries. *Stamatelou* and *Goldfarb* (2023) reviewed the variables affecting prevalence and incidence, including age, gender, race, ethnicity, occupation, climate, geography, systemic diseases, diabetes, vascular disease, chronic kidney disease, and dietary risk factors relevant to kidney stones.

Aim. The aim of the study was to review and analyze available literature about the topography of kidney and clinical significance; to review and analyze the literature about kidney stones, to dissect the kidneys and to examine the topography of the retroperitoneal space components.

Materials and Methods. The human cadaver and all the necessary equipment for the dissection was provided by the Laboratory of Anatomy of the Department of Morphology of the Institute of Anatomy and Anthropology.

Results. Analysis of literature sources showed that kidney stones are a common condition affecting 0.5 million people annually with rising incidences over the last 50 years. There are gender differences in the occurrence of nephrolithiasis with a male to female ratio of 3 : 1. The incidence of kidney stones varies by geographic area, with rates being generally low in Asia, higher in Europe, and highest in North America. Patients with urolithiasis in kidney were treated by two different techniques (Percutaneous nephrolithotomy (PCNL) and Retrograde intrarenal surgery (RIRS), however in some cases (anomalous kidneys) in the management of stones in patients could use laparoscopic assisted PCNL, flexible ureteroscopy and laparoscopy (*Gok et al*., 2020; *Su et al*., 2020; *Faw et al*., 2021). Anatomical aspects of topography of kidneys have clinical significance for operative management of the kidney stones. Kidneys are situated in retroperitoneal space, surrounded by a layer of fat that helps to protect and insulate them (*capsula adiposa*). From a topographical standpoint, the right kidney (T12–L3) is typically lower than the left kidney (T11–L3) due to the presence of the liver on the right side. The ureters are long, narrow tubes connecting each kidney to the urinary bladder.

Conclusions.

1. The topographic aspects of the kidney, the course of the ureter and its relationship to the retroperitoneal space, and the blood supply had clinical importance for treatment of kidney stones by using different techniques: Percutaneous nephrolithotomy (PCNL) and Retrograde intrarenal surgery (RIRS), laparoscopic assisted PNL, flexible ureteroscopy and laparoscopy.
2. Kidney stones are a common medical complication, there are numerous risk factors that contribute to the development of kidney stones.

Brachial Artery Diameter Variations and Clinical Importance in Its Aneurysms

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Introduction. The brachial artery is an extension from the axillary artery located in the upper arm, it runs down until it reaches the cubital fossa where it bifurcates into ulnar and radial arteries. There is currently a limited amount of data available regarding the average diameter of the brachial artery both in male and female populations. Aneurysms of the brachial artery are rare conditions when the diameter of the brachial artery enlarges by at least 50% (*Thompson*, 2000). Brachial artery aneurysms can be a result of a complication from an infection such as infective endocarditis or trauma. Knowing the average diameter of the brachial artery can be useful in identifying the development of brachial artery aneurysms. The available case reports indicate that the diameter of the brachial artery aneurysms can vary significantly, starting from 9.0 mm (*Shaban et al.*, 2020) and reaching up to 84.0 mm (*Dinoto et al.*, 2012).

Aim. The study aimed to measure the diameter of the brachial artery and investigate the importance of brachial artery diameter in brachial artery aneurysms.

Materials and Methods. In this study, 4 male and 1 female cadaver were used. In total ten brachial arteries were evaluated from the materials that were provided by the Laboratory of Anatomy of the Department of Morphology of the Institute of Anatomy and Anthropology, Rīga Stradiņš University. In the beginning, the skin was cut open and lifted to expose the underlying tissue layers including the superficial and deep fascia. This provided access to the upper limb and front of the forearm up to the cubital fossa. The bicipital aponeurosis was dissected to reveal the brachial artery which was then furthermore dissected and traced to the place of bifurcation. Brachial artery circumference was measured by an elastic thread at the place of origin, in the middle, and at its bifurcation. Then using a special formula, the diameter was calculated for all brachial arteries.

Results. The average diameter of the brachial artery at its origin was measured to be 6.11 mm on the right side and 5.80 mm on the left side. The maximum diameter on the right side was 7.01 mm and the minimum was 5.41 mm. The maximum diameter on the left side was 7.64 mm and the minimum was 5.10 mm.

The average diameter of the brachial artery in the middle was 4.97 mm on the right side and 5.03 mm on the left side. The maximum diameter on the right

side was 5.73 mm and the minimum was 4.40 mm. The maximum diameter on the left side was 5.73 mm and the minimum was 4.46 mm.

The average diameter of the brachial artery at its bifurcation was found to be 4.97 mm on the right side and 5.22 mm on the left side. The maximum diameter on the right side was 5.41 mm and the minimum was 4.14 mm. The maximum diameter on the left side was 5.41 mm and the minimum diameter was 5.10 mm.

The average diameter between all samples at every place of measurement was 5.35 mm. This average diameter result did not indicate brachial aneurysms. However, in the case where the diameter at origin on the left side was 7.64 mm, in the middle 5.73 mm, and at bifurcation 5.10 mm, it could indicate a possible brachial artery aneurysm at its origin, since enlargement is observed only at one place.

Conclusions.

1. Results of studied samples showed major differences in diameters among different parts of the brachial artery ranging from the smallest in the middle – 4.14 mm to the largest at the point of origin – 7.64 mm. This shows that the diameter of the brachial artery aneurysm can vary between patients according to the initial diameter of the artery.
2. Between all samples, the average brachial artery diameter was measured to be 5.35 mm which is not indicative of brachial artery aneurysms, however, one case displayed possible signs of an aneurysm at the origin of the brachial artery, reaching a diameter of 7.64 mm.
3. It is crucial for medical practitioners when performing upper extremity angiograms and ultrasounds, to observe changes and irregularities in the diameter of the brachial artery, particularly if the patient has a history of upper limb trauma, catheterization, or infection.
4. This study also has the potential to be used as a source of metadata that can be used to establish the average diameter of the brachial artery.

Analysis of the Anatomy and Branching Pattern of the Posterior Cerebral Artery

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Introduction. The posterior cerebral artery (PCA) is the terminal branch of the basilar artery which courses towards the occiput around the cerebral peduncle and over the *tentorium cerebelli*. The PCA is divided into three segments: P1, P2, P3. Each segment gives off groups of branches that in general supply multiple brain regions such as the occipital lobe, the inferomedial temporal lobe, a large portion of the thalamus, the upper brainstem, midbrain, choroid plexus and part of the lateral and third ventricles (*Júlio César Claudino dos Santos et al., 2022*). As far as textbooks and other resources do not provide deep insight into the anatomy of the PCA, the treatment of the mentioned regions can be complicated and time consuming (*Pankaj A.K. et al.,* 2022).

Aim. The aim of the research was to evaluate the length of the posterior cerebral artery and its branches, explore supplied regions and compare received data with other resources.

Materials and Methods. One brain sample was provided by the Laboratory of Anatomy of the Department of Morphology of the Institute of Anatomy and Anthropology, Rīga Stradiņš University. The length of the right and the left posterior cerebral arteries and branches were measured using a ruler. The angle between the right and the left posterior cerebral arteries was measured using a protractor. The regions supplied by the posterior cerebral artery were examined and comparative analysis was conducted on the obtained data.

Results. Extracted brain was placed on a flat plane with a white background, ventral surface up. The RPCA and the LPCA origin from the basilar artery. The angle between the RPCA and the LPCA is 124.4°. The length and the origin of the branches in the right posterior cerebral artery (RPCA) and in the left posterior cerebral artery (LPCA) do not match. The length of the P1 segment in the RPCA is 1.3 cm, in the LPCA – 0.7 cm. The RCPA P1 represents the thalamo-perforating artery 2.6 cm long; the short circumflex artery 4.9 cm long; the long circumflex artery 5.8 cm long. The LPCA P1 represents the thalamo-perforating artery 2.3 cm long; the short circumflex artery 5.6 cm long with the additional branch 2.6 cm long.

The length of the P2 segment in the RPCA is 3.1 cm, in the LPCA – 5.4 cm. The RCPA P2 represents the anterior temporal artery 6.3 cm long; the middle temporal artery 7.2 cm long; the posterior temporal artery 4.4 cm long; the lateral

posterior choroidal artery 4.1 cm long. The LCPA P2 represents the anterior temporal artery 9.7 cm long with the additional branch 7.7 cm long; the middle temporal artery which is 10.3 cm long with the additional branch 11.1 cm long; the posterior temporal artery which is 4.2 cm long.

The length of the P3 segment in the RPCA is 3.1 cm, in the LPCA – 5.4 cm. The RCPA P3 represents the calcarine artery 8.2 cm long with the additional branch 6.6 cm long; the parieto-occipital artery 13.3 cm long with two additional branches 9.1 cm and 5.6 cm long.

The LCPA P3 represents the lateral posterior choroidal artery which is 7.1 cm long; calcarine artery 10.8 cm long with two additional branches 7.4 cm and 6.6 cm long; the parieto-occipital artery 8.3 cm long with the additional branch 8.6 cm long.

Conclusions.

1. The present study provides a complete description of PCA regarding its anatomy, branching pattern, asymmetry, and sizes.
2. The research proves the complicated anatomy of PCA and the massive area that it supplies.
3. These anatomical details described shall prove to be useful for cerebrovascular procedures.
4. The morphological variations of segments of PCA provide valuable addition which is likely to be useful in vascular pathophysiology and treatment.
5. Since anatomical studies of PCA with special branching patterns are highly limited, similar studies all over the world on large scale are necessary.

Appendix Vermiformis: Positions, Their Frequencies and Variations of the Arterial Supply

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Introduction. *Appendix vermiformis* is an important reservoir for benevolent gut bacteria, as the immune tissue that surrounds it, also called gut-associated lymphoid tissue, has many important functions in the body. The variations of the appendix position in the human body are well known but considering that

often appendix is a mobile structure, therefore the medical importance of its relative positions has been questioned (*de Souza et al.*, 2015). The appendix is a "worm-shaped" structure that is connected to the caecum. It is in the lower right quadrant of the abdomen, in proximity to the right hip bone. *Appendix vermiformis* is supplied by *a. appendicularis*, which is usually a branch of ileocolic artery, but some variations in positions and origins can occur. Depending on the position of the appendix, the inflammation can lead to different symptomatology (*de Souza et al.*, 2015).

Aim. The aim of this study was to determine the length, diameter, and frequencies of the different positions of the appendix, and its arterial supply variants to show the importance in the clinical settings for appendicitis treatment and appendectomy procedure.

Material and Methods. All materials were provided by Laboratory of Anatomy of the Department of Morphology of the Institute of Anatomy and Anthropology, Rīgas Stradiņš University. Positions, frequencies, and variations of the *appendix vermiformis* were clarified by and dissection on cadavers, analysis of cases in a digital library of the virtual dissection Table "*Anatomage*" and searched medical, surgical literature and databases from *PubMed, Scopus*, and *Web of Science*. Measurements of the length and diameter of the caecum were also performed, due to a lack of literature sources regarding caecum morphology.

Results. There were recorded four pelvic positions, two subcaecal, one retrocaecal and one paracaecal. The length of the appendixes measured ranges from 2.18 cm to 6.72 cm, with a mean of 4.25 cm, while the diameter measurements range from 0.46 cm to 1.51 cm, with a mean of 0.74 mm. The length of the caecum measurements ranges from 4.11 cm to 9.73 cm, with a mean of 6.48 cm, while the diameter measurements range from 3.03 cm to 8.29 cm, with a mean of 5.62 mm.

Several studies show that the length of the appendix ranges from 1.0 cm to 20.0 cm, with a mean of 7.43 cm, while the diameter ranges from 0.5 cm to 0.73 cm, with a mean of 0.64 cm (*de Souza et al.*, 2015; *Lamture et al.*, 2018; *Syed et al.*, 2020). According to the classification by *de Souza et al.* (2015), there exist different positions: pelvic (the appendix is pointing downwards, above the psoas major and with its tip just above the upper side of the lower pelvis); subcaecal (the appendix is located under the caecum, laying on the right iliac fossa and divided by a peritoneal lining from the iliac muscle); retrocaecal (the appendix is pointing upwards behind the caecum, as it could be near the ascending colon); post-ileal (the distal section of the appendix is posteriorly and superiorly of the terminal ileum, pointing at the spleen); pre-ileal (the distal part of the appendix is located anteriorly and superiorly to the terminal ileum, pointing at the spleen); paracaecal (the appendix is located on the lateral side of the caecum and ascending colon)

and the ectopic (the appendix is not located in any of the described positions). Based on results of some studies (*de Souza et al*., 2015; *Lamture et al*., 2018; *Syed et al*., 2020), there are following frequencies of the positions: 60.8% retrocaecal, 6.1% subcaecal, 29.9% pelvic, 4.6% pre-ileal, 5.7% post-ileal, 3.5% paracaecal position and 2.4% ectopic.

Regarding the arterial supply of *appendix vermiformis*, in the majority cases or 75% there exist only main *a. appendicularis* (*Ajmani et al*., 1983; *Kulkarni et al*., 2011; *Nirmaladevi et al*., 2016), while around 15% cases show also accessory arteries (*Ajmani et al*., 1983; *Kulkarni et al*., 2011; *Nirmaladevi et al*., 2016). Mostly this artery started as a branch of the inferior division of the ileocolic artery.

Conclusions.

1. The practical study done on the *appendix vermiformis* confirms the literature sources regarding the length and diameter but it doesn't confirm the results regarding the positions.
2. Surgeons and different medical specialists are required to have the normal and also variant anatomy knowledge of the *appendix vermiformis* and *a. appendicularis*, because recognition of the positions and variations of the arterial supply can help in the process of successful diagnosis, giving the chance to start early treatment and reduce the risk for complications from inflammation.

Reconstructive Preparation of a *Latissimus Dorsi* Muscle Flap

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Supervisor – *Dr. med*., Associate Professor Dzintra Kažoka

Introduction. *M. latissimus dorsi* is the largest muscle of the back covering the dorsal side of the thorax. It covers with its flat, triangular shape the posterior inferior half of the human back. The muscle's main arterial blood supply is ensured by the thoracodorsal artery, which branches from the subscapular artery. This muscle is innervated by the thoracodorsal nerve that enters the muscle along the vascular pedicle in the posterior axilla. The function of the latissimus is the adduction, extension, and rotation of the humerus on the medial plane (*Schnücke et al*., 2018). Those anatomical characteristics make the *m. latissimus*

dorsi is ideal for transplantation as a muscle flap. This flap has many clinically relevant applications in different clinical fields, including plastic surgery.

Aim. The aim of this study was to completely explant the *m. latissimus dorsi* with the thoracodorsal artery still embedded in the muscle. This could be either done with a skin island attached to the explant or without it. The focus mainly lays on the preparation of the muscle as a muscle flap, which then could be used for transplantation. Furthermore, the theoretical part of this was to explore the clinical application and relevance of this procedure.

Materials and Methods. In the dissection was used one cadaver that was provided by the Laboratory of Anatomy of the Department of Morphology of the Institute of Anatomy and Anthropology, Rīga Stradiņš University. In this procedure was used the information from the book "*Reconstructive Surgery: Anatomy, Technique, and Clinical Application*" (2012) by *M. Zenn*, *G. Jones*. The methods which are used in the clinical setting had to be adapted, due to the difference between living human tissue and the tissue state of the cadaver body: namely the lack of flexibility and the resulting stiffness of the cadaver skin and the immobility of the joints.

Results. In this study, the brachium could not be abducted to expose the axillar in comparison with the normal operating procedure. Therefore, the arm of the cadaver body was fixed in a forward position, exposing the posterior side of the axillar. The first cut was made approximately 5 cm dorsal of the medial axillary line, originating along the posterior edge of the axillar, ending at the eleventh costae. The secondary incision was made from the inferior end of the first cut, running horizontally approximately 5–8 cm ventrally. Then two further incisions had to be made due to the lack of elasticity of the skin. The first 5 cm was below the 12th costa and the second was 4 cm below the axilla. Both run dorsal toward the vertebral column. After this, there was a possibility to dissect the *m. latissimus dorsi*.

Those incisions enabled exposure of the hole in *m. latissimus dorsi*. Then the latissimus was separated from the tissue below, starting at the superior margin of the muscle. From there the *fascia thoracolumbalis* was cut, down to the *crista iliaca*. While doing this, a paraspinal perforator was perpetrated. With the superior, dorsal, and inferior edges of the muscle freed, the muscle could be lifted and separated from the tissue below. This was done in a cranial fashion. It exposed the entrance of the thoracodorsal artery and vein. Those main blood vessels were exposed and severed, leaving 3 cm of the artery protruding from the muscle. Finally, the hole muscle was separated from the underlying tissue and the last attachment point was cut towards the *crista tuberculi minoris humeri*. Resulting in the whole removal of the *m. latissimus dorsi*.

Conclusions.

1. In this study, the planned preparation of a *latissimus dorsi* muscle flap could not be performed on the selected cadaver's body completely, due to the difficulties with flexibility and elasticity of skin and blood vessels.
2. The *m. latissimus dorsi* muscle flap is suggested for several clinical uses such as mainly used in breast reconstruction after a radical mastectomy and other reconstructions to cover larger areas of damaged tissue.

Simulation of an Oblique Metacarpal III Fracture Procedure for Anatomical and Surgical Education

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Introduction. The *os metacarpale* III is one of the five metacarpal bones, that connect the *ossa carpi* (*carpalia*) and the *ossa digitorum* (*phalanges*). It connects on its proximal end to the *os capitatum* and the *basis phanlangis proximalis* on its distal end (*caput metacarpale* III). On the proximal end, it is fixed/attached with/to the *lig. carpometacarpale dorsale*, the *ligg. metacarpale dorsales* and the *lig. metacarpale palmare*. On the distal end, where the *art. metacarpophalangealis / capsula articularis* continues, it is fixated with the *ligg. collateralia*. Metacarpal fractures account for 36–42% of hand trauma cases (*Dreyfuss et al.*, 2019). Proper identification and management of traumatic hand injuries are important for preventing loss of function, nerve damage, joint instability, or persistent pain. The pattern of metacarpal fractures has been described as transverse (the deformity is typically apex-dorsal), oblique (short or long), spiral, and as comminuted (*Zhu et al.*, 2021). Therefore, delays in indicated surgery have to be avoided (*Kavin et al.*, 2018). Choice of treatment should be met by skills and preference of surgeon and availability of resources.

Aims. This study was aimed to illustrate a fracture of the *os metacarpale* III, which typically can be caused by high-impact trauma focused on the midhand region, and to discuss a possible selection of fracture treatment methods for anatomical and surgical education.

Materials and Methods. For this work, a specimen preparation (dissection of a right hand and fracturing of *os metacarpale* III using dissection instruments and an oscillating electric saw) was performed on a cadaver provided by

the Laboratory of Anatomy of the Department of Morphology of the Institute of Anatomy and Anthropology, Rīga Stradiņš University. Before and after practical work, the literature review was performed using standard anatomy textbooks and databases for medical studies (*PubMed*, *NCBI*, *BMC*, and *MDedge*).

Results. After a longitudinal dissection of the skin, the *os metacarpale* III was isolated and a fracture was simulated with an oblique saw cut. The metacarpal head and base were primarily cancellous bones, and the metacarpal shaft was primarily cortical bone. The blood supply of the metacarpal III was rich and in general, enabled the metacarpal to heal well after a fracture. The *os* metacarpale III represented the long bone of the hand and provided a stable platform for the phalanx and palmar neurovascular structures. The interossei muscles originated along the metacarpal shaft, which was then inserted along the base of the proximal phalanx, the extensor hood, and contributed to the lateral bands of the extensor tendon apparatus. More proximally, the wrist extensors and flexors are inserted on the metacarpal base. The sagittal bands stabilized the extensor tendon over the head of the *os* metacarpale III.

The primary goals of treatment are to achieve acceptable alignment, stable reduction, strong bony union, and unrestricted motion. Multiple treatment techniques have been described to provide optimal treatment of the metacarpal fractures including splinting, initial immobilization in the intrinsic plus position, internal fixation with k-wires, screws, plates, and external fixation. In the case of an oblique metacarpal fracture, usually, two operative methods are performed, the lag screw, by compressing the fracture fragments together, or a bone plate fixation, by immobilization and initial orientation of the structure (*Kawamura et al.*, 2006). However, an understanding of the extensor tendon apparatus should be appreciated, as a dorsal approach was typically undertaken to treat these fractures.

Conclusions.

1. An oblique fracture of *os metacarpale* III is simulated with standard preparation techniques for anatomical and surgical education.
2. Advantages of the bone plate fixation are an easier way to perform, an earlier range of motion, and therefore also an earlier start for rehabilitation programs, like physical therapy, and provision of higher fixation strength.
3. Complications like metacarpophalangeal joint stiffness or extensor tendon adhesion are more likely to occur.
4. Future studies and simulations of metacarpal fracture procedures may provide higher levels of knowledge and skills that can be used in hand surgery.

Modeling of Radial Artery Interposition Graft in Extracranial-to-Intracranial (EC-IC) Bypass

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Introduction. Vascular surgeons have used extra-anatomic bypass with excellent results (*Gobble et al.*, 2008). The first EC-IC bypass was reported in 1969 when Yasargil performed a bypass from the superficial temporal artery (STA) to the middle cerebral artery (MCA) for the treatment of a complex intracranial aneurysm. That procedure is used to treat neurovascular diseases, e.g. Moyamoya disease (MMD), intracranial aneurysms, intracranial tumors, arterial stenosis, and occlusion (mostly in the internal carotid artery (ICA)) in patients with progressively neurological and cognitive deficits. There are two options when performing EC-IC bypass – a direct anastomosis from the STA to an intracranial artery (STA-IC), and the second requires the use of a conduit, either great saphenous vein (GSV) or radial artery (RA), to bypass from the common carotid artery (CCA) or external carotid artery (ECA) to an intracranial (CCA-IC or ECA-IC) artery (*Amin-Hanjani et al.*, 2005). Revascularization surgery restores blood flow to intracranial arteries and relieves hemodynamic stress to prevent cerebral ischemia and hemorrhage. Radial artery grafts were considered alternatives to saphenous vein grafts.

Aim. The aim of the study was to model the radial artery interposition graft in extracranial-to-intracranial bypass between *a. cerebri media* and *a. temporalis superficialis*.

Materials and Methods. The arterioarterial anastomosis was made between *a. cerebri media* and *a. temporalis superficialis* by using *a. radialis* as the second artery (2-donor-2-recipient (2D2R) bypass technique). Instruments and materials for the dissection of the cadaver and procedure were provided by the Laboratory of Anatomy of the Department of Morphology of the Institute of Anatomy and Anthropology, Rīga Stradiņš University. During the study, multiple books and atlases of anatomy, and scientific papers from *PubMed* and *NCBI* databases were used.

Results. The type and size of the craniotomy were dictated by the indication of the revascularization. The layers of the tissue of the scalp from the right frontal, temporal, sphenoidal, and parietal bones were removed. Right hemicraniectomy was performed from the midline on a sagittal plane to the pterional region on the axial plane. The *dura mater* was opened. The region of *a. cerebri media* (ACM) M4 cortical segment was localized at the exit from the Sylvian fissure. *Pia mater* was dissected from the ACM. Skin, adipose tissue, and connective tissue were

removed anteriorly from the right ear. *A. temporalis superficialis* was visualized in front of the ear below bifurcation to frontal and parietal/lateral branches. The anastomosis between *a. cerebri media* and *a. temporalis superficialis* was made by using *a. radialis* like a second artery. *A. radialis* was dissected from the right upper limb between *m. flexor carpi radialis* and *m. brachioradialis*. The advantage of using a radial artery was that there existed a uniform diameter throughout the length of the conduit. For anastomosis was used monofilament, polypropylene, and non-absorbable suture (*Optilene* 5/0). The anastomosis was sutured with a running locking suture technique. The length of *a. radialis* in EC-IC arterial bypass was 8.0 cm. The *dura mater* was closed. The removed bone was placed back onto the skull.

Conclusions.

1. Extracranial-to-intracranial (EC-IC) arterial bypass surgery is performed to revascularize blood flow to the brain.
2. Unlike venous grafts, the *a. radialis* lacks valves and varies and is technically easier to harvest because of its consistent anatomical location and size.
3. Radial artery interposition graft can be used in EC-IC bypass surgery to restore normal blood flow in the brain and prevent cerebral ischemia and hemorrhage but it could be a technically challenging procedure that required neurosurgical and vascular expertise.
4. Future research is recommended to use pterional craniotomy to get the best approach for *a. cerebri media* on Sylvian fissure.

Anatomical Evaluation of Wormian Bones: Their Sizes, Location and Frequency

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Introduction. Wormian (sutural) bones (WBs) are small accessory bones that are located on the skull (*Yap J.*, 2022; *Li J.-H. et al.*, 2021). These bones consist of extra ossification centers around cranial sutures and fontanelles. Their occurrence varies among different populations. The precise mechanism of formation is unknown and is under the control of genetic background and environmental factors. Sutural bones can be isolated or supernumerary, irregular, accessory, and

abnormal small bones. These bones were named Wormian bones after the Danish anatomist, Olaus Wormius, a medical doctor at the University of Copenhagen (*Romero-Reverón R. et al*., 2019). Knowledge about WBs is important because they are present in normal individuals as well as in those with various disorders.

Aim. The study was undertaken to examine the frequency of WBs, their sizes, location, and frequency in skulls in addition to analyzing their topographical distribution and possible relationships with each other and compare with other studies.

Materials and Methods. The study was conducted on 38 dry human skulls with unknown age and sex which were obtained from the Laboratory of Anatomy of the Department of Morphology of the Institute of Anatomy and Anthropology, Rīga Stradiņš University. The side of the head, location of the suture, and number of WBs were noted and documented. The vertical (lengths) and horizontal (widths) sizes of WBs were measured by using the Vernier caliper (accuracy ± 0.01 mm). Additionally, the virtual 3D dissection table "*Anatomage*" was used for the visualization of 46 skulls with detection and measurements of WBs in a digital way using a virtual roller. Excel was used to perform statistical analyses after the measurements were completed.

Results. WBs bones were found on both sides of the cranium, but the dominant side was the left side. All detected bones and measured bones exhibited different irregular shapes: round, oval, triangular, quadrilateral, or polygonal. The number of WBs was generally limited from one, two, or three to five. The total frequency of WBs presence was 58%.

Among all natural specimens, the mean sizes of WBs were 9.9 mm vertically and 6.20 mm horizontally, ranging from 0.87 mm to 25.04 mm vertically and 1.12 mm to 18.83 mm horizontally. The most common shapes were long ovals and polygons. *Sutura lambdoidea* was the most common place (51.72%), then *sutura coronalis* (37.93%) and *sutura sagittalis* (6.90%). The left side (41.80%) of the head was more dominant compared to the right (34.48%) and the center (17.24%). The frequency of WBs showed that in 16 skulls these bones were not seen. The location and frequency of WBs correspond to other studies made about them (*Piagkou M*., 2019; *Kiliç Safak N*., 2019; *Marti B*., 2013).

WBs from the "*Anatomage*" had on average mean sizes of 16.48 mm vertically and 16.53 mm horizontally, ranging from 5.60 mm to 51.84 mm vertically and 3.56 mm to 55.94 mm horizontally. The most common shapes were long ovals and without a clearly defined forms. WBs were observed on lambdoid suture (43.75%), asterion (37.50%) and lambda (18.75%). WBs were seen on the left side at a rate of 35.41% in the middle 18.75% and 45.83% on the right side of the skull. Among the digital skulls, WBs were not presented in 20 cases. In the digital skulls,

the right side of the head with the location of the WBs was more prominent in comparison to the natural skulls.

Conclusions.

1. In this study, there were evaluated the sizes, locations, and frequency of WBs in different natural and digital cranial locations and summarized the anatomical characteristics of these bones.
2. All examined WBs showed highly irregular patterns and significantly more numerous WBs were located in the lambdoid sutures.
3. These results may be compared with other studies and provide an anatomical basis for medical studies, human anatomy, anthropometry, clinical practice, neurosurgery, and in radiographic investigations.

Analysis of Mitral Valve *Chordae Tendineae* Lenght and Left Ventricle Wall Thickness

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Introduction. Mitral valve (left atrioventricular valve) *chordae tendineae* are endothelial-covered collagenous threads between papillary muscles and valve leaflets. These connections perform the protective function of blood backflow in the atria during systole. Nevertheless, *chordae tendineae* maintain continuity between the valve cusps and the papillary muscles. *Chordae tendineae* are classified as true or false based on their attachment sites to the valve cusps or other structures like the septum, ventricle wall, and papillary muscles (*Gunnal et al.*, 2015). The posterior leaflet of the mitral valve has two well-defined indentations which divide the leaflet into three individual scallops identified as P1 (anterior or medial scallop), P2 (middle scallop), and P3 (posterior or lateral scallop). There are described three corresponding segments of the anterior leaflet are A1 (anterior segment), A2 (middle segment), and A3 (posterior segment) (*Kukavica et al.*, 2021).

Aim. The aim of this study was to measure true *chordae tendineae* length in the left ventricle, divided into segments A1, A2, A3, P1, P2, and P3 into 5 human hearts and to inspect the correlations between left ventricle wall thickness to *chordae tendineae* length.

Materials and Methods. Totally 5 human hearts for this study were provided by the Laboratory of Anatomy of the Department of Morphology of the Institute

of Anatomy and Anthropology, Rīgas Stradiņš University. Hearts were opened among their lateral borders. The left ventricle was cut open along the left border of the hearts without damaging general mitral components. Only true *chordae tendineae* that attached directly to the mitral valve from the tip of papillary muscles to the edges of the cusp were measured by Vernier calliper in the left ventricle. The longest *chordae tendineae* were also measured in each segment. At the anterolateral papillary muscle level, the thickness of the left ventricle wall was evaluated by Vernier caliper.

Results. The human mitral valve was a complex and highly variable structure. *Chordae tendineae* branched from a single stem after their origin from apical one-third of papillary muscle or proceeded as a single chordae that divided into several branches near their attachment. *Chordae* also supported the entire free edge of the valvular cusps, together with varying degrees of the ventricular aspects.

In 5 human hearts, the mean values of *chordae tendineae* in A1, A2, A3, P1, P2, and P3 segments were: 15.13 ± 1.02 mm, 19.38 ± 2.37 mm, 17.38 ± 3.28 mm, 15.46 ± 3.89 mm, 17.17 ± 1.97 mm, 14.43 ± 1.81 mm, respectively. The maximal values of *chordae tendineae* in A1, A2, A3, P1, P2, and P3 segments were: 15.79 mm, 23.50 mm, 20.48 mm, 19.46 mm, 20.07 mm, and 16.63 mm, respectively. The minimal values of *chordae tendineae* in A1, A2, A3, P1, P2, and P3 segments were: 13.36 mm, 17.82 mm, 12.29 mm, 12.04 mm, 15.29 mm, and 12.38 mm. The longest *chordae tendineae* were in the A2 segment, the shortest chordae tendineae were in the P1 segment. In each leaflet, the middle (A2, P2) segments had the longest *chordae tendineae*.

The mean value of the left ventricle wall thickness was 15.23 ± 4.11 mm. The maximal value was 18.17 mm and the minimal value was 8.12 mm. The average length of the longest *chordae tendineae* in the P1 segment was very close to the average thickness of the left ventricle wall: 15.46 ± 3.89 mm and 15.23 ± 4.11 mm, respectively.

Conclusions.

1. Lenght of the *chordae tendineae* varied in different segments of the mitral valve.
2. There were no detected important correlations between the longest *chordae tendineae* in each mitral valve segment and left ventricle wall thickness.
3. These data are important for cardiac surgical reconstructions of mitral valves and annulopapillary distance for mitral allografts.
4. The study has to be further continued with a wide range of populations with modern technological aids in measuring the *chordae tendineae*.

Development and Installation of Self-anchoring Humerus Bone Head Prosthesis to Prevent Periprosthetic Humerus Fractures after Shoulder Arthroplasty

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Introduction. Shoulder arthroplasty procedure is commonly used nowadays for patients who suffer from osteoarthritis, inflammatory arthritis, proximal humerus fractures, irreparable rotator cuff tears, rotator cuff arthropathy, and avascular necrosis of the humeral head (*Lin et al.*, 2016). In the United States in 2017 more than 105 000 shoulder arthroplasties were performed (*Best et al.*, 2020). Complications of shoulder replacement surgery range from 3.6% to 20% and include: prosthesis dislocation, rotator cuff failure, nerve damage, and postoperative movement of the prosthesis that may become a reason for periprosthetic fracture. Movement of the shoulder prosthesis is associated with the patient's discomfort and decrease in the articular mobility. It is followed by significant treatment challenges complicated by the position and type of fracture (*Gebrelul et al.*, 2018).

Aims. This study was aimed: 1) to study literature on shoulder arthroplasty procedure and common complications; 2) to develop a head prosthesis with self-anchoring humerus bone that will be able to reduce the probability of future prosthesis movement; 3) to prepare the shoulder of the cadaver for partial humerus resection; 4) to make a 3D scan of the cadaver humerus bone and model a prosthesis using computer software; 5) to print the prosthesis, and 6) to implant it back into the cadaver's humerus.

Materials and Methods. One cadaver sample was provided by the Laboratory of Anatomy of the Department of Morphology of the Institute of Anatomy and Anthropology, Rīga Stradiņš University. Scalpel was used to prepare access to the shoulder joint. The rotational cuff muscles, joint capsule, *m. latissimus dorsi*, *m. teres major* and *m. pectoralis major* were resected to gain complete access to the proximal part of the humerus. An electric saw was used to cut the humerus distal to the surgical neck. The ejected proximal part of the humerus was placed on a tripod and scanned with a portable 3D scanner "*SHINING 3D, EinScan-H*". The scanned 3D model was then edited in software provided by the scanner manufacturer. "*Meshmixer*" software was used to create a prosthesis consisting of 2 parts based on a 3D scan. The prosthesis was then printed out using a 3D

printer "*Phrozen Sonic Mega 8K*". The printed prosthesis was post-processed. An electric saw was used to dissect the joint surface of the humeral head, where later the prosthesis was implanted.

Results. During the work, it was decided to completely remove the articular surface of the humerus head to make a proper scan. That is why the proximal part of the humerus was resected from the cadaver, otherwise scanning would not be possible due to tissue stiffness. To implant the stem prosthesis proximal epiphysis of the humerus bone was cut along the anatomical neck and then spongious bone was penetrated. The two-part prosthesis was developed in a way that the inner part expands the outer part during installation, so the prosthesis is firmly placed in the humerus bone. To achieve this goal, the outer part was developed in a wall plug manner.

Conclusions.

1. In clinical practice, it is possible to produce a 3D model of a patient's humerus head using CT.
2. The self-anchoring prosthesis can be used in hemiarthroplasty, anatomical total shoulder arthroplasty, and reverse shoulder arthroplasty as a way to decrease complications due to postoperative prosthesis shifting.
3. To obtain the best positioning of the prosthesis, all the anatomical peculiarities of the patient's humerus should be considered.
4. The self-anchoring prosthesis model should be improved and its use needs to be tested further.

Reconstruction of the Anterolateral Acromion with a Tricortical Iliac Crest Bone Graft

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Consultant – *Dr.* Inese Breide

Introduction. Reconstruction of the anterolateral acromion is a rarely performed surgical intervention, which is used to treat or reduce symptoms of osteosarcoma, treat pseudoarthrosis caused by os acromiale, treat multiple acromion fractures that do not heal, and in cases of unsuccessful acromioplasty (*Tross at al.*, 2021). Complete removal of the acromion may produce severe shoulder abnormality with pain and joint stiffness. Recreation of the acromion as a fulcrum

of the shoulder joint markedly improves pain and range of motion in these patients (*Agneskirchner et al.*, 2001). Considering all the significance of acromion reconstruction previously mentioned, there is still little information available about such surgical operations. Reconstruction of bony deficiencies can be performed using autografts (obtained from the patient), allografts (obtained from another individual), xenografts (obtained from another species), bone substitutes, or implants. The best option is to use autologous bone grafting there.

Aims. The aims of the study are 1) to detect possible techniques of acromion reconstruction with autograft and use one of them in practical work; 2) to learn from accessible literature about different autograft types and preparation techniques; 3) to evaluate possible complications after reconstruction and deltoid reattachment.

Materials and Methods. One cadaver sample was provided by the Laboratory of Anatomy of the Department of Morphology of the Institute of Anatomy and Anthropology, Rīga Stradiņš University. Scalpel was used to detach the deltoid muscle from the acromion and clavicle. The electric bone cutting saw was used for dissecting the anterolateral part of the acromion and tricortical iliac bone autograft harvest. 35.0 x 15.0 mm sized tricortical autograft was harvested from an iliac crest 75.0 mm posteriorly from the anterior superior iliac spine. The harvested autograft was shaped with an electric saw and sandpaper. A 3.0 mm drill was used to make holes in the acromion and scapula for the following insertion of two 3.0 x 40.0 mm screws.

Results. Deltoid muscle detachment from the acromion and clavicle was necessary to perform acromion dissection. The coracoacromial ligament was also partly removed from the acromion. The full deltoid detachment was performed due to the hardness of cadaver tissues only. In the available literature, it was mentioned that autograft should be harvested 35.0 mm posteriorly from the anterior superior iliac spine. Practically it was proved that a 35.0 mm distance is not enough for graft harvest in cases of acromion reconstruction. We suggest increasing the distance to at least 70.0 mm, so the graft is denser, thinner, and thus more suitable for reconstruction of the acromion. To drill attachment holes in both iliac autograft and scapula it is strongly suggested to use a drill guide – it allows the drilling of 2 parallel 3.0 mm holes through the bone. It is important to ensure that the holes are centered on the graft and perpendicular to the prepared surface. In real-life patients 3.0 mm cannulated screws are used for this. Possible complications include the breakdown in a connection point between autograft and scapular bone, acromial and deltoid branch damage of the thoracoacromial artery, and damage of the axillary nerve.

Conclusions.

1. The usage of autograft is strongly suggested to get the best healing results in the case of reconstruction of acromion bone after total acromion ectomy.
2. Specifically, a tricortical iliac bone graft is the best option for acromion reconstruction.
3. A distance of at least 70.0 mm from the anterior superior iliac spine is recommended for autograft harvest.
4. Since acromion reconstruction is a rarely performed surgery, there is a lack of studies describing the operation technique, thus more clinical studies are necessary.

Morphometrical Variations of the Scaphoid and Lunate Bones

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Introduction. The scaphoid and lunate bones are important for radiocarpal joint mobility and also stability. It is found that the scaphoid acts as a link bone between the two rows of carpal bones and prevents the buckling of the midcarpal joint, especially of the capitato-lunate joint surface (*Chakraborty et al.*, 2011). Knowledge of variations of healthy bone shapes is essential for diagnosing wrist pathologies (*Moritomo et al.*, 2000) or fractures (*Compson et al.*, 1994). However, the most important is to distinguish the pathology from a physiological shape variation. Moreover, special relations have been found between bone shapes and their kinematics (*Nakamura et al.*, 2000).

Aims. The aims of this study were to measure scaphoid and lunate bones and to detect if there are any morphometrical variations and differences between the obtained results.

Materials and Methods. 86 scaphoid bones and 72 lunate bones were measured from the material, provided by the Laboratory of Anatomy of the Department of Morphology of the Institute of Anatomy and Anthropology. A digital caliper and ruler were used to obtain the width and height of bones (viewed in the sagittal plane) and to find out the differences between them. Digital analysis of the measurements was done and data, including mean values, and the standard deviations (SD), were analyzed by using Excel. The ratios between the widths and heights of bones were detected too.

Results. The measurements of the scaphoid bones showed that there were significant differences between bones. The maximum height of the bone's waist was 19.4 mm, but the minimum was 7.9 mm. The maximum width of the bone's capitate facet was 20.0 mm, however, the minimum was 11.0 mm. The mean height of the waist was 12.2 mm, but the mean width of the capitate facet was 14.8 mm. When it comes to the ratio, the width of the capitate facet was 1.8 times bigger than the height of the bone's waist. The minimum ratio of the width of the capitate facet was 0.7 times smaller than the height of the scaphoid's waist. The mean ratio between width and height was 1.3. All these bones were boat-shaped but with considerable differences in size.

Related to the lunate bone, the maximum width of lunate bones was 17.0 mm, but the maximum height was 15.0 mm. The minimum width was 10.0 mm, and the minimum height was 8.0 mm. The mean width of lunate bones was 13.7 mm, but the mean height was 10.8 mm. The maximum ratio was 1.7 times wider than high. The minimum ratio was 0.9 times smaller than height. The mean ratio between width and height was 1.3.

There were differences in angles between the lunate bones' sides adjacent to the scaphoid and triquetrum. Also, some of the bones had a higher volar bone end, while others had a dorsal end. Some of the bones had extra facets adjacent to the hamate bone.

Conclusions.

1. There exist morphometrical differences between scaphoid and lunate bones' widths and heights – scaphoid and lunate bones' widths of the capitate facet are bigger than their heights of the waist.
2. Considerable differences were detected in scaphoid and lunate bone shapes.
3. These detected variations could help predict the possible outcomes of the wrist's injuries and can be a determinant factor of the wrist's mobility, stability, and endurance. Furthermore, these differences should be considered for the design of the prostheses.
4. Further studies are recommended to gain more information about the different measurements of the scaphoid and lunate bone shapes to see how it affects the endurance, stability, and mobility of the radiocarpal joint.

Morphological Variations of *Plexus Brachialis* Branches: Case Study

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Introduction. Upper extremity innervation is provided by a complex network of nerves or *plexus brachialis*, which is formed by *ramus anterior/ventralis n. spinalis C4*, *C5-C8, Th1*. It divides into three trunks, further three divisions, and three cords (lateral, medial, and posterior) that segregate the upper extremity innervation in regions (*Mahan et al*., 2016). Variations in nerves, dividing further from the three cords branches, can cause confusion in clinical examinations, and also in surgery. Nerves can communicate with fibers differently, forming variants, and causing various neurologic pathways resulting in disorientation when determining neuropathy. Knowledge of variations of the brachial plexus is mandatory in cases like a surgical exploration of the axilla and arm, during cervical rib correction, which is a cause for thoracic outlet syndrome, anesthetic block either through, cervical or axillary approach, internal fixation of the humeral fracture from common anterior approach and even during orthopedic and neurosurgical procedures on the cervical spine and prosthetic implant placements (*Pattanshetti et al*., 2012). Nerve branching variations may be associated with various upper extremity neuralgias and other clinical presentations (*Patel et al*., 2023).

Aims. The aim of the study was to evaluate the branch variants of the *plexus brachialis* and compare the results with those reported in other studies.

Materials and Methods. Dissection was done on cadavers provided by the Laboratory of Anatomy of the Department of Morphology at the Institute of Anatomy and Anthropology. The dissection included the removal of muscles – *m. pectoralis major* and *m. subclavius*. The clavicula was removed using a bone saw. More precision was needed when dissecting *v. axillaris* located above *a. axillaris*, and *plexus brachialis*. The *plexus brachialis* was compared on both sides of the cadaver and analyzed by known anatomical nerve variations.

Results. On one cadaver both sides the *plexus brachialis* branches were morphologically typical. Cords were divided in the letter "*M*" perfectly displaying *n. medianus* in the middle and *n. ulnaris* medially, and *n. musculocutaneus* laterally (*Mahan et al*., 2016). An unusual separation in nerves was seen on another cadaver's right side. It showed the division of nerve fibers where *n. medianus* arose from the medial cord.

Anatomically the medial cord divides into two segments – *radix medialis n. mediani* and n. *ulnaris*. In this case, the cadaver *n. ulnaris* divided from *radix medialis* closer to the arising location of *plexus brachialis*. *N. medianus* had an extra loop in the medial side, that did not continue as the ulnar nerve but arose from it. The atypical nerve branch is divided in the anatomically usual location where *n. ulnaris* divides. Studies did not show additional loops and variations in this region. Usually, the variation occurs in distal regions in the lower arm – *Martin Gruber* anastomosis (*Pedrini et al*., 2019).

Conclusions.

1. In the atypical *plexus brachalis* division, the medial cord is divided in *n. unaris* and *radix medialis nervi mediani* closer to the *plexus brachialis* trunks, where anatomically the location is lower in the upper arm, where *n. medianus* is branched.
2. Interconnections between *n. ulnaris* and *n. medianus* are usually located in the lower arm but in this case, it was seen in the upper arm, which is not addressed in used studies.
3. In this case, there is an additional neurological pathway, which should not interfere with the pathways that are typical, because of the added loop branching from the typical location of *n. ulnaris* and merging with *n. medianus* after the branching.

Anatomical Study of Several Variations of *A. Thyroidea Inferior* and Its Origins

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Supervisor – *Dr. med*., Associate Professor Dzintra Kažoka

Introduction. *A. thyroidea inferior* (*ITA*) is an artery that supplies the lower part of the thyroid gland with blood, the artery is located in the neck arising from the thyrocervical trunk shortly after its origin from the subclavian artery and is near the recurrent laryngeal nerve (cranial nerve X). Regarding the morphological variations of *ITA*, there are more anatomical variants than *a. thyroidea superior*. This artery acts as a marker for the *n. laryngeus reccurens* during head and neck procedures including hemi-/total thyroidectomies and parathyroidectomies (*Noussios*, 2020; *Rajabian*, 2017). Referring to existing literature, *ITA* most commonly originates from the thyrocervical trunk, but it

can also originate from other vessels such as the subclavian artery, the vertebral artery, the common carotid artery, or the suprascapular artery (*Toni*, 2005).

Aims. The aims of this study were: 1) to dissect *ITA* on both virtual and real cadavers; 2) to measure *ITA* diameter and length and compare them on both sides of the neck; 3) to determine anatomical variabilities of the artery.

Materials and Methods. Virtual dissection table "*Anatomage*" and cadavers provided by the Laboratory of Anatomy of the Department of Morphology of the Institute of Anatomy and Anthropology were used for measurements. Five cadavers were dissected and examined. The location of *ITA* origin was observed and noted. The diameter of it was also measured closer to its origin and closer to the thyroid gland as well as its length on both sides of the neck to assess if the arteries course was straight or if any additional loops were done. Since there was a lack of classification method for *truncus thyrocervicalis* variants, it was categorized into 5 types using a modified classification according to a study by *P. Ostrowski* (2022) and an additional subtype when the artery originated from *a. subclavia*. Different sources (*PubMed* and *ScienceDirect*) were used as theoretical backgrounds.

Results. *ITA* forms the main functional blood supply to the gland and is typically larger than *a. thyroidea superior* as it enters the hilus. The thyrocervical trunk is referred to as the artery that gives rise to four branches in the majority of anatomical textbooks (*a. thyroidea inferior*, *a. cervicalis ascendens*, *a. suprascapularis*, *a. transversa colli*). However, more recent studies indicate that only about 30% of the population exhibits this.

ITA was found on both sides of all 6 cadavers that were dissected. On the right side in 4 cases *a. thyroidea inferior* originated from *truncus thyrocervicalis* while 2 originated from *a. subclavia*. On the left side, it originated from *truncus thyrocervicalis* in 5 cases while only 1 originated from *a. subclavia*. In 9 cases the diameter of the artery closer to point of its origin was wider. The length of *ITA* was also measured and the longest was found to be 49.4 mm and the shortest 34.6 mm.

According to the modified classification by *P. Ostrowski* (2022), this study detected: Type A (4 cases) where *a. suprascapularis* (*SSA*) sprouted as the first branch, and a further common trunk for *ITA* and *a. transversa colli* (*TCA*); Type B (3 cases) where *ITA* branches at the same level as *TCA* and *SSA*; Type C (2 cases) where *ITA* branches of higher than *TCA* and *SSA*; Type D (no cases detected) where *ITA* branched at the same level as (*TCA*) and an additional; Type E (3 cases) where *ITA* originates from *a. subclavia* independent from *truncus thyrocervicalis*.

Conclusions.

1. The knowledge of the *a. thyroidea inferior* (*ITA*) anatomical variants is essential for its relationship with the *n. laryngeus recurrens*.
2. In this study, *ITA* originated mostly from *truncus thyrocervicalis* but also in a significant amount of cases originated from *a. subclavia*.
3. *ITA* had a wider diameter closer to the point of its origin rather than closer to the thyroid gland.
4. For surgical and diagnostic operations in the neck region, awareness of variations in the ramifications of the *truncus thyrocervicalis* arteries is crucial.

Analysis of the Segmental Lengths and Their Differences in Descending Colon

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Introduction. Regional variations in the human colon are important in anatomical studies and surgical practice. The length and mobility of different colonic regions impact laparoscopic and endoscopic colorectal procedures. The descending colon is 25–30 cm long and descends from the left colic flexure in the left hypochondriac region to the level of the iliac crest, where it curves medially anterior to the iliacus to transitions to the sigmoid colon (*Standring*, 2021). Colonic stenosis, which may be a birth defect or may develop later in life, is a condition in which part of the colon is more narrow than normal. A congenital anomaly of the colon that results in either stenosis or a complete absence of a colonic segment carries a real danger to human life and health (*Phillips et al.*, 2015). Therefore, it requires immediate intervention due to complications and risks.

Aims. The aims of this study were to refine the anatomical understanding of the descending colon in its segmental length, to measure different parts, and to compare the received data with other studies, including the analysis of stenosis epidemiology, etiology, pathogenesis, clinical features in this part of the large intestine.

Materials and Methods. The descending colons of 2 male and 1 female cadavers were dissected and examined to determine their lengths. All materials

were provided by the Laboratory of Anatomy at the Department of Morphology of the Institute of Anatomy and Anthropology, Rīga Stradiņš University. The sizes of the segments of the colon were measured by Vernier caliper and elastic tape in 5 segments with a distance of 3–4 cm between them.

Different resources and databases (*ClinicalKey*, *AccessMedicine*, *DynaMed Plus, UpToDate*) were analyzed to delve deeper into the anatomical normal descending colon sizes, their epidemiology, etiology, evaluation, and clinical features.

Results. The anterior abdominal wall was dissected and after the reflection of the anterolateral abdominal wall and removal of the peritoneum, abdominal organs were observed for their locations in the abdominal cavity. The descending colon was predominantly fixed. It descended down attached to the left posterior abdominal wall into the left iliac fossa where it continued as the sigmoid colon. The descending colon passed in front of and down the left kidney. Peritoneum covered the anterior and lateral surfaces. In both cadavers, it was different in caliber and more posteriorly situated on the opposite side of the ascending colon. In the 1st case, the sizes of the segments of descending colon were 10.51 mm, 10.93 mm, 14.08 mm, 16.62 mm, and 10.14 mm. There were different sizes of the segments of descending colon in the 2nd case (20.8 mm, 22.62 mm, 20.8 mm, 17.48 mm, and 20.76 mm) and in the 3rd case (20.54 mm, 19.12 mm, 17.72 mm, 15.34 mm, 20.57 mm). In several places descending colons were occluded or stenotic due to the diameter measurements that were less than 3 cm.

Inoue (2022) reported that stenosis is caused by chronic diverticulitis, which leads to fibrosis obstruction of the colonic lumen. *Adams et al.* (2014) indicated, that the occlusions or stenosis of the descending colon can lead to an increase in its anatomic dimensions and there can be mentioned several reasons with different clinical expressions. It should be kept in mind as a differential diagnosis while managing a case of intestinal obstruction. Treatment should be individualized and based on the clinical status.

Conclusions.

1. In the present cases, there were various differences in the segmental sizes of the descending colon.
2. This study suggests variations in the length of the descending colon may produce difficulties in radiological diagnosis and instrumentation.
3. Knowledge of the variation in the morphology and position of the descending colon is of value to clinicians, pathologists, surgeons, and radiologists for interventional procedures, preventing misdiagnosis and treatment of changes in size colon.

The Symmetry of Anthropometric Parameters in Knee Joint and Lower Extremity

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Introduction. It is impossible to imagine the mobility and function of lower extremity without knee joint (*art. genus*), which can be described by both – its complex structure and volnerability. Frontally knee joint is covered only with skin, but joint itself has large cavity, multiple ligaments. In humans it is common to have assymetry in antropometric parameters in lower extremities, which can be assotiated with different levels of load with one leg dominant, especially in context of physical activities (*Shi H.*, 2019). Sports and recreational injuries usually are asymmetrical, when only one of lower extremities gets injured, in some cases injury may occur even multiple times (*Helme*, 2021). Meniscus injuries are present in all age groups and make joint function significantly difficult – movement is restricted, pain and discomfort appear and quality of life overall deteriorates.

Aims. The aims of the study were to identify the correlation between student involvement in sport, anthropometric parameters and knee and leg muscle symmetry through voluntary anonymous student questionnaires for 10 women and 10 men, and to provide an additional description of the knee joint and its structures through *cadaveric* dissection.

Materials and Methods. Paper-format questionnaires of the Laboratory of Anthropology of the Department of Morphology of the Institute of Anatomy and Anthropology, and measuring instruments – measuring tape and caliper were used in the work. In a male cadaver of the Laboratory of Anatomy of the Department of Morphology of the Institute of Anatomy and Anthropology, dissection was used to investigate joint structures.

Results. The research led to a discovery of a correlation between the dominant leg in sport and the anthropometric parameters of that leg – the muscle circumference of the dominant leg thigh (*femur* in men is average for 2.5 cm (mean) greater than the circumference of the non-dominant leg thigh). The muscle circumference of the dominant leg calf in men is for 2.3 cm (mean) greater than the circumference of the non-dominant calf. The circumference of the dominant leg knee joint in men is for 2.8 cm (mean) greater than the circumference of the non-dominant leg knee joint. In women, the muscle circumference of the thigh (*femur*) of the leading leg is on average 3.1 cm larger than that of the thigh of the non-dominant leg. The muscle circumference of the dominant leg calf in women is for 2.4 cm (mean) greater than the circumference of the non-dominant leg calf. The circumference of the dominant leg knee joint in women is for 1.2 cm

(mean) greater than the circumference of the non-dominant leg knee joint. During dissection, knee joint structures such as *patella*, patellar ligament, *femur* and *tibia* joint surfaces covered with hyalin cartilage were visualized, and *meniscus* between *condyli femoris* and *condyli tibiae. Lig. collaterale laterale* and *lig. collaterale mediale* were also inspected.

Conclusions.

1. Asymmetry in anthropometric parameters of the knee joint and leg was observed in those participants who are involved in sports with one of the legs dominant.
2. The asymmetry of anthropometric parameters of the knee and leg are gender-independent.
3. The structures and elements of the knee joint meet its functional needs and are well visualised on the cadaver.

Morphological Variations of Central Renal Artery and Its Position Concerning Renal Veins

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Introduction. Renal arteries are visceral paired arteries that arise from the abdominal aorta at a right angle and the level of the second lumbar vertebra. They run laterally to the renal hilum. Renal arteries are the only arterial supply to the kidney. Based on *F. T. Graves* (1954) proposed classification, the kidney is divisible into five segments, each supplied by its artery: the apical segment, the upper (anterior) segment, the middle (anterior) segment, the inferior segment, and the posterior segment. Morphological variations in the renal arteries are commonly encountered and can directly affect surgical approach (*Omar et al.*, 2021).

Aim. The study aimed to evaluate and classify renal artery variations of kidney samples and evaluate renal artery position concerning renal veins and recognize arterial variation significance during kidney surgery described in the literature.

Materials and Methods. Central renal arteries were evaluated and classified based on *F. T. Graves* (1954) proposed classification of four kidney samples from the materials that were provided by the Laboratory of Anatomy of the Department of Morphology of the Institute of Anatomy and Anthropology, Rīga Stradiņš University. During the dissection of the abdomen, to access the retroperitoneal

tissues, the mesentery and peritoneum were pulled away from the back of the abdominal wall. The fascia surrounding the abdominal aorta and inferior vena cava was also removed to visualize the further vascular supply of the kidney, its branching and positioning.

Results. Central renal arteries from four kidney samples (2 right and 2 left) were evaluated. In all kidney samples, except number 3, the central artery is divided into anterior and posterior divisions. Sample number 1 had an aberrant renal artery that originated above the central renal artery. In sample number 4 an aberrant renal artery is located below the central renal artery, supplying the inferior renal segment. In all samples, the anterior divisions were divided into two segmental arteries that supplied all renal segments except the posterior. Samples number 1 and number 4 had small branches originating from segmental arteries supplying the apical segment and adrenal gland while in sample number 2 the small branches supplied the inferior segment. Sample number 3 had an apical segmental artery, supplying apical segment without entering the renal hilum. This sample was the only one with a middle division split into two – an inferior segmental artery, supplying the inferior segment, and a middle segmental artery, supplying the middle segment. The posterior divisions in samples number 1 and number 4 were divided into 2 segmental arteries, both supplying the posterior segment and apical segment. Sample number 3 posterior division with a small branch supplied posterior segment. In sample number 2 posterior division did not divide into further segmental arteries, supplying the posterior segment.

In all samples, the central renal artery passed behind the central renal vein. In sample number 1 the additional artery branch was behind the additional renal vein. Sample number 4 had an anastomosis between a branch of the central vein and a superior segmental artery. The aberrant artery in sample number 4 passed in front of the central artery but posteriorly to the central renal vein. The aberrant artery entered the kidney next to another renal vein branch.

Conclusions.

1. Most commonly the central renal artery among studied samples had two divisions – anterior and posterior that divided into segmental arteries, one case had an additional middle division.
2. In all samples, the central renal artery passed behind the central renal vein but the aberrant arteries were behind the central renal and aberrant vein.
3. Knowledge about the morphological variants of the central renal artery and its position concerning renal veins is essential in understanding the possible complications and determining the appropriate surgical approach during kidney surgeries.
4. An understanding of the kidney's vascular pattern is also crucial due to the technical challenge of hemorrhage control during the surgery.

Characteristics of the Atypical Location of Duodenum

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Introduction. Anatomical variations within the normal range of the duodenum have seldom been reported. However, the position of the duodenum reportedly undergoes considerable changes with age. *Anson* (1963) visually depicted eight duodenal types according to the specific form and position of the duodenum, but *Myles* (1937) reported four types of duodenal ptosis in an X-ray study. Duodenum has also a great range of topography due to the high variability of *lig. hepatoduodenale* in the population (*Becker et al.*, 1988). Nowadays due to different factors, there are detected an increased level of duodenal ulcers and tumor formations (*World Cancer Research Fund*, 2018). Therefore, an understanding of duodenal variations and topography in a real-life patient case may be useful for clinicians to provide reasonable interventions.

Aim. The main aim of this study was to describe the atypical location of the duodenum and compare this case with the normal topography of this intestine.

Materials and Methods. An adult female cadaver was provided by the Laboratory of Anatomy of the Department of Morphology of the Institute of Anatomy and Anthropology. For the dissection of the abdominal cavity and examination of the duodenum, there were used different surgical instruments. The lineal and plastic tape were used to obtain the different measurements of the duodenum. A comparison was made on the base of the measurement length of different parts of the duodenum, its total length and topography correspond with other structures.

Results. Standard textbooks of anatomy describe the duodenum as most predictably placed part of the small intestine. Typically duodenum has 4 parts: D1 – *pars superior duodeni*, which is starting from *pars pylorica* on the level of *L1* and makes the loop; D2 – *pars descendens duodeni* with high variability of topography, but in most cases, it moves from L1 to L3; D3 – *pars horizontalis duodeni* goes in front of L3; D4 – *pars ascendens duodeni* that starts at the L3 and goes up till L2, making loop above *radix mesenterii*, where starts *jejunum*. The total length of the duodenum is 27–30 cm, but the widest part is 4.75 cm in diameter (*Silnelnikov*, 2009).

In this study, during dissection, the retroperitoneal space was reached and an atypical duodenal location was clearly detected. Duodenum was tight fixated with connective tissues to the surrounding structure. The total length of

the duodenum was 29 cm. D2 was tightly pressed by the *pancreas* to the vertebral column. The diameter of the duodenum in D1 was 15.19 mm and the shape of this part was round. D2 was oval and the diameter was wider than D1. The lengths of all duodenal parts were the following: D1 – 6.5 cm, D2 – 13.2 cm, D3 – 4.8 cm, and D4 – 4.5 cm. In the area of duodenojejunal transition was founded the necrosis of the wide part of the *jejunum*.

Due to the tight fixation of *caput pancreatis* to the surrounding structure, *v. cava inferior* lumen was increased to 19 mm in the area of *pars horizontalis duodeni*. There *v. renalis sinistra* was deformed too and its lumen was increased to 8 mm (after the discharge of *v. ovarica sinistra*).

Conclusions.

1. The present study reports an atypical variation of the location of the midgut segment of the adult female duodenum and surrounding blood vessels.
2. This finding can be a problem, and make more complicated the operative treatment of duodenal ulcers and tumors due to the closeness to general vessels.
3. Knowledge about duodenal variation and location help radiologists, endoscopists, or even surgeons know the anatomical abnormalities encountered in clinical practice.

Is there a Link between HHV-6 Infection and Kupffer Cell Recruitment in Case of Chronic Alcohol Consumption?

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Introduction. Kupffer cells are liver macrophages that reside in the liver sinusoids, phagocytize pathogens from portal and arterial blood, and function as a first line of defence against immunoreactive substances from the gastrointestinal tract, such as ethanol. Prolonged alcohol consumption is related to liver inflammation, hepatic tissue damage, as well as increased lymphocyte migration and antigen presentation by Kupffer cells, which results in immunosuppression and inflammation. In response to the inflammation, the Kupffer cell count increases and promotes alcoholic liver disease (ALD). Kupffer cells are one of

many in which human herpes virus 6 (HHV-6) resides in its latent state. HHV-6 is a member of the Herpesviridae family and infects hepatocytes and macrophages among other cells. In a case of immunosuppression, HHV-6 can reactivate and contribute to the development of hepatitis.

Aim. The study aims to investigate the relation between HHV-6 positive Kupffer cell count in 3 study groups – young and healthy adults, young alcoholics, and chronic alcoholics in order to determine whether HHV-6 increases damage to the liver and increases Kupffer cell recruitment in a case of prolonged alcohol consumption.

Materials and Methods. Liver autopsy specimens from 58 individuals (11 young adults, 15 young alcoholics and 32 chronic alcoholics) were analysed using a light microscope. The ratio of total lobule count to HHV-6 positive lobule count was calculated on slides stained with haematoxylin and eosin and anti-HHV-6 antibody. HHV-6-positive Kupffer cells were also counted quantitatively in three different areas: the central vein, the lobular area, and the periportal area. The SPSS 28.0 program was used for statistical data analysis.

Results. Only 48.75% of all lobules in the control group were positive for HHV-6, while 63.89% of all lobules in young alcoholics and 63.74% of all lobules in chronic alcoholics were HHV-6-positive. There is a strong negative correlation between HHV-6 positive Kupffer cell count in both lobular and central vein areas in the control group ($r = -1.000$, $p < 0.01$), but a significant positive correlation between HHV-6 positive Kupffer cell count in portal area and central vein in young alcoholics ($r = 1.000$, $p < 0.01$). Significantly more HHV-6-positive Kupffer cells in the lobular area were found in the chronic alcoholic group than in the control group ($p < 0.001$).

Conclusions. These findings lead to the idea that alcohol abuse, in combination with HHV-6, contributes to Kupffer cell recruitment and ALD. However, further research should be conducted to distinguish the difference in Kupffer cell count between HHV-6-negative and HHV-6-positive liver tissue.

Expression and Distribution of CD34, MMP2 and TIMP2 in Human Umbilical Cord Tissue

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Introduction. It is proposed that CD34 marks not only hematopoietic progenitor cells, but also indicates a distinct subset of cells with enhanced progenitor activity in diverse tissues. Matrix metalloproteinase-2 (MMP2) and tissue inhibitor of metalloproteinases-2 (TIMP2) are both factors affecting extracellular matrix remodelling. Banking of umbilical cord tissue has gained popularity in the recent years and research has mostly focused on mesenchymal stem cells (MSCs) found in cord tissue. Exploration of expression of markers mentioned above can further characterize MSCs and their biological properties as well as give an insight about whether other cells aside from MSCs could potentially be used in regenerative medicine.

Aim of the study. To determine the expression and distribution of CD34, MMP2 and TIMP2 in human umbilical cord tissue.

Materials and methods. 17 samples of human umbilical cord were obtained and examined by haematoxylin and eosin staining. The gestational age varied from 28 to 40 weeks. MMP2, TIMP2 and CD34-positive cells were detected by the immunohistochemistry method. The number of positive structures was counted semi-quantitatively. Statistical analysis was carried out using the statistical program SPSS Statistics, version 27.0 (IBM Company, Chicago, USA).

Results. CD34-positive cells were most frequently seen in the endothelium of umbilical arteries, where the number of positive cells varied among samples. Expression of MMP2 was most prominent in the extraembryonic mesenchyme and in the amniotic epithelium. Variable number of MMP2-positive cells was also seen in the endothelium of umbilical veins. Number of TIMP2-positive cells was noteworthy in all tissues examined, strongest expression of TIMP2 was seen in the extraembryonic mesenchyme. Five strong correlations were observed, among them a strong correlation between number of MMP2-positive cells and TIMP2-positive cells in the extraembryonic mesenchyme. Multiple moderate negative correlations were seen between marker-containing cells in different tissues and gestational age.

Conclusions. Number of CD34-positive cells varied significantly among samples suggesting a presence of some factor/factors that affect the expression of CD34 in individual cases. Overall expression of TIMP2 was greater than the expression of MMP2 revealing that extracellular matrix remodelling is limited/supressed in human umbilical cord.

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