

РОЛЬ СОСУДИСТЫХ РЕКОНСТРУКЦИЙ В ХИРУРГИИ ОПУХОЛЕЙ ГЕПАТОПАНКРЕАТОБИЛИАРНОЙ ЗОНЫ

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Многие годы существовала общепринятая точка зрения, согласно которой панкреатодуоденальная резекция показана только при локализованных опухолях поджелудочной железы опухолях без вовлечения магистральных сосудов. Учитывая распространенность данной патологии, в последнее время многие авторы указывают на необходимость выполнения резекции опухоли поджелудочной железы единым блоком с вовлеченными сосудами, что дает шанс повысить резектабельность большому числу пациентов. **Цель.** Анализ резектабельности опухолей поджелудочной железы по данным современных клинических исследований. Множество различных хирургических подходов за последние десятилетия было усовершенствовано, что позволяет увеличить шансы на успешное и безопасное оперативное вмешательство. Данные проведенного анализа источников литературы по проблеме сосудистых реконструкций в хирургии опухолей гепатопанкреатобилиарной зоны показали, что резекции и реконструкции мезентерикопортального венозного сегмента позволяют повысить резектабельность опухоли и должны соответствовать основополагающим принципам хирургической онкологии. На сегодняшний день по частоте послеоперационных осложнений и летальности статистически значимых различий между больными, которым резекция сосудов выполнялась, и больными со стандартной панкреатодуоденальной резекцией не выявлено. Тщательный предоперационный отбор больных наряду с правильной стратегией венозной реконструкции одинаково важны для правильной и успешной резекции сосудов *en bloc*.

Ключевые слова: панкреатодуоденальная резекция; рак поджелудочной железы; резектабельность; сосудистые реконструкции.

THE ROLE OF VASCULAR RECONSTRUCTIONS IN SURGERY OF TUMORS OF THE HEPATOPANCREATOBILIARY ZONE

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According to the point of view that has been dominating for many years, pancreatoduodenal resection was indicated only for localized tumors of the pancreas without involvement of the major vessels. In view of the prevalence of this pathology, many authors have recently pointed out the need to perform resection of a pancreatic tumor in a single bloc with the vessels involved, which gives a chance to increase the resectability in a larger number of patients. **Aim.** Analysis of resectability of pancreatic tumors on the basis of the data of current clinical research. In recent



decades many different surgical approaches have been improved which increases chances for successful and safe surgical intervention. The data of the analysis of literature on vascular reconstructions in surgery for tumors of the hepatopancreatobiliary zone showed that resections and reconstructions of the mesenteric portal venous segment permit to increase resectability of tumor and should correspond to the fundamental principles of surgical oncology. To date, in terms of the incidence of postoperative complications and mortality, no statistically significant differences were found between the group of patients in whom vascular resection was performed, and the group with a standard pancreatoduodenal resection. A thorough preoperative selection of patients along with the correct strategy of venous reconstruction is equally important for correct and successful resection of the blood vessels *en bloc*.

Keywords: *pancreatoduodenal resection; pancreatic cancer; respectability; vascular reconstructions.*

According to statistical data, pancreatic cancer (PC) in Russia causes 13 000 deaths per year. Approximately the same amount of newly diagnosed cases of PC is annually reported. Gender analysis of PC mortality showed a higher incidence of the disease in men: 10 cases per 100,000 of male population, while the incidence in women is 8.1 per 100,000 of female population. PC is the fourth leading cause of death from neoplastic diseases in men and the sixth cause in women (4.1 and 4.7%, respectively).

The *aim* of this work was to analyze resectability of pancreatic tumors (PT) based on the data of modern clinical studies (CS).

History of development of extended pancreatoduodenal resection (PDR). There are no principal differences as to the methods and stages of implementation of standard PDR, since they are well developed both in Russia, Western Europe, USA and Japan. Differences concern indications for standard PDR at suspicion on tumor invading the major vessels of hepatopancreatobiliary region (HPBR).

According to the commonly accepted point of view existing for many years, PDR is indicated for localized PT without involvement of the major vessels. In 1952, C.G. Child et al. for the first time performed ligation of the portal vein in case of tumor of HPBR. It was shown in the experiment that ligation of the portal vein led to shock and rapid death of experimental animals. In the meanwhile, the maximal time of compression of the portal vein in a human is 30 min [2,3].

G.E. Moore, et al. (1951) first performed resection of the superior mesenteric vein in PC. In 1973 J.G. Fortner formulated the concept of «*regional pancreatectomy*» which suggested the extended PDR to be supplemented with systematic resection of the main vascular peripancreatic structures together with a wide lymph node dissection.

The rate of invasion of pancreatic tumor into the major vessels reaches 7.7%, with this, macroscopic suspicion on tumorous infiltration of the vessel walls is present in 75-100% of patients with this pathology [4]. For a long time invasion of the pancreatic cancer into the major vessels has been considered a contraindication for a radical surgery. After 2007 many researchers showed that immediate and long-term results of surgery with resection of major vessels are not worse than the results of standard PDR [6,7]. Thus, in the recent decade indications for radical and conventionally radical interventions were expanded, that is, resectability rate increased. Here, tumor invading the zone of fusion of the splenic and superior mesenteric veins is not always resectable because of poor conditions for mobilization of the tumor and for retroperitoneal lymph node dissection. Resection and ligation of the splenic vein considerably simplify the technical aspect of the task, but lead to splenic infarction, left-sided portal hypertension and threaten with gastric hemorrhage.

Nowadays, in case of invasion of the major vessels by tumor, there are performed

resection and prosthetic repair of the superior and inferior venae cavae and also of the aorta. Besides, many clinics perform operation for removal of tumor thrombi and of large tumors with hemodynamically significant stenoses of major vessels with good immediate and long-term results [8].

Modern methods and indications for pancreatoduodenal resection in invasion of tumor into major vessels. Today different methods are proposed for recovery of the portal blood flow in case of resection of venous wall in the zone of confluence [9]. Reconstruction of resected splenic vein with an autovein is performed by splenoportal or splenorenal «end-to-end» anastomosis, but is associated with a high rate of thrombosis of the anastomosis due to developing tension, and use of the autovein makes the intervention longer and more complicated [10-12].

During 5-year period, M.A. Mansour, et al. performed 16 venous resections using polytetrafluoroethylene prostheses and the great saphenous vein in case of invasion of tumor into the inferior vena cava (8 patients), portal vein (7 patients), and iliac vein (1 patient). Reconstruction of the portal vein in 4 patients was performed in the form of «end-to-end» anastomosis and in 4 patients – with use of the great saphenous vein. Reconstruction of the inferior vena cava was performed by application of «end-to-end» anastomosis, and of the iliac vein – by prosthetic repair with an autovein. Within 9 months all the anastomoses were patent except one. The authors made a conclusion that large venous reconstructions are required in a small number of patients, and «end-to-end» anastomosis or autovenous prosthetic repair are more preferable than ligation or use of an artificial prosthesis [13,14].

Standard PDR in combination with resection of the superior mesenteric and the portal vein was performed in N.N. Blokhin Russian Cancer Research Center of RAMS in 25 patients – a circular resection with the length of venous segment from 2.5 to 4 cm in 17 patients and a marginal resection of the venous wall in 8 patients. No statistical-

ly significant differences in the rate of post-operative complications (44%) and mortality rate (4%) were revealed between the groups of patients with resection of vessels and with standard PDR. According to the data of N.N. Blokhin Russian Cancer Research Center of RAMS, prognostic ally significant factors were:

- retroperitoneal extra organ invasion and invasion into the wall of the superior mesenteric and the portal vein;
- degree of differentiation of tumor;
- invasion into the anterior capsule of pancreas.

Resection of the superior mesenteric and the portal vein in PDR did not prolong life in comparison with patients in whom venous resection was not performed [15].

M. Shoup, et al. (2003) analyzed the results of distal resections of pancreas with resection of vessels and of adjacent organs [27]. The study included 513 patients with lesion of the body and tail of pancreas. Of them, 57 (11%) were operated on. In 22 patients extended PDR was performed, in 14 of them the operation was supplemented with resection of the adjacent organs, in 8 – with resection of the portal vein. The median of life duration after extended PDR was 15.9 months and after standard PDR – 5.8 months ($p < 0.0001$). Overall survival within one and two years after extended PDR reached 22% and 18%, respectively, after standard PDR – 8 and 8%, and without resection because of invading of local structures – 0% in both groups. The authors showed reasonability of the extended distal pancreatectomy in case of locally advanced cancer of the body and tail of pancreas [16].

Arterial resections are rarely performed in case of locally advanced tumor of pancreas because of a high occurrence of infiltration of the retroperitoneal nervous plexus, and are associated with a poor prognosis. Since the operation is technically challenging, the question of arterial resection in patients with past PDR was touched upon only in few studies [17,18].

In a study of Yu.I. Patyutko et al. a circular resection of the tumorous celiac trunk and the common hepatic artery with resection

of veins was conducted in 10 patients (in 6 – parietal resection, in 3 – circular resection with the primary anastomosis, in 1 – prosthetic repair with polytetrafluoroethylene). In the early postoperative period after distal subtotal resection of pancreas with resection of celiac trunk, complications developed in 10 patients (47.6%). After conducted surgical treatment no lethal outcomes were recorded. In histological examination, the resection edges, including the retroperitoneal edge, did not contain tumor elements (R0 in all cases). Invasion into the celiac trunk and the common iliac vein was identified in 16 patients (76.2%, depth of invasion – adventitia in 11 patients and media in 5 patients). Survival rate within the first two years in patients operated for locally advanced duct carcinoma of the body and tail of pancreas using distal subtotal resection of pancreas with resection of the celiac trunk, was 59.1 and 21.5% with maximal duration of life 57 months. Thus, authors came to the conclusion about distal subtotal resection of pancreas with resection of the celiac trunk and the common hepatic artery as being a safe operation that heightens resectability and considerably extends the range of indications for resection of the body and tail of pancreas [19,20].

The aim of study of S. Mohammed, et al. was to determine perioperational mortality rate in patients with PDR with/without venous resection, and the long-term results concerning patency of the zone of reconstruction of the vein, and also assessment of oncological outcomes for patients with PDR with/without venous resection in adenocarcinoma of pancreas. In case of involvement of segments of the vein, «end-to-end» anastomosis was performed, in case of resection of more than 2 cm of vein – prosthetic repair using the internal jugular vein [21].

In meta-analysis of 27 research works (n=9005), improvement of 1-, 3-, and 5-year survival rate of patients with past PDR with venous resection was recorded (n=1587) [22-25].

According to the results of pathoanatomical examination (N.N. Blokhin

RCRC) of the long-term preparations after extended gastropancreatoduodenal resection with resection of mesentericoportal venous segment, invasion of the tumor into the wall of venous segment was histologically confirmed in 72.2% of cases. Besides, different combinations of invasion of the tumor into the wall of vein, artery and also existence of a tumor thrombus in the venous lumen were found. Thus, in cancer of the head of pancreas, extended PDR with resection of a venous segment is indicated irrespective of the size of tumor [26-28].

A group of experts of the American Hepato-Pancreato-Biliary Association and Society of Surgical Oncology (AHPBA/SSO) joined their efforts for development of a consensus document on the problem of resection and reconstruction of veins in PDR (published in 2009). Experts arrived at the conclusion that *PDR with resection and reconstruction of veins should be a variant of treatment for tumor of pancreas located in close proximity to the venous wall on the following conditions: existence of the adequate venous inflow and outflow; non-involvement of the superior mesenteric artery or of hepatic artery; a high probability for R0/R1 resection*. It is also said in the given consensus document that *patients with non-metastatic adenocarcinomas should be assessed and operated on in the institutions that have potential for performing resections and reconstructions of major veins* [29].

So, many researchers show feasibility of venous resection. Nevertheless, the data concerning benefits of the arterial resection are limited, that is why it should be performed only in the context of randomized clinical studies of adequate potential.

Conclusion

Analysis of the literature on the problem of vascular reconstructions in the surgery of tumors of hepatopancreatobiliary zone showed that resections and reconstructions of mesentericoportal venous segment permits to high ten resectability of the tumor and should correspond to the fundamental principles of surgical oncology.

In recent years, numerous surgical approaches have been improved that increases the chances for successful and safe surgical intervention.

Only thorough preoperative selection of patients together with a correct strategy of venous reconstruction are equally important for correct and successful resection of vessels *en bloc*.

Литература

1. Патютко Ю.И., Котельников А.Г., Абгарян М.Г. Современное хирургическое и комбинированное лечения больных экзокринным раком головки поджелудочной железы и органов периапулярной зоны // Практическая онкология. 2004. Т. 5, №2. С. 94-107.
2. Child C.G., Holswade G.R., McClure R.D., et al. Pancreaticoduodenectomy with resection of the portal vein in the Macaca mulatta monkey and in man // Surgery, Gynecology & Obstetrics. 1952. Vol. 94, №1. P. 31-45.
3. Pan G., Xie K.L., Wu H. Vascular resection in pancreatic adenocarcinoma with portal or superior mesenteric vein invasion // World Journal of Gastro-enterology. 2013. Vol. 19, №46. P. 8740-8744. doi:10.3748/wjg.v19.i46.8740
4. Porembka M.R., Hawkins W.G., Linehan D.C., et al. Radiologic and intraoperative detection of need for mesenteric vein resection in patients with adenocarcinoma of the head of the pancreas // HPB. 2011. Vol. 13, №9. P. 633-642. doi:10.1111/j.1477-2574.2011.00343.x
5. Патютко Ю.И., Котельников А.Г. Хирургия рака органов билиопанкреатодуоденальной зоны. М.: Медицина; 2007.
6. Leach S.D., Lee J.E., Charnsangavej C., et al. Survival following pancreaticoduodenectomy with resection of the superior mesenteric portal vein confluence for adenocarcinoma of the pancreatic head // British Journal of Surgery. 1996. Vol. 85, №5. P. 611-617. doi:10.1046/j.1365-2168.1998.00641.x
7. Kim P.T., Wei A.C., Atenafu E.G., et al. Planned versus unplanned portal vein resections during pancreaticoduodenectomy for adenocarcinoma // British Journal of Surgery. 2013. Vol. 100, №10. P. 1349-1356. doi:10.1002/bjs.9222
8. Давыдов М.И. Перспективные направления в онкохирургии // Клиническая онкология. 2011. №1(1). С. 10-12.
9. Clavien P.A., Rüdiger H.A. A simple technique of portal vein resection and reconstruction during pancreaticoduodenectomy // Journal of the American College of Surgeons. 1999. Vol. 189, №6. P. 629-634.
10. Sanjay P., Takaori K., Govil S., et al. 'Artery-first' approaches to pancreatoduodenectomy // British Journal of Surgery. 2012. Vol. 99, №8. P. 1027-1035. doi:10.1002/bjs.8763
11. Liao K., Wang H., Chen Q., et al. Prosthetic graft for superior mesenteric-portal vein reconstruction in pancreaticoduodenectomy: a retrospective, multi-center study // Journal of Gastrointestinal Surgery. 2014. Vol. 18, №8. P. 1452-1461. doi:10.1007/s11605-014-2549-6
12. Turley R.S., Peterson K., Barbas A.S., et al. Vascular surgery collaboration during pancreaticoduodenectomy with vascular reconstruction // Annals of Vascular Surgery. 2012. Vol. 26, №5. P. 685-692. doi:10.1016/j.avsg.2011.11.009
13. Mansour M.A., Wheatley B., Gorsuch J.M., et al. Large Vein Reconstruction with Oncologic Procedures // Journal of Vascular Surgery. 2010. Vol. 51, №3. P. 795. doi:10.1016/j.jvs.2009.11.026
14. Hemming A.W., Kim R.D., Mekeel K.L., et al. Portal vein resection for hilar cholangiocarcinoma // American Journal of Surgery. 2006. Vol. 72, №7. P. 599-604; discussion 604-605.
15. Giovinazzo F., Turri G., Katz M.H., et al. Meta-analysis of benefits of portal-superior mesenteric vein resection in pancreatic resection for ductal adenocarcinoma // British Journal of Surgery. 2016. Vol. 103, №3. P. 179-191. doi:10.1002/bjs.9969
16. Shoup M., Conlon K.C., Klimstra D., et al. Is Extended Resection for Adenocarcinoma of the Body or Tail of the Pancreas Justified? // Journal of Gastro-intestinal Surgery. 2003. Vol. 7, №8. P. 946-952; discussion 952. doi:10.1016/j.gassur.2003.08.004
17. Kondo S., Katoh H., Hirano S., et al. Results of radical distal pancreatectomy with en bloc resection of the celiac artery for locally advanced cancer of the pancreatic body // Langenbeck's Archives of Surgery. 2003. Vol. 388, №2. P. 101-106. doi:10.1007/s00423-003-0375-5
18. Murakami Y., Satoi S., Motoi F., et al. Portal or superior mesenteric vein resection in pancreatoduodenectomy for pancreatic head carcinoma // British Journal of Surgery. 2015. Vol. 102, №7. P. 837-846. doi:10.1002/bjs.9799
19. Патютко Ю.И., Абгарян М.Г., Кудашкин Н.Е., и др. Резекция чревного стола при раке тела и хвоста поджелудочной железы с выраженным болевым синдромом // Хирургия. Журнал им. Н.И. Пирогова. 2016. №11. С. 8-18. doi:10.17116/hirurgia2016118-18
20. Кригер А.Г., Кармазановский Г.Г., Смирнов А.В., и др. Диагностика и лечение рака головки под-

- желудочной железы, прорастающего мезентерико-портальный сегмент вен // Хирургия. Журнал им. Н.И. Пирогова. 2018. №12. С. 21-29. doi:10.17116/hirurgia201812121
21. Mohammed S., Mendez-Reyes J.E., McElhany A., et al. Venous thrombosis following pancreaticoduodenectomy with venous resection // *Journal of Surgical Research*. 2018. Vol. 228. P. 271-280. doi:10.1016/j.jss.2018.02.006
22. Ravikumar R., Sabin C., Abu Hilal M., et al. Portal vein resection in borderline resectable pancreatic cancer: a United Kingdom multicenter study // *Journal of the American College of Surgeons*. 2014. Vol. 218, №3. P. 401-411. doi:10.1016/j.jamcollsurg.2013.11.017
23. Sgroi M.D., Narayan R.R., Lane J.S., et al. Vascular reconstruction plays an important role in the treatment of pancreatic adenocarcinoma // *Journal of Vascular Surgery*. 2015. Vol. 61, №2. P. 475-480. doi:10.1016/j.jvs.2014.09.003
24. Nayak S.B., Aithal A.P., Melanie R.D., et al. Unusual jejunal tributaries of the splenic vein and their surgical importance: A case report // *OA Case Reports*. 2013. Vol. 2, №4. P. 36-37. doi:10.13172/2052-0077-2-4-561
25. Papavasiliou P., Arrangoiz R., Zhu F., et al. The Anatomic Course of the First Jejunal Branch of the Superior Mesenteric Vein in Relation to the Superior Mesenteric Artery // *International Journal of Surgical Oncology*. 2012. Vol. 2012. Article ID 538769. doi:10.1155/2012/538769
26. Cassinotto C., Cortade J., Belleannée G., et al. An evaluation of the accuracy of CT when determining resectability of pancreatic head adenocarcinoma after neoadjuvant treatment // *European Journal of Radiology*. 2013. Vol. 82, №4. P. 589-593. doi:10.1016/j.ejrad.2012.12.002
27. Strasberg S.M., Sanchez L.A., Hawkins W.G., et al. Resection of tumors of the neck of the pancreas with venous invasion: the «Whipple at the Splenic Artery (WATSA)» procedure // *Journal of Gastrointestinal Surgery*. 2012. Vol. 16, №5. P. 1048-1054. doi:10.1007/s11605-012-1841-6
28. Lee D.Y., Mitchell E.L., Jones M.A., et al. Techniques and results of portal vein/superior mesenteric vein reconstruction using femoral and saphenous vein during pancreaticoduodenectomy // *Journal of Vascular Surgery*. 2010. Vol. 51, №3. P. 662-666. doi:10.1016/j.jvs.2009.09.025
29. Christians K.K., Lal A., Pappas S., et al. Portal vein resection // *Surgical Clinics North America*. 2010. Vol. 90, №2. P. 309-322. doi:10.1016/j.suc.2009.12.001
- References**
1. Patyutko YuI, Kotel'nikov AG, Abgaryan MG. Sovremennoye khirurgicheskoye i kombinirovannoye lecheniya bol'nykh ekzokrinnykh rakom golovki podzheludochnoy zhelezy i organov periampulyarnoy zony. *Practical Oncology*. 2004; 5(2):94-107. (In Russ).
2. Child CG, Holswade GR, McClure RD, et al. Pancreaticoduodenectomy with resection of the portal vein in the Macaca mulatta monkey and in man. *Surgery, Gynecology & Obstetrics*. 1952; 94(1):31-45.
3. Pan G, Xie KL, Wu H. Vascular resection in pancreatic adenocarcinoma with portal or superior mesenteric vein invasion. *World Journal of Gastroenterology*. 2013;19(46):8740-4. doi:10.3748/wjg.v19.i46.8740
4. Porembka MR, Hawkins WG, Linehan DC, et al. Radiologic and intraoperative detection of need for mesenteric vein resection in patients with adenocarcinoma of the head of the pancreas. *HPB*. 2011; 13(9):633-42. doi:10.1111/j.1477-2574.2011.00343.x
5. Patyutko YuI, Kotel'nikov AG. *Khirurgiya raka organov biliopankreatoduodenal'noy zony*. Moscow: Meditsina; 2007. (In Russ).
6. Leach SD, Lee JE, Charnsangavej C, et al. Survival following pancreaticoduodenectomy with resection of the superior mesenteric-portal vein confluence for adenocarcinoma of the pancreatic head. *British Journal of Surgery*. 1998;85(5):611-7. doi:10.1046/j.1365-2168.1998.00641.x
7. Kim PT, Wei AC, Atenafu EG, et al. Planned versus unplanned portal vein resections during pancreaticoduodenectomy for adenocarcinoma. *British Journal of Surgery*. 2013;100(10):1349-56. doi:10.1002/bjs.9222
8. Davydov MI. Promising directions in cancer surgery. *Clinical Oncology*. 2011;1(1):10-2. (In Russ).
9. Clavien PA, Rüdiger HA. A simple technique of portal vein resection and reconstruction during pancreaticoduodenectomy. *Journal of the American College of Surgeons*. 1999;189(6):629-34.
10. Sanjay P, Takaori K, Govil S, et al. 'Artery-first' approaches to pancreatoduodenectomy. *British Journal of Surgery*. 2012;99(8):1027-35. doi:10.1002/bjs.8763
11. Liao K, Wang H, Chen Q, et al. Prosthetic graft for superior mesenteric-portal vein reconstruction in pancreaticoduodenectomy: a retrospective, multicenter study. *Journal of Gastrointestinal Surgery*. 2014;18(8):1452-61. doi:10.1007/s11605-014-2549-6
12. Turley RS, Peterson K, Barbas AS, et al. Vascular surgery collaboration during pancreaticoduodenectomy with vascular reconstruction. *Annals of Vascular Surgery*. 2012;26(5):685-92. doi:10.1016/j.avsg.2011.11.009
13. Mansour MA, Wheatley B, Gorsuch JM, et al. Large Vein Reconstruction with Oncologic Procedures. *Journal of Vascular Surgery*. 2010;51(3): 795. doi:10.1016/j.jvs.2009.11.026
14. Hemming AW, Kim RD, Mekeel KL, et al. Portal vein resection for hilar cholangiocarcinoma. *American Journal of Surgery*. 2006;72(7):599-604; discussion 604-5.

15. Giovinazzo F, Turri G, Katz MH, et al. Meta-analysis of benefits of portal-superior mesenteric vein resection in pancreatic resection for ductal adenocarcinoma. *British Journal of Surgery*. 2016; 103(3):179-91. doi:10.1002/bjs.9969
16. Shoup M, Conlon KC, Klimstra D, et al. Is extended resection for adenocarcinoma of the body or tail of the pancreas justified? *Journal of Gastrointestinal Surgery*. 2003;7(8):946-52; discussion 952. doi:10.1016/j.gassur.2003.08.004
17. Kondo S, Katoh H, Hirano S, et al. Results of radical distal pancreatectomy with en bloc resection of the celiac artery for locally advanced cancer of the pancreatic body. *Langenbeck's Archives of Surgery*. 2003;388(2):101-6. doi:10.1007/s00423-003-0375-5
18. Murakami Y, Satoi S, Motoi F, et al. Portal or superior mesenteric vein resection in pancreatoduodenectomy for pancreatic head carcinoma. *British Journal of Surgery*. 2015;102(7):837-46. doi:10.1002/bjs.9799
19. Patyutko YI, Abgaryan MG, Kudashkin NE, et al. Celiac trunk resection in patients with pancreatic cancer and severe pain syndrome. *Khirurgiya. Zhurnal imeni N.I. Pirogova*. 2016;(11):8-18. (In Russ). doi:10.17116/hirurgia2016118-18
20. Kriger AG, Karmazanovsky GG, Smirnov AV, et al. Diagnosis and treatment of pancreatic head cancer followed by mesenteric-portal vein invasion. *Khirurgiya. Zhurnal imeni N.I. Pirogova*. 2018;(12):21-9. (In Russ). doi:10.17116/hirurgia201812121
21. Mohammed S, Mendez-Reyes JE, McElhany A, et al. Venous thrombosis following pancreaticoduodenectomy with venous resection. *Journal of Surgical Research*. 2018;228:271-280. doi:10.1016/j.jss.2018.02.006
22. Ravikumar R, Sabin C, Abu Hilal M, et al. Portal vein resection in borderline resectable pancreatic cancer: a United Kingdom multicenter study. *Journal of the American College of Surgeons*. 2014;218(3):401-11. doi:10.1016/j.jamcollsurg.2013.11.017
23. Sgroi MD, Narayan RR, Lane JS, et al. Vascular reconstruction plays an important role in the treatment of pancreatic adenocarcinoma. *Journal of Vascular Surgery*. 2015;61(2):475-80. doi:10.1016/j.jvs.2014.09.003
24. Nayak SB, Aithal AP, Melanie RD, et al. Unusual jejunal tributaries of the splenic vein and their surgical importance: A case report. *OA Case Reports*. 2013;2(4):36-7. doi:10.13172/2052-0077-2-4-561
25. Papavasiliou P, Arrangoiz R, Zhu F, et al. Anatomic Course of the First Jejunal Branch of the Superior Mesenteric Vein in Relation to the Superior Mesenteric Artery. *International Journal of Surgical Oncology*. 2012;2012:538769. doi:10.1155/2012/538769
26. Cassinotto C, Cortade J, Belleannée G, et al. An evaluation of the accuracy of CT when determining resectability of pancreatic head adenocarcinoma after neoadjuvant treatment. *European Journal of Radiology*. 2013;82(4):589-93. doi:10.1016/j.ejrad.2012.12.002
27. Strasberg SM, Sanchez LA, Hawkins WG, et al. Resection of tumors of the neck of the pancreas with venous invasion: the «Whipple at the Splenic Artery (WATSA)» procedure. *Journal of Gastrointestinal Surgery*. 2012;16(5):1048-54. doi:10.1007/s11605-012-1841-6
28. Lee DY, Mitchell EL, Jones MA, et al. Techniques and results of portal vein/superior mesenteric vein reconstruction using femoral and saphenous vein during pancreaticoduodenectomy. *Journal of Vascular Surgery*. 2010;51(3):662-6. doi:10.1016/j.jvs.2009.09.025
29. Christians KK, Lal A, Pappas S, et al. Portal vein resection. *Surgical Clinics North America*. 2010; 90(2):309-22. doi:10.1016/j.suc.2009.12.001

Дополнительная информация [Additional Info]

Финансирование исследования. Бюджет ФГБОУ ВО Ростовский государственный медицинский университет Минздрава России. [Financing of study. Budget of Rostov State Medical University.]

Конфликт интересов. Авторы декларируют отсутствие явных и потенциальных конфликтов интересов, о которых необходимо сообщить, в связи с публикацией данной статьи. [Conflict of interests. The authors declare no actual and potential conflict of interests which should be stated in connection with publication of the article.]

Участие авторов. Кательницкий Иг.И. – сбор, перевод и анализ материала, написание текста, Кательницкая О.В. – концепция литературного обзора, редактирование. [Participation of authors. Ig.I. Katelnitskiy – collection, translation and analysis of material, writing the text, O.V. Katelnitskaya – concept of the review, editing.]

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Цитировать: Кательницкий Иг.И., Кательницкая О.В. Роль сосудистых реконструкций в хирургии опухолей гепатопанкреатобилиарной зоны // Российский медико-биологический вестник имени академика И.П. Павлова. 2019. Т. 27, №3. С. 305-312. doi:10.23888/PAVLOVJ2019273305-312

To cite this article: Katelnitskiy IgI, Katelnitskaya OV. The role of vascular reconstructions in surgery of tumors of the hepatopancreatobiliary zone. *I.P. Pavlov Russian Medical Biological Herald.* 2019;27(3):305-12. doi:10.23888/PAVLOVJ2019273305-312

Поступила/Received: 18.04.2019
Принята в печать/Accepted: 16.09.2019