

BLOOD SUPPLY OF THE ANAL CANAL IN PATIENTS WITH CHRONIC HEMORRHOIDS

Serhii Sidoruk

**Ivano-Frankivsk National Medical University,
Dpt. Surgery 1**

Abstract

The most important factors in the development of chronic haemorrhoids today are considered to be the combination of two factors (vascular and mechanical) that lead to the development of hemorrhoids. The underlying vascular factor is the vascular dysfunction, providing arterial blood flow through the arteries to the cavernous bodies and outflow through the cavernous veins, which leads to dilation of cavernous bodies and the formation of vascular malformations.

There were performed clinical examination and treatment of 140 patients with chronic hemorrhoids of stage III-IV according to Goligher. The features of arterial blood supply of the anal canal were evaluated by transrectal ultrasound examination.

It was found that there was no clear linear relationship between the number of anal arteries with increased blood flow and the number of hemorrhoidal nodes in the patient. Each node was supplied with blood from one or two arteries: the node placed at 11 o'clock had blood supply from the arteries visualized at 10 and 11 o'clock, the node at 3 o'clock - arteries at 3 and 5 o'clock, the node at 7 o'clock - arteries at 7 and 9 o'clock. The arteries were most frequently visualized at the first (89.4%), the third (93.3%), the seventh (88.8%) and the eleventh (93.4%) hours. With less frequency the hemodynamically significant arteries were visualized at the fifth (65.0%), the ninth (62.8%) and the tenth (66.7%) hours. The arteries

that were supplying blood hemorrhoidal vessels were located in the internal sphincter at a depth of 5 to 10 mm. In the area of 3, 7 and 11 hours, they overlapped with a mosaic pattern that corresponded to the localization of the cavernous body and resembled an arteriovenous fistula according to the CDS.

Key words: chronic hemorrhoids; ultrasound examination; blood flow; anal canal.

Introduction. Nowadays the most important in the development of chronic hemorrhoids is the combination of two factors (vascular and mechanical) that lead to the development of hemorrhoids. The underlying of the vascular factor is dysfunction of vessel, providing arterial blood flow through the arteries to the cavernous bodies and outflow through the cavernous veins, which leads to dilatation of cavernous bodies and the formation of vascular malformations [1]. If against this background there is a violation of the elastic properties of the rectococcygeal muscle (musculus rectococcygeus, Treitz muscle) and Parks ligament (connective tissue bed of cavernous bodies), which separates the internal hemorrhoid from the external, the internal nodes come out of the anal canal [2, 3, 4].

The cavernous bodies, which hemorrhoidal nodes are form, are part of the anorectum, and in 1975 were described by W. Thomson as "vascular pillows" that form the "upper" ("internal") cavernous plexus. Vascular cushions fill with blood from the arterial and venous channels, forming arteriovenous shunts that respond subtly to hormonal and neurophysiological irritants. Some of these shunts are closed at rest, however, under the influence of certain factors (changes in intra-abdominal pressure, pregnancy, spicy food, constipation, spasm of the internal sphincter, etc.) may cause a significant increased blood flow through the rectal arteries, leading to increased pressure and hemorrhoidal plexus [4, 5].

The goal of the work. Evaluate the features of arterial blood flow of the anal canal in patients with chronic hemorrhoids with the help of transrectal ultrasound examination.

Materials and methods. We conducted a clinical examination and treatment of 140 patients with chronic hemorrhoids of stages III-IV according to Goligher. Criteria of inclusion of patients in the study were informed consent of the patient, age from 18 to 89 years, clinical and instrumental signs of chronic hemorrhoids III-IV degree according to Goligher, the absence of other pathology of the rectum. Patients underwent the necessary complex of examinations: general blood test with leukocyte formula, general urine analysis, biochemical blood test (total bilirubin and its fractions, transaminases, urea, creatinine, total protein), rectoromanoscopy, transrectal ultrasound examination of the anal canal (TRUS), colonoscopy

according to the indications. Among the examined patients, there were 58 males ($41.4 \pm 4.20\%$) and 82 females ($58.6 \pm 4.20\%$). Most of the patients were young ($52.1 \pm 4.20\%$).

Before performing TRUS, patients were recommended a cleansing enema with a laxative drug. The patient was placed on the left side for examination. The examination was performed with a rectal sensor 8-4 MHz (ATL 3000 or 5000, ATL Ultrasound, Bothell, WA, USA), wearing a condom. TRUS allowed a standardized assessment of the anal canal, mucous and submucosal membranes, internal (hypoechoogenic) and external (hyperechoogenic) sphincters. During the study, the patient was lying on his left side with his knees bent to the abdomen. The rectal transducer was covered with gel and inserted into the rectum for a length of 3-5 cm. The landmarks for sufficient depth of injection were the muscles of the prostate or vagina. Pressure on the sensor was avoided as this could affect the thickness of the anal tissue. The anal canal was examined clockwise. Normally, the anal canal was visualized as a three-layer structure: a mucous membrane with a subserous layer, internal and external sphincters. The external sphincter was a hyperechoogenic structure, which was separated from the internal sphincter by a narrow hyperechoogenic belt (intrasphincteric diaphragm).

In the mode of Color Duplex Scanning (CDS) evaluated the size, shape, distribution, number, shape and vascular hemodynamic index. CDS parameters were set at low frequency. The diameter of each artery was measured three times after which the average value was calculated.

Results and discussion. An important aspect of quality surgical treatment of patients with hemorrhoids was a clear preoperative establishment of arterial blood flow in the anal canal with TRUS. During sonographic imaging, the mucous membrane was not clearly visualized, the submucosal layer was hypoechoogenic, surrounded by a structure with moderate echogenicity - the internal sphincter. The Parks ligament was defined as a thin hyperechoogenic band. It was usually not possible to clearly visualize all the layers of the anal canal at the same time - the wall of the rectum looked like concentric echo-dense rings. The first three rings corresponded to the mucosa and submucosa, the fourth layer to the sphincters, and the fifth to the pararectal fat. The mesorectum had different echogenicity, which was due to the presence of a large number of small vessels, which were difficult to differentiate from the lymph nodes. It should be noted that lymph nodes in patients with chronic hemorrhoids in the mesorectum were not visualized.

At CDS most often pulsation noise began to be defined within 2-4 cm from the Morton line. It should be noted that its intensity was different and depended on the diameter of the vessel, the speed of blood flow in it and the blood supply of the hemorrhoid. Usually,

each node was supplied with blood from one or two arteries: the node placed at 11 o'clock had blood supply from the arteries visualized at 10 and 11 o'clock, the node at 3 o'clock - arteries at 3 and 5 o'clock, the node at 7 o'clock - arteries 7 and 9 o'clock (fig. 1).

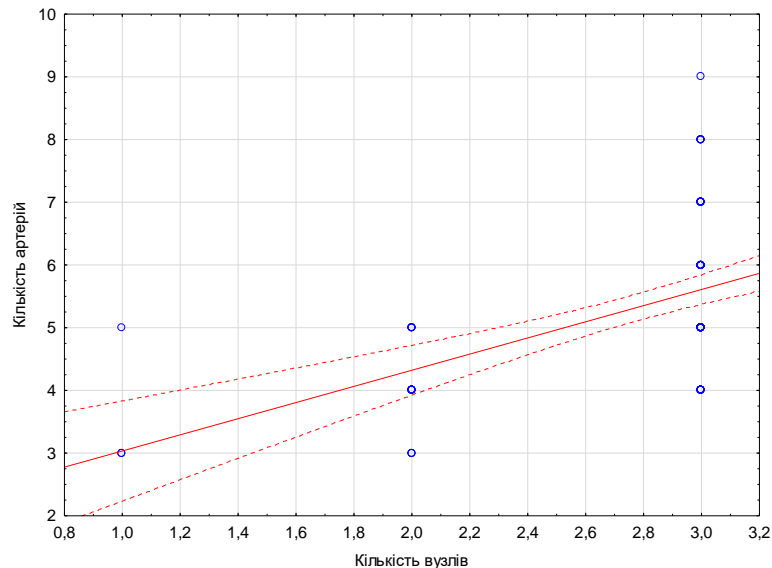


Fig. 1. The relationship between the number of arteries visualized in TRUS and the number of hemorrhoidal nodes in the patient

We did not observe a clear linear relationship between the number of anal arteries with increased blood flow and the number of hemorrhoids in the patient.

The arteries were most frequently visualized at the first (89.4%), the third (93.3%), the seventh (88.8%) and the eleventh (93.4%) hours. With a slightly lower frequency, hemodynamically significant arteries were visualized at the fifth (65.0%), the ninth (62.8%), and the tenth (66.7%) hours.

Overall, the number of arteries visualized in the anal canal ranged from three to nine. Most often, patients had 5-6 arteries that approached different hemorrhoid nodes.

The arteries that supplied blood to the hemorrhoidal nodes were located in the internal sphincter at a depth 5 to 10 mm. In the area of 3, 7 and 11 hours, they overlapped with a mosaic pattern that corresponded to the localization of the cavernous body and, according to the CDS, resembled an arteriovenous fistula.

Due to the compression of the rectal probe by the anal canal, the hemorrhoidal nodes collapsed, which reduced blood flow to them and allowed to visualize the vascular structures behind the Parks ligament. In patients with chronic III and IV degree hemorrhoids, Goligher ultrasound indicated divergent blood flow in the corpora cavernosa.

According to our research, TRUS is a simple, affordable, inexpensive, safe and painless technique that allows non-invasive assessment of anorectal structures with high specificity and sensitivity, to establish the features of blood supply in patients with hemorrhoids and establish a plan of surgical treatment.

Conclusions

1. Hemorrhoidal node is supplied with blood from one or two arteries, but there is no clear linear relationship between the number of anal arteries with increased blood flow and the number of hemorrhoids in the patient.

2. Arteries are most often visualized at the first (89.4%), the third (93.3%), the seventh (88.8%) and the eleventh (93.4%) hours at a depth from 5 to 10 mm. In the zone of 3, 7 and 11 o'clock they are overlapped by a mosaic picture, which corresponds to the localization of the cavernous body.

References

1. Sheng-Long Li, Fang-Yan Jing, Li-Li Ma, Li-Li Guo, Feng Na, Sheng-Li An, Yan Ye, Jun-Ming Yang, Ming Bao, Dong Kang, Xiao-Lan Sun, Yong-Jian Deng Myofibrotic malformation vessels: unique angiodysplasia toward the progression of hemorrhoidal disease. *Drug Des Devel Ther.* 2015; 9: 4649–4656.

2. Zoulamoglou M, Kaklamanos I, Zarokosta M, Flessas I, Bonatsos V, Piperos T, Theodoropoulos P, Barla G, Stathopoulou I, Mariolis-Sapsakos T. The ligament of Parks as a key anatomical structure for safer hemorrhoidectomy: Anatomic study and a simple surgical note. *Ann Med Surg (Lond).* 2017 Oct 16;24:31-33.

3. Fox A, Tietze PH, Ramakrishnan K Anorectal conditions: hemorrhoids. *FP Essent.* 2014 Apr;419:11-9.

4. Jacobs D. Hemorrhoids // *N Engl J. M.* – 2014. – Vol. 371. – P. 944-951.

5. Miyamoto H Minimally Invasive Treatment of Advanced Hemorrhoids and Ultrasound Imaging of Hemorrhoids // *RRJMHS/ Volume 5 / Issue 1 / March, 2016 / 22-28*