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THE POSSIBILITIES OF THE APPLICATION OF INNOVATIVE TECHNOLOGIES IN THE CORRECTION OF DIURETIC – RESISTANT ASCITES IN PATIENTS WITH LIVER CIRRHOSIS

The results of the treatment of the patients with liver cirrhosis complicated with diuretic-resistant ascites, applying the Celsite® peritoneal port systems (12 patients) and peritoneovenous shunting with LeVeen valve (42 patients) are analyzed. The use of peritoneal ports allows performing a fractional and dosed reinfusion of the ascitic fluid, and this ultimately eliminates the appearance of serious complications as hemorrhagic syndrome associated with hemodilution and coagulopathy because of the massive inflow of the ascitic fluid into the venous bed.

Key words: *liver cirrhosis, portal hypertension, peritoneal port system, diuretic-resistant ascites.*

One of the most difficult problems of hepatology is the treatment of diuretic-resistant ascites (DRA) in patients with liver cirrhosis (LC). The conservative treatment does not allow getting the expected results; the use of laparocentesis to alleviate their condition, usually leads to the development of ascites-peritonitis and death in 50% of patients within 6 months [2].

The removal of 10-15 liters of ascitic fluid worsens the already critical condition of the patient, aggravates hemodynamic disorders, and contributes to the progression of hypo-and dysproteinemia, hypovolemia and other severe disorders of homeostasis, the development of complications related to the puncture of the abdominal cavity [1, 4].

Over the past decade, the peritoneovenous valvular shunting which is more pathogenetically oriented and causes minimal injuries has been a perspective and crucially new direction in the surgical treatment of refractory ascites [6]. However, the development of complications such as thrombosis or the infection of the shunt, recurrent esophageal bleeding are possible [3].

The above indicate the need for improved methods of the correction of refractory ascites and search for minimally invasive alternative interventions.

The aim of the study is to assess the results and determine the effectiveness of a new method for the correction of DRA in patients with LC – PH syndrome with the application of the completely implanted Celsite® peritoneal port systems.

Material and methods

We observed 104 patients with LC in the stage of sub- and decompensation of PH, complicated with edematous- ascitic syndrome. At that, moderate ascites was found in 34 (32.7%) patients, tense ascites – in 67 (64.4%) patients, and the presence of free fluid in the abdominal cavity was determined by instrumental methods in 3 (2.9%) cases. In 101 (97.1%) cases, the presence of ascites at admission was identified without special methods of investigation. Thirty-one (57.4%) patients had a history of repeated laparocentesis.

The results of the correction of DRA in 54 patients with LC are analyzed; at that, the Celsite® peritoneal port systems (PPS) were implanted in 12 (22.2%) patients (group I) and the peritoneovenous shunting (PVSh) with LeVeen valve was performed in 42 (77.8%) patients (group II). The presence of tense ascites, resistant to conservative therapy for more than 8-12 months was the indication for the surgical intervention. According to Child classification, 31 patients fell into functional group B and 23 patients – into C. Thirty-five patients were males and nineteen patients were females. The majority of patients (34 (62.9%) were at the age of 21-60 years, i.e. at the most active working age. The significant enlargement of the abdomen and the anterior abdominal wall tension due to the ascitic fluid made it impossible to perform the palpation of the abdominal cavity organs in 33 (78.6%) cases.

The technique of the PVSh is well known and described in the literature in detail [3, 5]. The technique of the implantation of the PPSs was as follows: first, the ascitic fluid was investigated to solve the issue of the allowability of autoreinfusion of ascitic fluid. Then, the PPS was completely implanted in the patient under regional anaesthesia (Fig. 1).

At that, the catheter of the port was introduced into the abdominal cavity through the incision on the abdominal wall. The working end of the catheter was directed to the left iliac fossa with the implantation to the abdominal rectus muscle, on to the cuff, and then it was carried to the port placed on the base of ribs. The port was washed with saline solution; the catheter was cut to the required length and connected to the port. Subsequently, the nonreusable transfusion system carried through the Braun FMS infusion pump was connected to the port system; the venous end of the transfusion system was connected to the subclavian vein. The reinfusion of the ascitic fluid was conducted at 15-20 ml per minute, fractionally, by 500-700 ml, at intervals of 5-7 minutes, to prevent the overload of the cardiovascular system and the let the introduced fluid be redistributed. The autoreinfusion of the ascitic fluid was performed every day, at a volume of 1.5-2.5 L, fractionally, dosing, taking into account the patient's general condition and hemodynamic parameters.

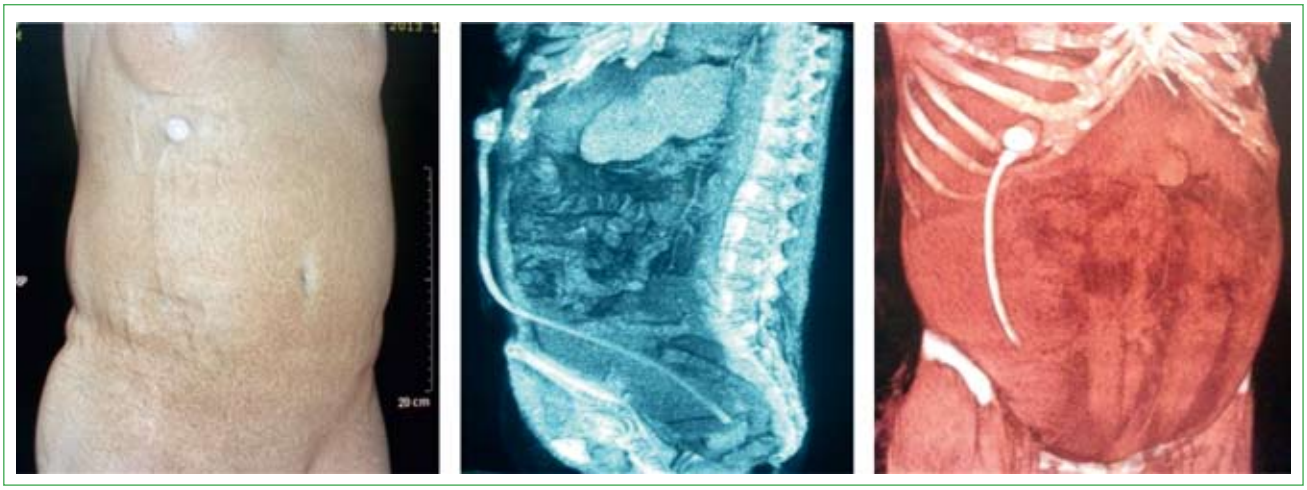

Figure 1 – Computed tomography of the PPS implanted in the abdominal cavity of the three-dimensional reconstruction

Eighteen patients (5 – group I, 13 – group II) developed toxic-allergic reactions during the introduction of the ascitic fluid. To prevent such complications, the subsequent reinfusions were performed after the exposure of the ascitic fluid to low-intensity laser irradiation (LILI): 11 –outside the organ, 7 – intraperitoneally. In these cases, in advance, before the reinfusion, the irradiation of the ascitic fluid was performed with the low-intensity helium-neon laser of LG-75 apparatus, through a waveguide with an output power of 10 mW, an exposure of 10-15 minutes, and a wavelength of 0.63 μm in a continuous mode.

Given the fact, that the risk of hemorrhagic syndrome is significantly increased in the reinfusion of ascitic fluid, the preventive endoscopic sclerotherapy (EST) was performed in 19 cases of the presence of DRA and pronounced esophageal varices and gastric cardia. The preventive EST was used in 5 patients before the implantation of the PPS and in 14 patients before the installation of PVSh. All patients were operated on a planned basis after they had undergone a course of preoperative preparation. The surgical interventions on the implantation of the PPS and LeVeen valves were conducted under regional anesthesia, and in our opinion, that is a big advantage of such operations on the background of the exhausted functional reserves of the liver when all the compensatory reactions of the body are used up. In all cases of the implantation of the port systems and reinfusion of the ascitic fluid, as well as during the laparocentesis for the investigation of the ascitic fluid, the determination of the intra-abdominal pressure was performed, which was 249.0±78.0 mm w.g on average. The values of the CVP before the operation were in the range of 49.0±16.0 mm w.g. The efficacy endpoints of the operation conducted were the changes in the abdominal circumference (the perimeter at the level of the umbilicus), the patient's body weight, the urinary output per day, the indices of the clinical analyses and biochemical tests. A daily weighing of the patients on an empty stomach with a standard measurement of the abdominal perimeter was conducted to determine the regression and stabilization of ascites. The findings were compared with the results of preoperative examinations.

Results and discussion

The ascitic process dynamics was observed during the control ultrasound examinations. During the postoperative period, a course of conservative therapy, including broad-spectrum antibiotics, analgesics, hepatoprotectors, the transfusion of protein preparations and blood substitutes and conditioning exercises was prescribed for all the patients. At that, diuretics, cardiac glycosides, β-blockers were included to prevent the overburden of the pulmonary circulation. The dynamic control of the CVP indices was performed to adequately calculate their dosages. During the immediate postoperative period, there was a reduction of the abdominal perimeter – from 116±14 cm to 94±11 cm. At that, first, there was an increase in the daily urine output – from 620.0±110.0 ml to 2.2±0.4 L (group I) and 4.8±1.3 L (group II) during the first days and subsequently to 1.7±0.5 L, after stopping the administration of diuretics. In cases of the PVSh, the reduction of the ascites was observed during the first 3 weeks, the maximal one – during the first three days; The implantation of the port systems as a result of the fractional, dosed transfusion of the ascitic fluid led to a gradual regression of the abdominal perimeter and a steady increase in the daily urine output, which prevented the appearance of serious complications associated with the massive inflow of the ascitic fluid into the venous bed. The use of PPS in the treatment of refractory ascites is a controlled process which enables to carry out the reinfusion of the ascitic fluid by portions.

Conducting the ascites – correcting operations aimed at the drawing the ascitic fluid into the venous bed can cause the appearance of serious complications as hemorrhagic syndrome associated with hemodilution and coagulopathy because of the massive reinfusion of the ascitic fluid into the venous bed, which was more pronounced in group II of patients with peritoneovenous valvular shunting.

To prevent the pointed out complications, the implantation of the peritoneal port systems was always conducted taking into account the patients' general condition hemodynamic parameters, conducting intensive conservative therapy, as well as by the minimization of the starting dose of the reinfused ascitic fluid – within 0.8±0.25 L. The procedure of the autoreinfusion

Table 1 – **The results of the application of the peritoneal port systems and peritoneovenous shunting in the patients with liver cirrhosis complicated with diuretic-resistant ascites**

Operation	The number of patients	The result of the treatment			
		good	satisfactory	not satisfactory	lethal outcome
Peritoneal port systems	12	4 (33,3%)	6 (50%)	2 (16,7%)	1 (8,3%)
Peritoneovenous shunting	42	9 (21,4%)	16 (38,1%)	17 (40,5%)	12 (28,6%)

with astitic fluid was continued until the complete regression and stop of the process.

The operative treatment on the implantation of the PPS and installation of the PVSh started after a preliminary course of complex conservative therapy; in 2 cases this tactic resulted in the regression of ascites with its complete disappearance.

However, as our experience has shown, the slow performance of the operations in DRA can lead to the deterioration of the patients' general condition, the occurrence of serious complications as the appearance of ventral hernias as a result of the anterior abdominal wall overdistension and the emergence of chylous ascites, which makes it impossible to perform the PVSh and ultimately it has a negative impact on the outcomes of the conducted interventions and casts some doubt on its effectiveness.

The presence of these complications was not a contraindication for the implantation of the PPS. A greater frequency of postoperative complications in group II of patients, where the PVSh was applied, was associated with the development of hemodilution and hypocoagulation.

The malfunction of the PVSh due to its obstruction on any segment led to the development of recurrent ascites in 9 patients of group II, followed by the surgical removal of obstacles.

The EST was conducted in 24 patients: in 5 (41.7%) patients it was combined with the implantation of the PPS and in 19 (45.2%) cases it was with the installation of the peritoneovenous valvular shunt. The application of the preventive EST during the preoperative period made it possible to halve the number of gastroesophageal bleeding during the early postoperative period compared with a group of patients who had not undergone the EST during the preoperative period. We associate the occurrence of hemorrhagic syndrome in patients of group II, even despite the conducted EST combined with the LILI, with the development of pronounced phenomena of coagulopathy on the background of the massive reinfusion of ascites. The use of the PPS eliminated the appearance of such a complication owing to the dosed, fractional transfusion of the ascitic fluid. A significant difference in the postoperative mortality rates also took place. The improvement of the surgical methodology led to the reduction or prevention of complications related to the reinfusion of the ascitic fluid.

There was a positive effect of the LILI on the ascitic fluid in its reinfusion, which allowed minimizing the duration of leveling the functional disorders of the liver and kidneys and preventing the occurrence of allergic reactions associated with the reinfusion of the ascitic fluid in18 patients (5 patients – group I and 13 patients – group II). The technique allows conducting an effective desensitization of the reinfused ascitic fluid and prevents the risk of toxic-allergic reactions. A decrease in the abdominal perimeter in the postoperative period, the indices of which were within 116±14 cm before the operation was considered as the efficacy endpoints of the conducted intervention. The technique of the autoreinfusion of the ascitic fluid with the application of the peritoneal port system allowed normalizing the homeostatic indices in all cases.

A good result of the surgical treatment was achieved in 4 (33.3%) patients of group I and in 9 (21.4%) patients of group II; at that, there was an adequate diuresis without any stimulation on a background of the satisfactory feeling with the normalization of the appetite, sleep and stool; there was no ascites (Table 1).

The presence of mild ascites with an adequate diuresis which was identified in 6 (50%) and 16 (38.1%) cases, respectively, in patients receiving diuretics was regarded as satisfactory. At the same time in all cases there was a significant regression of ascites: a complete disappearance of ascites was in 5 patients of group I and in 11 patients of group II; ascites determined only by the ultrasound examination was in 1patient of group I and 3 patients of group II; a pronounced reduction with a steady stabilization of ascites was in 1 patient of group II; ascites did not grow without the use of diuretics, and the minimum intake of diuretics provided an adequate diuresis, thus avoiding the necessity of laparocentesis in 1 patient of group II.

The unsatisfactory outcomes included the cases of ascites rise with a repeated laparocentesis, lack of diuresis during the stimulation with diuretics and remote complications (thrombosis or an infection of the implant) which were observed in 2 (16.7%) patients of group I and 17 (40.5%) patients of group II. The reasons for the ineffectiveness of the PVSh in 3 cases were a high CVP caused by the chronic heart failure that resulted in the non-functioning of the shunt due to lack of the necessary pressure gradient between the abdominal cavity and the venous system. In 2 cases, the above mentioned condition was due to the thrombosis and the overbending of the venous catheter shunt. In the application of the PPS there were no such complications.

The mean duration of the PPS functioning was 8 months; the maximal duration was observed until 14 months; 1.5 years and 5 years, respectively in the application of the PVSh. In different remote times of the postoperative period we rehospitalized and reexamined 23 (54.8%) patients. As the experience showed, the PPS could be used for a long time – up to several years.

During the immediate postoperative period, the lethal outcomes were observed in 12 patients after the PVSh and in 1 patient after the implantation of the PPS.

At that, 8 patients of group II were discharged from the hospital because of the growth of phenomena of hepatocellular and renal failure in the incurable condition, while there was no reduction of ascites; 5 decompensated patients did not have an effect of the operation: the ascites quickly rose up to the operational level, became tense and advanced in the presence of the evidently non-functioning shunt. The conduction of the operation with the PVSh was fraught with the appearance of

hemorrhagic syndrome from the zone of the gastroesophageal collector, while the inclusion of some therapeutic activities of the preventive EST led to a relative decrease in the number of postoperative complications.

The conduction of the operation using PPS with a fractional, dosed reinfusion of ascitic fluid eliminated the development of severe fatal complications that led to adverse outcomes.

Conclusions

1. The corrections of diuretic-resistant ascites in patients with liver cirrhosis using completely implanted the Celsite® peritoneal port system and peritoneovenous shunting are pathogenetically effective operations and lead to the improved functional condition of the hepatorenal system, the regression and relief of ascites, allow removing the use of the vicious treatment technique – laparocentesis from the therapeutic activities.

2. The application of the peritoneal port system allows extending the range of the indications and possibilities of the surgical correction of diuretic-resistant ascites significantly: performing the implantation at a low gradient between the intra-abdominal and CVP, in the presence of chylous ascites, as well as in ventral hernias. Compared to this, the range of indications in the peritoneovenous shunting is limited and performable if there is a sufficient gradient between the intra-abdominal and CVP, transparent ascitic fluid with minimal viscosity, as well as in the absence of ventral hernias of the anterior abdominal wall.

3. The use of the peritoneal ports in the correction of diuretic-resistant ascites is a controlled process which enables to carry out a fractional, dosed reinfusion of the ascitic fluid taking into account the patients' general condition and hemodynamic parameters, which ultimately eliminates the appearance of serious complications such as hemorrhagic syndrome associated with hemodilution and coagulopathy because of the massive inflow of the ascitic fluid into the venous bed.

4. The conduction of the reinfusion of ascitic fluid using the peritoneal port system proved to be an effective, minimally invasive treatment and can be an alternative to the existing peritoneovenous shunting techniques in the treatment of diuretic-resistant ascites. The inclusion of the preventive sclerotherapy of varicose veins into the complex treatment allows decreasing the possibility and frequency of hemorrhagic syndrome and extending the range of indications for ascites-correcting interventions.

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ТҰЖЫРЫМ

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Х.А. Ясави атындағы Халықаралық Қазақ-Түрік университетінің дипломнан кейінгі білімнің оқу-клиникалық орталығы, Шымкент қ.

БАУЫР ЦИРРОЗЫМЕН АУЫРАТЫНДАРДА ДИУРЕТИКОРЕЗИСТЕНТТІ АСЦИТТІ ТҮЗЕТУДІҢ ИННОВАЦИЯЛЫҚ ТЕХНОЛОГИЯЛАРЫН ҚОЛДАНУ МҮМКІНДІКТЕРІ

Перитонеальды Celsite® (12 науқастар) порт жүйесін және Левин клапанын (42 науқастар) перитонеовенозды шунтирлеуді қолдана отырып, асқынған диуретикорезистентті асцитті бауыр циррозымен ауыратындарды емдеу нәтижелері талданған. Перитонеальды порттарды пайдалану асцитореинфузияны бөлшекті, мөлшерлеп жүзеге асыруға мүмкіндік береді, бұл ақырғы нәтижесінде венозды арнаға асцитті құрамының массивті келіп түсуі негізіндегі гемодилюция мен коагулопатиямен байланысты геморрагиальды синдром түріндегі ауыр асқынулардың орын алуын болдырмайды.

Негізгі сөздер: *бауыр циррозы, портальды гипертензия, перитонеальды порт-жүйе, диуретикорезистентті асцит.*

РЕЗЮМЕ

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ВОЗМОЖНОСТИ ПРИМЕНЕНИЯ ИННОВАЦИОННЫХ ТЕХНОЛОГИЙ В КОРРЕКЦИИ ДИУРЕТИКОРЕЗИСТЕНТНОГО АСЦИТА У БОЛЬНЫХ ЦИРРОЗОМ ПЕЧЕНИ

Анализированы результаты лечения больных циррозом печени, осложненным диуретикорезистентным асцитом, с применением перитонеальной порт-системы Celsite® (12 больных) и перитонеовенозным шунтированием клапаном Левина (42 больных). Использование перитонеальных портов позволяет осуществить асцитореинфузию дробно, дозированно, что в конечном итоге исключает возникновение серьезных осложнений в виде геморрагического синдрома, связанных с гемодилюцией и коагулопатией на почве массивного поступления асцитического содержимого в венозное русло.

Ключевые слова: *цирроз печени, портальная гипертензия, перитонеальная порт-система, диуретикорезистентный асцит.*

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