Research Article
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# Clinical and Anatomical Substantiation of Access to the Splenic and Left Renal Veins in the Operation of Distal Splenorenal Anastomosis

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**AIM OF STUDY** Development in an anatomical experiment of a technique for operative access to the splenic and left renal veins during distal splenorenal bypass surgery with justification of the possibility of its successful application in clinical conditions.

**MATERIAL AND METHODS** In the conditions of an anatomical experiment on 40 unfixed corpses of adults of both genders, objective volumetric and spatial indicators in surgical wounds were studied in two variants of exposure of retroperitoneal space vessels, as the first stage of distal splenorenal anastomosis. In clinical conditions in 40 patients with portal hypertension of various genesis, during the operation of distal splenorenal anastomosis, the wide exposure of the anterior surface of the pancreas, spleen, left renal veins and most of their branches was performed using the original method of partial left – sided medial visceral rotation, followed by an objective assessment of the volume-spatial parameters of access. Measurements were performed using a medical goniometer in relation to the mobilized areas of the left renal and splenic veins. Statistical processing of the study results was carried out using the method of variation statistics. To identify statistically significant differences, the Student's t-test was used for disjoint samples.

**RESULTS** An original method of operative access to the splenic and left renal veins was developed during the operation of distal splenorenal bypass by lifting the internal organs of the left flank of the abdominal cavity from the posterior abdominal wall and diverting them to the right. In the anatomical experiment in the original method of partial left-sided medial visceral rotation, all indicators were better (depth of the wound is less and the angles of operative activity and the inclination of the axis of operative activity – larger) than with a classic approach of intraoperative intraperitoneal access via transverse incision in the mesentery of the transverse colon.
Despite the various variants of vascular architectonics and various anthropometric indicators of patients, there were no any forced refusal of distal splenorenal bypass surgery or unintentional damage to both the vessels themselves and the pancreas, specific complications associated with the implementation of the proposed operative approach to the vessels of the left retroperitoneal space, including damage to the spleen and ischemia of the descending colon, in any of 40 clinical cases.

**CONCLUSION** The suggested option of operative access to the splenic, left renal veins and their branches at the first stage of performing distal splenorenal anastomosis in patients with portal hypertension of various genesis provides convenient spatial relations in the operating wound; creates comfortable conditions for performing the main surgical technique – applying vascular anastomosis; has a minimal risk of developing specific complications associated with the approach to the vessels of the left retroperitoneal space.

**Keywords:** portal hypertension; surgical treatment; distal splenorenal anastomosis; anatomical experiment; operative access
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AIAOA - angle of inclination of the axis of the operating action
AO - angle of operation
AO wl - angle of the operating action along the length of the wound
AO ww - angle of the operating action across the width of the wound
LRV - left renal vein
SV - splenic vein
WD - wound depth
WL - wound length
WW - wound width

## INTRODUCTION

Portal hypertension as a hemodynamic anomaly in the form of a chronic rise in pressure in the vessels of the portal venous system above the level of 12 mm Hg due to increased resistance to portal blood flow in combination with increased splanchnic blood flow leading to potentially life-threatening complications, including bleeding from varicose veins of the esophagus and stomach, has been and remains the focus of surgeons [1-3]. In 1967, *W.D. Warren et al*. marked the beginning of an era of effective surgical treatment of patients with portal hypertension with the help of a selective distal splenorenal shunt, which allowed not only to preserve the spleen and left kidney, but also ensured a decrease in pressure and flow volume through the gastroesophageal veins, maintenance of portal venous perfusion of the liver and persistent venous hypertension in the intestinal vessels with postoperative prevention of complications of portal hypertension [4, 5]. However, at the turn of the third millennium, ironically, when shunt surgery was convincingly demonstrating its benefits as a therapeutic alternative for the treatment of portal hypertension, the indications for distal splenorenal shunt decreased significantly, and the number of surgeons who performed it freely, declined. The secret turned out to be simple: new players appeared on the scene. Minimally invasive endoscopic ligation and stents, X-ray transjugular intrahepatic portosystemic shunting, and, finally, orthotopic liver transplantation, which has come of age, left little room for shunting surgery for varicose bleeding [6–9]. In this regard, a very important question arises: is it possible in modern conditions of economic development of the state to solve the problem of portal hypertension only by endoscopic ligation or stenting, transjugular intrahepatic portosystemic shunts and liver transplantation? We are deeply convinced that the answer is no. With the exception of a few limited groups of patients in controlled, prospective and randomized protocols, in which researchers are interested in carefully monitoring the results of their procedures, most of the patient population continues to receive sporadic conservative treatment with high mortality rates and a high rate of recurrent bleeding. Every year, hundreds of patients after conservative treatment return to the emergency department with new episodes of bleeding and liver failure. It is important to note that if conservative measures fail, some patients die, and many lose good liver function and are unlikely to get positive results from the operation. It is no coincidence that the *Baveno* VI workshop was entitled “Risk Stratification and Individualization of Portal Hypertension Treatment” [3]. In this aspect of the distal splenorenal anastomosis is a good option for patients with preserved liver function and variceal bleeding refractory to endoscopic and medical treatment. The first question to be decided in this situation is whether the patient is now or in the future a candidate for liver transplant. If the patient is likely to need a transplant in the next year or two, a surgical shunt is not indicated. If the patient is unlikely to need a transplant in the near future, a distal splenorenal anastomosis may be a good solution [10]. At the same time, the shortage of hepatobiliary surgeons with experience in shunt surgery and the relative technical complexity of the distal splenorenal anastomosis, which further contribute to a decrease in the number of surgical shunts performed, stands in the way of widespread use of this operation [11]. Distal splenorenal anastomosis is a surgical operation to connect the proximal splenic vein (SV) (part of the portal venous system) to the left renal vein (LRV) (part of the caval venous system) [12]. One of the disadvantages of this variant of portocaval shunting is considered the technical difficulties in mobilizing the veins of the splenic-portal and left renal basins associated with the variant topographic anatomy and its dependence on the patient's anthropometric parameters [13, 14]. Mobilization of SV when it is deeply located behind the pancreas or in the thickness of the latter is fraught with a high risk during surgical manipulations of unintentional intraoperative damage to both the vessel itself and the pancreas - the main causes of intraoperative bleeding and postoperative pancreatitis, shunt thrombosis, recurrent bleeding from varicose veins and, ultimately, death. That is why the topographic and anatomical variant of the SV location behind the pancreas often forces us to abandon splenorenal bypass grafting [15, 16]. The solution to this issue lies in the way of improving the

intraoperative technique (maneuver), which ensures effective exposure of the SV and LPV, and is an urgent task of clinical surgery.

Based on the foregoing, the **aim of the study** was to develop in an anatomical experiment a technique for surgical access to the SV and LPV during splenorenal bypass grafting with substantiation of the possibility of its successful application in a clinical setting.

## MATERIAL AND METHODS

At the first stage of the study, in the conditions of an anatomical experiment on 40 unfixed corpses of adults of both sexes, including male - 22 (55%) and female - 18 (45%), objective volumetric-spatial parameters in surgical wounds were studied with two exposure options vessels of the retroperitoneal space as the first stage of performing splenorenal anastomosis. The main group consisted of 20 corpses. The comparison group included 20 corpses. Pathological diagnoses in all corpses excluded diseases of the abdominal organs. In the main group, access to the SV, LPV and their tributaries was performed using the original method of partial left-sided medial visceral rotation, dissecting the parietal peritoneum in the avascular plane along the Toldt's white line, then raising and retracting the internal organs of the left flank abdominal cavity from the posterior abdominal wall to the right (Fig. 1).

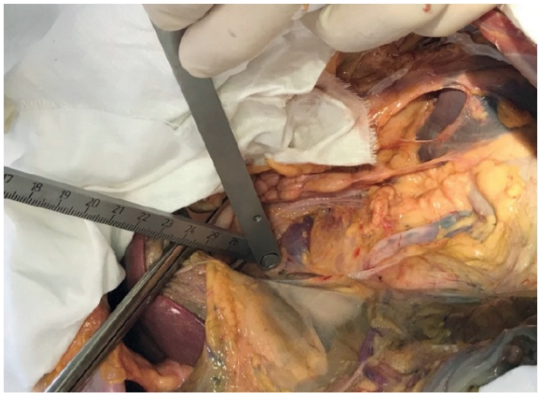

Fig. 1. Autopsy material. Partial left sided medial visceral rotation: parietal peritoneum is dissected in non-vascular area along the Toldt white line; the internal organs of the left flank of the abdominal cavity are moved upwards and retracted from the posterior abdominal wall to the right. The measurement of the operating angle of the action on the splenic vein is performed

In the comparison group, the classical version of the surgical approach to the splenic and renal veins was used from the intraperitoneal approach through a transverse incision in the mesentery of the transverse colon [4] (Fig. 2).

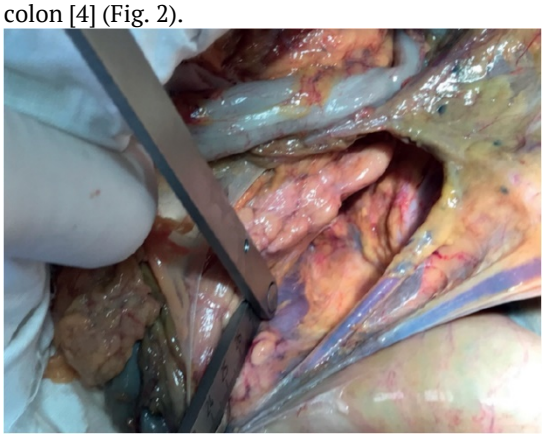

Fig. 2. Autopsy material. The classic version of the surgical approach to the splenic and renal veins from the intraperitoneal approach through a transverse incision in the mesentery of the transverse colon. The measurement of the angle of operational activities to the splenic vein is performed

The measurements were carried out using a Khvisyuk medical goniometer in relation to the mobilized areas of the LPV and SV (Fig. 3).

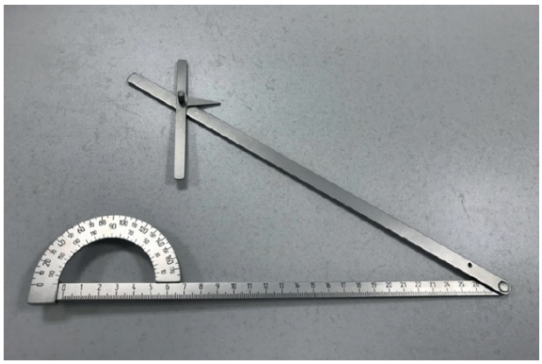

Fig. 3. Medical goniometer of Khvisyuk

The length of the surgical wound (SW) on the anterior abdominal wall, the width of the surgical wound on the anterior abdominal wall after hardware correction with two retractors of the Sigal-Kabanov retractor - 10 (WW), the depth of the wound (WD), the angle of surgical action along the length of the wound (AO wl) were measured, the angle of the operating action across the width of the wound (AO ww) and the angle of inclination of the axis of the operating action (AIAOA) [17].

In a clinical setting, in 40 patients with portal hypertension of various origins at the first stage of the splenorenal anastomosis, a wide exposure of the anterior surface of the pancreas, SV, LRV and most of their branches was performed according to the original technique of partial left-sided medial visceral rotation (Fig. 4).

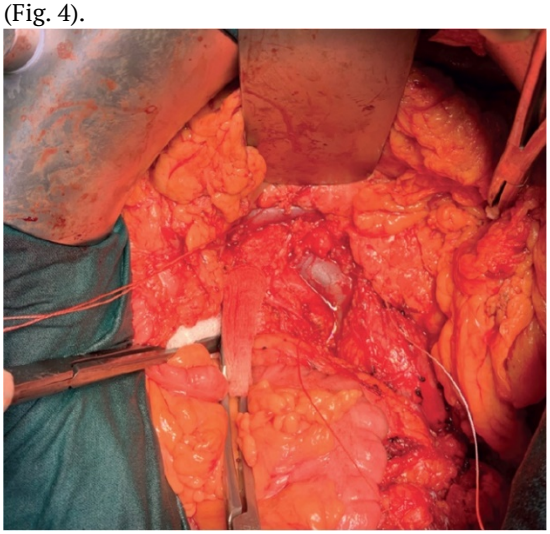

Fig. 4. The left-handed partial medial visceral rotation (incomplete Mattox maneuver in clinical conditions: extensive exposition of the anterior pancreatic surface, splenic (v. lienalis) and the left renal (v. renalis sinistra) veins of the first stage of performing splenorenal anastomosis

There were 21 men (52.5%) and 19 women (47.5%). At the age from 15 to 39 years there were 9 (22.5%), from 40 to 59 years - 28 (70%), from 60 and over - 3 patients (7.5%). In 24 patients (60%) the cause of portal hypertension was cirrhosis as the outcome of hepatitis *C,* in 1 (2.5%) – hepatitis *B*, 6 (15%) – auto-immune hepatitis. Three patients (7.5%) had alcoholic cirrhosis of the liver, 3 (7.5%) had mixed (hepatitis *C* and alcoholic), and 1 (2.5%) had non-refined etiology. Two patients (5%) had extrahepatic portal hypertension. During the operation of the distal splenorenal anastomosis, after performing partial left-sided medial visceral rotation and exposure of the SV, the LRV was measured with the same parameters of the surgical approach using the same technique as in the anatomical experiment.

Statistical processing of the research results was carried out by the method of variation statistics, calculating the arithmetic mean *(M)* , median *(Me)* , standard deviation *( σ)* , coefficient of variation and mean error of the arithmetic mean *(m)*. To identify statistically significant differences, we used *Student's t* - test for disconnected samples. *T* -test Student's calculated for all measured parameters operational access and compared with the critical value for a specific number of studies. The critical value (*t* cr) of the *Student's t*-test at the level of statistical significance $p \leqslant 0.05$ was 2.024. Differences were considered statistically significant at $p < 0.05$ [18–20].

## RESULTS

A technique has been developed for surgical access to the SV and LRV during splenorenal bypass surgery, which is based on the surgical technique used for the medial mobilization of the left and central internal organs of the abdominal cavity: the spleen, tail and body of the pancreas, the left kidney while preserving their integrity, in order to study more deep vascular structures of the I central and II left lateral zones of the retroperitoneal space, known as the *Mattox* maneuver or left medial visceral rotation [21, 22].

In our version, the manipulation allows access to the pancreas, SV, LRV and their branches by simply lifting the internal organs of the left flank of the abdominal cavity from the posterior abdominal wall and retracting them to the right. We believe that the key to the correct technical execution of this maneuver is knowledge, understanding and use of the appropriate avascular plane of mobilization. This is the *white line of Toldt* or *Toldt fascia* - the line of transition of the visceral peritoneum that covers the large intestine and its mesentery into the parietal peritoneum of the lateral abdominal wall - is a fibrous plate resulting from the fusion of the visceral and parietal peritoneum. We begin the maneuver with mobilization of the lower part of the descending colon, as in a left-sided hemicolectomy. We pull the descending colon medially to the midline of the body. Determine the incision line of the parietal peritoneum in the left lateral canal along the Toldt's white line. We make an incision of the parietal peritoneum and, dissecting it along the white line of Toldt, upward mobilize the descending colon towards its splenic angle. This opens the avascular dissection plane in the retroperitoneal space. Then, in this plane, we carry out a blunt separation and sequential complete mobilization of the mesentery of the descending colon with its main vessels, withdrawing it medially. There is one critical anatomical detail that distinguishes our maneuver from Mattox's. The latter always includes rotation of the spleen, pancreas and left kidney in the medial direction relative to the midline and the location of the plane of mobilization directly on the muscles of the posterior abdominal wall. In our case, since the target is SV and LRV with their branches, the spleen, pancreas and left kidney remain in place, and the plane of mobilization is located on Toldt's fascia. That is why we allowed ourselves to call this technique the incomplete Mattox maneuver or partial left-sided medial visceral rotation. Correctly performed manipulation provides a wide exposure of the anterior surface of the pancreas, spleen, left kidney, SV *(v. Lienalis)*, LRV *(v. Renalis sinistra)* and most of their branches, including the inferior mesenteric *(v. Mesenterica inferior)*, left adrenal vein *(v suprarenalis sinistra)*, left testicular *(v. testicularis sinistra)* or left ovarian *(v. ovarica sinistra)* veins.

To substantiate the possibility of successful clinical application of the proposed technique of surgical access to the SV and LRV, objective volumetric and spatial parameters in surgical wounds were previously analyzed under the conditions of an anatomical experiment for two variants of the exposure of the retroperitoneal vessels as the first stage of the splenorenal anastomosis.

The values of the parameters of the surgical access in the studied groups in the anatomical experiment are presented in table 1.

*Table 1*

**Parameters of the surgical approach in treatment groups in anatomical experiments**

| Options operational access | Average value *(M)* | | Average error of the arithmetic mean *(m)* | | *Student's t* -test | *p* |
|---|---|---|---|---|---|---|
| | Main group | Comparison group | Main group | Comparison group | | |
| WL | 25.75 | 25.75 | 0.26 | 0.26 | 0.00 | > 0.05 |
| WW | 22.40 | 22.40 | 0.42 | 0.42 | 0.00 | > 0.05 |
| WD LRV | 11.80 | 14.65 | 0.35 | 0.37 | 5.0 | <0.05 |
| WD SV | 9.90 | 14.85 | 0.30 | 0.39 | 10.06 | <0.05 |
| AO wl LRV | 101.30 | 67.00 | 1.36 | 1.96 | 14.38 | <0.05 |
| AO wl SV | 89.00 | 62.35 | 1.55 | 2.40 | 9.33 | <0.05 |
| AO ww LRV | 81.15 | 61.50 | 1.47 | 1.67 | 8.83 | <0.05 |
| AO ww SV | 77.55 | 60.45 | 1.03 | 1.80 | 8.25 | <0.05 |
| AIAOA LRV | 85.40 | 72.40 | 1.22 | 1.81 | 5.96 | <0.05 |
| AIAOA SV | 85.95 | 66.75 | 1.19 | 2.02 | 8.19 | <0.05 |

Notes: WD - wound depth; WL - wound length; LRV - left renal vein; SV - splenic vein; AO wl - the angle of operation along the length of the wound; AO ww - the angle of the operating action across the width of the wound; AIAOA - axis inclination angle of operation; WW - wound width

Analysis of the data presented in Table 1, allows us to conclude that under the conditions of the anatomical experiment, the difference in the length and width of surgical wounds on the anterior abdominal wall in the studied groups was statistically insignificant ($p > 0.05$). At the same time, under the conditions of an anatomical experiment, the difference in the WD indices, the angle of surgical action along the length of the wound, AO wl, AIAOA shr and AIAOA in relation to the mobilized areas of LRV and SV was statistically significant ($p < 0.05$) and depended on the variant of exposure of the retroperitoneal vessels. space as the first stage of the splenorenal anastomosis. With the proposed method of partial left-sided medial visceral rotation, all of the above indicators were better (WD — less, and AO and IAOA — more) than with the classical version of the intraoperative approach from intraperitoneal access through a transverse incision in the mesentery of the transverse colon.

Having obtained encouraging results in an anatomical experiment, further in a clinical setting, we analyzed objective volumetric and spatial parameters in surgical wounds after wide exposure at the first stage of performing splenorenal anastomosis of the anterior surface of the pancreas, SV, LRV according to the proposed technique of partial left-sided medial visceral rotation in 40 patients with portal hypertension of various origins.

The values of the parameters of the surgical approach in the clinical setting in comparison with those in the anatomical experiment are presented in Table 2.

*Table 2*

**Surgical access parameters in a clinical setting and in anatomical experiment**

| Options operational access | Mean | | Average error of the mean arithmetic | | *Student's t* - criterion | *R* |
|---|---|---|---|---|---|---|
| | Clinical data | Anatomical experiment | Clinical data | Anatomical experiment | | |
| WL | 25.64 | 25.75 | 0.31 | 0.26 | 0.27 | > 0.05 |
| WW | 16.74 | 22.40 | 0.32 | 0.42 | 10.72 | <0.05 |
| WD LRV | 11.74 | 11.80 | 0.37 | 0.35 | 0.12 | > 0.05 |
| WD SV | 11.61 | 9.90 | 0.28 | 0.30 | 4.17 | <0.05 |
| AO wl LRV | 98.33 | 101.30 | 1.17 | 1.36 | 1.66 | > 0.05 |
| AO wl SV | 103.92 | 89.00 | 1.53 | 1.55 | 6.85 | <0.05 |
| AO ww LRV | 83.10 | 81.15 | 1.11 | 1.47 | 1.06 | > 0.05 |
| AO ww SV | 81.15 | 77.55 | 0.72 | 1.03 | 2.86 | <0.05 |
| AIAOA LRV | 90.00 | 85.40 | 0.29 | 1.22 | 3.67 | <0.05 |
| AIAOA SV | 90.13 | 85.95 | 0.34 | 1.19 | 3.38 | <0.05 |

Notes: WD - wound depth; WL - wound length; LRV - left renal vein; SV - splenic vein; AO wl - the angle of operation along the length of the wound; AO ww - the angle of the operating action across the width of the wound; AIAOA - axis inclination angle of operation; WW - wound width

The set of information contained in the Table 2, indicates that the difference in the indicators of the length of surgical wounds on the anterior abdominal wall, WD to LRV, AO wl and AO ww of the surgical wound to LRV both in clinical conditions and under the conditions of an anatomical experiment was statistically insignificant ($p > 0.05$). At the same time, the difference between the WD indices for SV, AO wl and AO ww the surgical wound to SV and AIOAO both to LRV and SV was statistically significant ($p < 0.05$). This suggests that both during surgery in patients and during examination on cadavers, the proposed method of partial left medial visceral rotation provides a wide exposure of SV and LRV and creates convenient conditions for performing the main surgical procedure - the imposition of a vascular anastomosis.

## DISCUSSION

A deep understanding of the topographic anatomy of the retroperitoneal space lies at the heart of the safe execution of the SV and LRV exposure maneuver [23, 24]. In the aspect of bypass surgery for portal hypertension, the body of the pancreas is located in the anterior pararenal, the tail of the pancreas - within the splenorenal ligament, and the kidneys and renal vessels - in the perirenal anatomical space [25]. In addition, the inferior vena cava and pancreas are located in the central zone I, and the kidneys and their vessels - in the lateral zone II [26]. Toldt's fascia (*Toldt fascia*; synonym: *prerenal* fascia, *fascia prerenalis*) is

the only barrier between LRV *(v. Renalis sinistra)* and SV *(v. Lienalis)*. Dissection of Toldt's fascia allows both veins to be exposed simultaneously [27].

There are various intraoperative approaches to SV and renal vein in portal hypertension. In the classical version, the technique of applying the distal splenorenal anastomosis involves the isolation and connection of the SV and LRV from the intraperitoneal approach. A long midline incision is made. The transverse colon is lifted upward and cranially. A transverse incision is made at the root of the mesentery of the transverse colon to the left of the mesenteric vessels. The lower edge of the pancreas is easily recognized. It is gently lifted cranially. In the retroperitoneal tissue behind the pancreas, a section of SV is isolated in the area of its junction with the inferior mesenteric vein, followed by gradual release from the surrounding tissues in the distal direction of the vein segment 4 to 6 cm long. According to the authors, the approach through a transverse incision in the mesentery of the transverse colon allows the pancreas to be freely mobilized by turning it and producing traction with much less trauma to the organ [4].

Other authors consider the long left hypochondrium incision through the right rectus muscle to be the preferred incision. The SV and LRV are accessed through the lesser omentum to expose the pancreas and retroperitoneal space. The gastroepiploic arcade is crossed from the pylorus to the first short gastric vessels. Exposure is greatly improved by mobilizing the splenic flexure of the colon. This allows access to the lower edge of the pancreas, which is mobilized along its entire length. The access key is to dissect the pancreas from the SV, not the vein from the pancreas. Then the LRV is isolated and mobilized from the retroperitoneal space [11].

A similar intraoperative surgical maneuver to expose the LRV and its tributaries, as well as the inferior mesenteric vein to the place of its confluence with the SV during resection of the LRV aneurysm, was proposed by *A. Rios et al*. The abdominal cavity was entered through the upper midline incision. The transverse colon was retracted upward, and the small intestine was retracted to the right side. The retroperitoneal tissue was divided between the inferior mesenteric vein and the duodenum, and the duodenum was mobilized to expose the place where the LRV enters the vena cava and the inferior mesenteric vein before its confluence with the SV [28].

I.I. Kagan et al. displaced the loops of the small intestine to the right after laparotomy. In the avascular area, the gastrocolic ligament was opened. The splenic vein was dissected for 5–6 cm. Then the parietal peritoneum was opened and LRV was isolated [29].

E.I. Galperin et al. mobilized SV from the site of the portal vein formation in the proximal direction by 4 cm during upper median laparotomy by access through the left mesenteric sinus along the lower edge of the pancreas. The parietal peritoneum was dissected over the LRV and the latter was isolated in the area of the proposed anastomosis. The SV was transected, after which the distal splenorenal anastomosis was formed. The integrity of the parietal peritoneum was restored [30]. However, the general disadvantages of the intraperitoneal approach are trauma, significant surgical blood loss, and in some patients, the inability to isolate SV due to complex topographic and anatomical conditions.

In cases where there are contraindications for the transperitoneal approach, for example, in patients who have undergone several abdominal operations, the task is achieved by the fact that the isolation and anastomosis of the SV and LRV is performed extraperitoneally, and the isolation of SV is performed in new anatomical ratios, in which the SV in the wound is and the pancreas veins are located anterior to the pancreas, in connection with which the isolation, ligation and intersection of the pancreatic veins is performed over the pancreas, focusing on the free wall of the SV. In the position of the patient on the right side with the roller installed at the level of the XI-XII thoracic vertebra, an incision is made along the IX intercostal space to the left of the posterior axillary line to the pararectal at the level of the navel. After a layer-by-layer dissection of the skin, subcutaneous tissue and muscles, the left pleural cavity is opened. The diaphragm is dissected around the perimeter. The peritoneal sac in a blunt and sharp way is widely exfoliated anteriorly from the lumbar muscles, kidney and diaphragm. After that, the posterior surface of the tail and the body of the pancreas with the SV located on it, the anterior surface of the kidney and the renal pedicle become accessible. The prerenal fascia is opened and the renal vein is isolated over a length of 4–6 cm. Then, over a distance of 5–6 cm, SV is isolated without mobilization of the pancreas in new anatomical ratios, in which the SV and pancreatic veins in the wound are located anterior to the pancreas. For this, the veins of the pancreas are isolated, ligated and crossed over the pancreas, focusing on the free posterior wall of the SV, which is the anterior in the wound with this access. This greatly facilitates and speeds up the implementation of this stage of the operation by 1–1.5 hours, and also allows the release of SV without trauma to the pancreas and additional blood loss. According to the authors, the advantage of the retroperitoneal approach is that it excludes traumatization of the pancreas during the release of SV, simplifies and becomes more reliable the technique of the vascular suture when applying the posterior and anterior lips of the anastomosis [31]. As follows from the report of *R. Stoney et al*., the left

retroperitoneal approach avoided possible complications and ensured successful portal decompression with cessation of bleeding in each case [32]. *M.S. Barsoum et al*. presented a preliminary report on a successful posterior opening of the SV, which allows a splenorenal shunt to be performed without removing the spleen [33]. The retroperitoneal approach, reaching the hilum through the lumbar region, turned out to be less aggressive, since it avoided the risk of damage to the pancreas, provided a more direct approach to the splenic vessels, which made it easier to perform anastomoses. In addition, with this approach, according to the authors, it is possible to avoid the loss or infection of ascites fluid in patients with liver cirrhosis [34].

The disadvantages of all the above methods of exposing the vessels of the retroperitoneal space as the first stage of performing the distal splenorenal anastomosis, in our opinion, are:

1. High trauma of manipulations at the stage of vascular mobilization, which can lead in the early postoperative period to pancreatitis, shunt thrombosis, infection of the abdominal cavity.

2. Significant technical complexity of the stage of vascular mobilization and, ultimately, the implementation of the anastomosis itself.

The persistent search for a technique that allows us to avoid the above-mentioned disadvantages of all the above methods of exposing the vessels of the retroperitoneal space as the first stage of performing the distal splenorenal anastomosis, led us to the decision to fundamentally change the technical execution of this stage of the operation. As a basis, we took the surgical technique used for the medial mobilization of the left and central internal organs of the abdominal cavity: the spleen, tail and body of the pancreas, the left kidney while maintaining their integrity, in order to explore the deeper vascular structures of the I central and II left lateral zones of the retroperitoneal space, known as the Mattox maneuver or left-sided medial visceral rotation [21, 22]. A general indication for the use of the Mattox maneuver is an abdominal trauma with damage to the vessels of the I central and II left lateral zones of the retroperitoneal space with hemodynamic instability [35–37]. At the same time, left-sided medial visceral rotation in elective vascular surgery and oncology was known even before the Mattox maneuver. Diseases of the aorta, left iliac and pelvic vessels, retroperitoneal tumors or malignant metastases are also indications for its use [38]. Potentially dangerous complications of the maneuver can be caused by the mobilization procedure itself and unintentional trauma to the organs with their blood vessels being treated during the procedure. Splenic injury and ischemia of the descending colon are the most common iatrogenic complications [39].

In none of our 40 clinical observations, despite different variants of the topographic anatomy of the veins of the splenic and left renal basins and different anthropometric parameters of patients, there was not a single involuntary refusal of distal splenorenal bypass grafting and not a single unintentional injury, both of the vessels themselves and of the pancreas. gland, which is considered the main cause of intraoperative bleeding, postoperative pancreatitis, shunt thrombosis, recurrent bleeding from varicose veins and, ultimately, death. We also did not observe any specific complications associated with the implementation of the proposed intraoperative approach to the vessels of the left retroperitoneal space, including damage to the spleen and ischemia of the descending colon.

The proposed version of the surgical access to the splenic, left renal veins and their tributaries at the first stage of performing the distal splenorenal anastomosis in patients with portal hypertension of various origins provides comfortable volumetric-spatial relationships in the surgical wound, creates comfortable conditions for performing the main surgical technique - making a vascular anastomosis, has a minimal risk of developing specific complications associated with the approach to the vessels of the left retroperitoneal space.

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