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## Extensive Liver Resections

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**Abstract:** This article includes information about the extensive liver resections. Detailed facts are mentioned with results gained from particular practices.

**Keywords:** liver, patient, anatomy, malignant tumor, bleeding, regeneration, function, protein.

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In recent years, there has been a clear trend worldwide towards an increase in the number of patients with focal liver formations of both malignant and benign nature. Thus, hepatocellular cancer in Russia accounts for 1.7 - 2.2% of all malignant neoplasms (Dvorin V.V., 1990), metastatic liver damage is detected in 20-70% of cancer patients (Granov A.M. et al., 2002; Foster J.N., 1990). Hemanpyums of the liver are found on autopsy in 0.4-7.3% of cases (Ishak K.G., Rabin L., 1975). Extensive anatomical resections of the liver are the main method of radical surgical treatment of patients with malignant tumors, as well as benign neoplasms of the liver of large sizes. At the same time, performing extensive liver resections to date is associated with a high risk of massive intraoperative bleeding and severe postoperative liver failure.

Due to the improvement of the surgical technique and the introduction of modern technologies, the mortality after ORP has recently decreased markedly and amounts to 2-6% for typical resections according to foreign statistics (Belghiti J. et al., 2002; Bismuth II. et al., 1995; Lee N.E. et al., 1998; Redaelli C. et al., 2002), and according to domestic authors - 4.1-9.5% (Gauthier C.B., 1998; Patyutko Yu.I. et al., 1999).

At the same time, in non-standard situations - with giant sizes of neoplasms, their localization in the caval or glisson gates of the liver, as well as in patients with low functional reserve of the liver, the risk of life-threatening complications continues to be extremely high. Thus, the mortality rate when performing extensive liver resections for cancer on the background of cirrhosis varies from 14 to 32% (Belghiti J. et al., 2002; Bismuth H. et al., 1986; Fan S.T. et al., 1995; Hemmig A.W. et al., 1992; Tjandra J.J. et al., 1991), and with radical operations for liver alveococcosis reaches 16.2% (Zhuravlev V.A., 2000).

The issue of prevention of massive intraoperative bleeding is the leading one in the implementation of ORP and has not been fully resolved to date. There are no clear recommendations for choosing the most effective methods of preventing blood loss, for using one or another method of vascular isolation of the liver, the issues of acceptable timing and intraoperative liver ischemia, the effect of thermal ischemia on the development of postoperative liver failure have not been finally resolved. The problems of prevention and prognosis of acute postresection liver failure have also not lost their acuteness and relevance to date. The possibilities of performing ORP with a low functional reserve of the liver, insufficient volume of its parenchyma have not been determined to date.

The issues of pathophysiological changes and compensation mechanisms occurring after the ORP are also poorly studied, namely, the timing and completeness of parenchymal

regeneration, restoration of biochemical parameters of the functional state of the liver, restructuring and adaptation of portal and arterial blood circulation in the liver.

A rational complex of intraoperative methods for the prevention of massive bleeding during extensive liver resections was developed, the tactics of its use were justified, indications for the use of each of the methods were determined. Based on a thorough analysis of the results of the immediate postoperative period, causal factors of the development of acute postoperative liver failure after extensive resections were identified; the most informative methods were identified and an algorithm for predicting this complication was developed; a set of measures for the prevention of its development was determined.

On a large clinical material (240 operations) using a complex of highly informative research methods, a comprehensive comprehensive characteristic of pathophysiological changes, compensation mechanisms and adaptation occurring after extensive liver resections is given. The characteristics of hemodynamic changes occurring in the liver after performing extensive resections are presented; the connection of severe postoperative hepatic insufficiency with the features of the revealed hemodynamic changes is noted.

The study of regeneration of the liver after extensive resections made it possible to clarify the timing of completion of structural and morphological restoration of the liver, the peculiarities of regeneration rates in patients with benign and malignant focal formations of the liver. For the first time, the significance of the study of a new vitamin K-dependent protein C hemostasis factor in assessing the severity of violations of the protein-synthesizing function of the liver is shown. The technique of preoperative portal venous embolization using the original occlusive RABROM material was developed for the first time; the effectiveness of the method in terms of increasing the preoperative functional reserve of the liver and reducing the risk of acute postoperative liver failure was shown.

Performing extensive liver resections to date is associated with a high risk of massive surgical blood loss and acute postoperative liver failure, which determine postoperative mortality. The main reason for the development of massive bleeding with extensive liver resections is damage to the hepatic veins in the cavernous gate or the inferior vena cava. This complication was noted by us in 5.4% of cases. Risk factors for the development of massive bleeding are: the vastness of focal liver damage, involvement in the pathological process of glissoid or cavalose gates, cirrhotic changes in parenchyma, the inability to approach the vascular secretory pedicle with the whole ligation.

The main technical aspects of reducing blood loss are: performing extensive resections in the anatomical version, using the pre-treatment - gate method; precision of the operation technique, rational use of methods of vascular isolation of the liver. Portal resection methods are accompanied by significantly smaller volumes of blood loss than fissural ones ( $2143.9 \pm 160.4$  and  $3140.0 \pm 465.3$  ml, respectively,  $p < 0.05$ ). The optimal way to prevent blood loss, in which its minimum volume is marked ( $1545.0 \pm 145.0$  ml), is complete vascular isolation of the removed lobe of the liver.

If it is impossible to approach the vascular-secretory pedicle in the liver gate, a fissural resection method with compression of the hepatoduodenal ligament is indicated. The presence of giant formations, as well as tumors infiltrating the mouth of the hepatic veins or the inferior vena cava, determines the indications for complete vascular isolation of the liver.

Continuous compression of the hepatoduodenal ligament lasting 60 minutes and intermittent for up to 85 minutes. in patients without cirrhosis of the liver, it does not entail destructive changes in the ultrastructure of hepatocytes and does not significantly affect the severity of changes in the biochemical parameters of the functional state of the liver.

In the immediate postoperative period of extensive liver resections, transient bilirubinemia,

decreased albumin synthesis, pseudocholinesterase levels, and short-term hyperglycemia are noted. The degree of severity of changes in biochemical parameters depends on the extent of liver resection and the preoperative state of the liver parenchyma. The volume of blood loss affects the severity of biochemical disorders of the functional state of the liver only with right-sided hemihepatectomy and extended right-sided hemihepatectomy.

Performing right-sided hemihepatectomy leads to the appearance of moderate portal hypertension in the early postoperative period, which manifests itself in an increase in the area of the spleen, a decrease in linear and volumetric velocities in the portal vein. There was also a certain reduction of significantly increased arterial blood supply to the liver before surgery. In severe postresection hepatic insufficiency, hemodynamic changes in the portal vein and hepatic artery system are more pronounced than in patients with a smooth postoperative course.

The rapid increase in the residual volume of the liver in the early stages after extensive resections is due to a combination of two factors - intensive regeneration and parenchymal edema. At a period of 2-3 months after surgery, there is a decrease in the volume of parenchyma due to the gradual disappearance of edema. The residual volume of the liver parenchyma fully reaches the preoperative volume of the unaffected parenchyma by 6 months after right-sided hemihepatectomy in both the group with benign and malignant focal liver formations.

Postoperative hepatic insufficiency of varying severity was noted after extensive resections in 43.8% of patients, while a severe form of insufficiency with a fatal outcome occurred in 8.3% of cases. The degree of severity of liver failure is influenced by the extent of resection, the presence of liver cirrhosis and the volume of intraoperative blood loss due to the preoperative functional reserve of the liver and the determination of the residual volume of its parenchyma are fundamental points in assessing the likelihood of severe liver failure. The most predictively sensitive laboratory indicators are preoperative indicators of albumin and protein C levels.

With a high risk of developing acute postoperative hepatic insufficiency, portal venous embolization is indicated in the preoperative period. The portal venous embolization method, when performed correctly, is a safe intervention, causes distinct regeneration and hypertrophy of the unembolized lobe of the liver, reduces the risk of liver failure and increases the resectability of malignant liver neoplasms.

In order to reduce the risk of massive surgical blood loss when performing extensive liver resections in the preoperative period, a thorough examination is shown to determine the exact segmental localization of the focal formation of the liver and clarify its possible contact with the main vascular structures of the liver. The complex of intraoperative technical measures for the prevention of blood loss should include adequate surgical access (bicostal or Rio Branco type), extensive mobilization of the liver, precision technique with the use of a cavitation surgical aspirator-destructer for the separation of parenchyma, clippers, IOUS to control the localization of the main veins of the liver, modern means of parenchymal hemostasis. In all cases of a potential threat of massive blood loss, the use of Cell Saver is indicated.

With free glissonic and cavalose liver gates, vascular isolation of the removed liver lobe is shown - ligation of the glissonic pedicle (separate or en block with posterior access) and extraparenchymatous ligation of the corresponding hepatic vein. In cases where extraparenchymatous ligation of the hepatic vein is not possible, resection is indicated after the glissone stem is removed; the hepatic vein is ligated transparenchymatously, during the separation of the parenchyma. If it is impossible to ligate the vascular-secretory pedicle from the side of the liver gate, it is advisable to use the fissural resection method with a clamped

hepatoduodepal ligament. In cases of localization of the focal formation of the liver in the caval gate of the liver, the giant size of the neoplasm, resection is indicated in conditions of complete vascular isolation of the liver.

The decision on the degree of risk of acute postoperative hepatic insufficiency should be made on the basis of an assessment of the patient's general condition, indicators of the functional reserve of the liver and the volume of parenchyma remaining after resection. The latter should be at least 20% in patients with normal liver parenchyma and at least 40% in the presence of dystrophic changes in the parenchyma, severe concomitant diseases or senile age.

Protein C can be used in clinical practice as one of the sensitive indicators of the protein-synthesizing function of the liver. In the presence of one of the risk factors for the development of postoperative hepatic insufficiency, it is advisable to use the method of preoperative portal venous embolization to prepare for surgery.

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