

GUIDELINES

<i>Academic discipline</i>	HUMAN ANATOMY
<i>Module №</i>	2
<i>The theme of the lesson</i>	Veins of the trunk: azygos and hemiazygos, inferior vena cava, veins of the pelvis. The portal vein. Intrasystem and intersystem anastomoses of veins
<i>Course</i>	I
<i>The number of hours</i>	3

1. The relevance of the topic

Liver compared with the specific laboratory of our body. Key indicators of malfunctions of the liver, primarily, are nausea and vomiting, yellowish skin tone, dark-colored urine and diarrhea, which indicates the presence of hepatitis B, which can lead to fibrous degeneration of liver tissue. If we talk about the frequency of diagnosed malfunctions of the liver, in the first place stand hepatitis B and C (HCV also known as a "gentle killer" - often progresses to cirrhosis). In cirrhosis of the liver blood goes through the liver to bypass anastomosis, thereby causing some clinical symptoms. For example, the involvement of the anterior abdominal wall anastomosis is a symptom of "Medusa head", which accompanied by the expansion of subcutaneous veins. In hemorrhagic from esophageal varices anastomosis of the upper wall are involved. Therefore, it is important for doctor to know this topic for understanding the clinical symptoms.

2. Specific objectives:

- Describe the sources of formation, topography of the inferior and superior vena cava.
- Classify veins of the trunk.
- Explain how the outflow of blood from the walls of the body are performed.
- Explain the features of venous outflow from the pelvis.
- Interpret the features of structure of lumbar veins.
- Analyze the sources of formation (roots and tributaries) of the portal vein.
- Explain the topographical relationship of portal vein with different structures, that are in hepato-duodenal ligament.
- Name the anastomoses that are situated on abdominal walls.
- Classify anastomoses between outflows of portal vein, superior and inferior vena cava.
- Describe the features of the blood supply and outflow of the liver.

3. Basic level of student's knowledge include the knowledge of medical biology and anatomy of chest, pelvis, internal organs, chest muscles, abdominal muscles, thoracic diaphragm, mediastinum, organs of abdominal cavity and pelvis, peritoneum: ligaments, folds, walls of abdominal cavity and pelvis cavity.

4. Task for independent during preparation to practical classes

4.1. Theoretical questions for the lesson:

1. Describe the skeletopy and syntopy of superior and inferior vena cava.
2. Identify the topography and demonstrate a venous plexus of pelvis on preparation.
3. Demonstrate on preparation the roots of the inferior vena cava.
4. Describe the veins of testicle and ovary, demonstrate their ways and location of confluence.
5. Determine which of veins formed internal iliac vein and demonstrate that on preparation.
6. Features of venous outflow from different parts of rectum.
7. Describe the syntopy of portal vein.
8. Name anastomoses between outflows of portal vein, superior and inferior vena cava.
9. Demonstrate on preparation anastomoses of anterior wall of abdominal cavity.
10. Count all veins, that belongs to anastomosing systems of anterior abdominal wall.

11. Methods of anastomosing.
12. Name all veins of anastomose of anterior abdominal wall, which divert blood to main venous vessels.
13. Demonstrate on preparation an anastomosis of posterior abdominal wall.
14. Count veins, which belongs to anastomosing systems of posterior abdominal wall.
15. Name all veins of anastomose of posterior abdominal wall, which divert blood to main venous vessels.
16. Demonstrate anastomoses on superior abdominal wall.
17. Demonstrate veins, that form anastomosis on inferior abdominal wall.

4.2. The list of practical skills:

- Hepatic portal vein
- Inferior vena cava
- Superior vena cava
- Internal thoracic vein
- Left and right brachiocephalic veins
- Azygos vein
- Hemiazygos vein
- Posterior and anterior intercostal veins
- Superior and inferior epigastric vein
- Hepatic veins
- Renal veins
- Median sacral vein
- Right testicular/ovarian vein
- External and internal iliac veins
- Right and left gastric veins
- Superior mesenteric vein
- Inferior mesenteric vein
- Splenic vein

4.3. The content of the topic

There are two venous systems that drain abdominal structures – the **portal venous system** and the **systemic venous system**. The portal system transports venous blood to the liver for processing, whilst the systemic venous system returns blood to the right atrium of the heart.

In this article, we shall consider the anatomy of these two venous systems – the major vessels involved, their anatomical course, and their tributaries.

The systemic venous system transports deoxygenated blood to the **right atrium** of the heart. The major vessel in this system is the **inferior vena cava**.

The inferior vena cava is the common convergence of venous drainage from all structures below the **diaphragm**. It is located on the posterior abdominal wall; anteriorly to the vertebral column and to the right of the **abdominal aorta**.

The vessel is formed by the union of the **common iliac veins** at the L5 vertebral level. It ascends superiorly, and leaves the abdomen by piercing the central tendon of the **diaphragm** at the T8 level (the caval hiatus). Within the thorax, the inferior vena cava drains into the **right atrium** of the heart.

During its long course, the inferior vena cava shares an anatomical relationship with numerous abdominal structures – including the right common iliac artery, the root of the mesentery, the head of the pancreas, the bile duct, the portal vein and the liver.

Tributaries

The inferior vena cava is responsible for the venous drainage of all structures below the diaphragm. It receives tributaries from:

- **Common iliac veins** – formed by the external and internal iliac veins. They drain the lower limbs and gluteal region.
- **Lumbar veins** – drain the posterior abdominal wall.
- **Renal veins** – drain the kidneys, left adrenal gland and left testis/ovary.
- **Right testicular/ovarian vein** – drain the right testes or ovary respectively in men and women (the left testicular/ovarian vein drains into the left renal vein).
- **Right suprarenal vein** – drains the right adrenal gland (the left adrenal vein drains into the left renal vein).
- **Inferior phrenic veins** – drain the diaphragm.
- **Hepatic veins** – drain the liver.

There are no tributaries from the spleen, pancreas, gallbladder or the abdominal part of the GI tract – as these structures are first drained into the **portal venous system**. However, venous return from these structures ultimately enters the inferior vena cava via the hepatic veins (after being processed by the liver).

The portal system carries venous blood (rich in nutrients that have been extracted from food) to the liver for **processing**.

The major vessel of the portal system is the **portal vein**. It is the point of convergence for the venous drainage of the spleen, pancreas, gallbladder and the abdominal part of the gastrointestinal tract. The portal vein is formed by the union of the **splenic vein** and the **superior mesenteric vein**, posterior to the neck of the pancreas, at the level of L2.

As it ascends towards the liver, the portal vein passes posteriorly to the superior part of the duodenum and the **bile duct**. Immediately before entering the liver, the portal vein divides into right and left branches which then enter the parenchyma of the liver separately.

Tributaries

The portal vein is formed by the union of the splenic vein and superior mesenteric vein. It receives additional tributaries from:

- **Right and left gastric veins** – drain the stomach.
- **Cystic veins** – drains the gallbladder.
- **Para-umbilical veins** – drain the skin of the umbilical region.

The **splenic vein** is formed from a variety of smaller vessels as they leave the hilum of the spleen.

Unlike the splenic artery, the splenic vein is straight and it maintains contact with the **body of the pancreas** as it crosses the posterior abdominal wall. As it reaches the neck of the pancreas, the splenic vein joins the superior mesenteric vein to form the portal vein.

Tributaries

Tributaries to the splenic vein include:

- **Short gastric veins** – drain the fundus of the stomach.
- **Left gastro-omental vein** – drains the greater curvature of the stomach.
- **Pancreatic veins** – drain the pancreas.
- **Inferior mesenteric vein** – drains the colon.

The **inferior mesenteric vein** drains blood from the rectum, sigmoid colon, descending colon and splenic flexure. It begins as the superior rectal vein and ascends, receiving tributaries from the sigmoid veins and the left colic veins. As it ascends further it passes posteriorly to the body of the pancreas and typically joins the splenic vein.

The superior mesenteric vein drains blood from the small intestine, cecum, ascending colon and transverse colon. It begins in the **right iliac fossa**, as a convergence of the veins draining the terminal ileum, cecum and appendix. It ascends within the mesentery of the small intestine, and then travels posteriorly to the neck of the pancreas to join the splenic vein.

Tributaries

Tributaries to the superior mesenteric vein include:

- **Right gastro-omental vein** – drains the greater curvature of the stomach.
- **Anterior and posterior inferior pancreaticoduodenal veins** – drain the pancreas and duodenum.
- **Jejunal vein** – drain the jejunum.
- **Ileal vein** – drain the ileum.
- **Ileocolic vein** – drains the ileum, colon and cecum.
- **Right colic vein** – drains the ascending colon.
- **Middle colic vein** – drains the transverse colon.

Many of these tributaries are formed as an accompanying vein for each branch of the superior mesenteric artery.

The veins of the pelvis drain deoxygenated blood and return it to the heart. There are three major vessels involved in the venous drainage of the pelvis – the external iliac vein, internal iliac vein and common iliac vein (these correspond to the major pelvic arteries).

In this article, we shall look at the anatomy of the pelvic veins – their anatomical course, tributaries, and clinical correlations.

Note: The ovarian/testicular vessels drain directly into the abdominal veins; into the inferior vena cava on the right and the renal vein on the left.

The external iliac vein is a continuation of the **femoral vein** (the major vessel draining the lower limb), arising when the femoral vein crosses underneath the **inguinal ligament**. It ascends along the medial aspect of the external iliac artery, before joining with the internal iliac vein to form the **common iliac vein**.

During its short course, the external iliac vein receives the **inferior epigastric** and **deep circumflex iliac veins**.

The internal iliac vein is responsible for the majority of pelvic venous drainage, and receives numerous tributaries from veins that drain the pelvic region. It is formed near the **greater sciatic foramen**, ascending anteriorly to the **sacroiliac joint**, before combining with the external iliac vein to form the common iliac vein.

With the exception of the iliolumbar vein (which drains into the common iliac), the tributaries of the internal iliac vein correspond with the branches of the internal iliac artery. It receives venous blood from the:

- **Superior and inferior gluteal veins** – drains the buttock and upper thigh.
- **Internal pudendal vein** – drains the reproductive organs and part of the rectum (via the inferior rectal vein).
- **Obturator vein**
- **Lateral sacral veins** – drains part of the sacrum.
- **Middle rectal vein** – drains the bladder, prostate (in males only), and part of the rectum.
- **Vesical veins** – drains the urinary bladder via the vesical venous plexus.
- **Uterine and vaginal veins** – drain the female reproductive organs via the vaginal and uterine venous plexuses.

The common iliac vein is formed at the upper margin of the pubic symphysis by the union of the **external** and **internal iliac veins**. It receives two additional tributaries:

- **Iliolumbar vein** – drains the L4 and L5 vertebrae, and the iliopsoas muscle.
- **Middle sacral veins** – drain part of the sacrum.

The left and right common iliac veins combine at L5 to become the **inferior vena cava**, which empties into the inferior aspect of the right atrium.

LITERATURE

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Tests "STEP – I"

**Theme: veins of the trunk: azygos and hemiazygos, inferior vena cava, veins of the pelvis.
The portal vein. Intrasystem and intersystem anastomoses of veins**

1. At what vertebral level do the two common iliac veins unite to form the inferior vena cava?

- A. L2
- B. L5
- C. Th5
- D. Th8

2. What structures does the right suprarenal vein drain?

- A. Right adrenal gland
- B. Kidneys
- C. Diaphragm
- D. Posterior abdominal wall

3. Which vein does not drain directly into the inferior vena cava?

- A. Left renal vein
- B. Splenic vein
- C. Right hepatic vein
- D. Left testicular vein

4. Where does the portal vein cross in relation to the duodenum?

- A. Inferior
- B. Superior
- C. Anterior
- D. Posterior

5. Which of the following is not a tributary to the splenic vein?

- A. Short gastric veins
- B. Pancreatic veins

- C. Left gastric vein
- D. Left gastro-omental vein

6. What structure does the middle colic vein drain?

- A. Ascending colon
- B. Transverse colon
- C. Descending colon
- D. Sigmoid colon

7. What portal venous pressure defines portal hypertension?

- A. 5mmHg
- B. 10mmHg
- C. 15mmHg
- D. 20mmHg

8. At which porto-systemic anastomosis site would you find caput medusae in portal hypertension

- A. Oesophageal
- B. Para-umbilical
- C. Retroperitoneal
- D. Rectal

9. Which structure does the left ovarian vein drain into?

- A. V. iliaca interna sinistra.
- B. V. renalis sinistra.
- C. V. iliaca interna dextra.
- D. V. cava inferior.

10. The external iliac vein arises when the femoral vein crosses which structure?

- A. Inguinal ligament
- B. Sartorius
- C. Femoral artery
- D. Ureter