NINETY-TWO HEPATIC RESECTIONS WITHOUT PERIOPERATIVE MORTALITY

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REZUMAT

Obiective: Rezecția tumorilor hepatice a devenit, pentru echipe antrenate, un procedeu chirurgical standard, atât pe ficat normal, cât și pe ficat cirotic. **Pacienți și metode:** Au fost studiați retrospectiv 92 de pacienți cu rezecție hepatică reglată, internați în Spitalul Clinic Municipal de Urgență Timișoara în perioada iulie 1997 - iulie 2005. Criteriile de selecție a acestor pacienți au cuprins numărul și localizarea formațiunilor tumorale, calitatea și cantitatea parenchimului restant. S-a urmărit procedeul operator și evoluția perioperatorie a acestor bolnavi prin date clinice și paraclinice. **Rezultate:** Vârsta medie a pacienților a fost de 58,3 ani, cu repartiția pe sexe: 55 bărbați și 37 femei. Din 92 de pacienți rezecați, 40 (43,4%) au prezentat ficat cirotic, iar 52 (56,6%) ficat macroscopic normal; 21 (22,8%) din aceștia au fost diagnosticați histopatologic și serologic cu hepatită cronică postvirusală VHB sau VHC. Au fost practicate 7 (7,6%) hepatectomii drepte, 8 (8,7%) hepatectomii stângi, 7 (7,6%) trisegmentectomii, 33 (35,8%) bisegmentectomii și 37 (40,2%) segmentectomii. Pierderea medie de sânge intraoperatorie a fost de 700ml/pacient. Mortalitatea perioperatorie a fost nulă; 29 (31,5%) au prezentat tulburări de coagulare, 5 (5,4%) hemoragii intraperitoneale, 3 (3,2%) biliragie. Insuficiență hepatică postoperatorie au prezentat 3 (5,7%) dintre pacienții fără ciroză hepatică și 17 (42,5%) dintre pacienții cu ciroză hepatică. **Concluzii:** În centrele specializate, mortalitatea în rezecția hepatică reglată tinde spre zero. Morbiditatea perioperatorie a fost mai importantă la pacienții cirotici, una din cauze fiind necesarul de sânge transfuzat.
Cuvinte cheie: ficat, rezecție, mortalitate

ABSTRACT

Objective: hepatic tumors resection has become for trained teams, a standard surgical procedure both on a normal liver and on cirrhotic liver. **Patients and methods:** 92 hospitalized patients from the Timisoara Clinical Emergency Municipal Hospital, which underwent anatomic hepatic resection between July 1997 and July 2005, were enrolled in this retrospective study. The selection criteria of these patients considered the number and the placement of the tumors, the quality and the quantity of the remaining parenchyma. The operative technique and the perioperative evolution of these patients were analyzed through clinical and laboratory data. **Results:** the mean age of the patients was 58.3 years, 55 were men and 37 women. From 92 patients who underwent hepatic resection, 40 (43.4%) presented cirrhotic liver and 52 (56.6%) normal macroscopic liver; 21 (22.8%) of these were histological and serological diagnosed with postvirusal HBV or HCV chronic hepatitis. The following surgical interventions were performed: 7 (7.6%) right hepatectomy, 8 (8.7%) left hepatectomies, 7 (7.6%) trisegmentectomy, 33 (35.8%) bisegmentectomy and 37 (40.2%) segmentectomy. The intraoperative average blood loss was of 700 ml/patient. Perioperative mortality was zero; 29 (31.5%) patients presented coagulation defect, 5 (5.4%) intraperitoneal hemorrhage, 3 (3.2%) billiary leakage. 3 (5.7%) from the patients without hepatic cirrhosis and 17 (42.5%) of the patients with hepatic cirrhosis presented postoperative hepatic failure. **Conclusions:** mortality rate in hepatic resections done in specialized centers tends to zero. Perioperative mortality was more important in cirrhotic patients, one of the causes being the need of transfused blood.
Key Words: liver, resection, mortality

INTRODUCTION

The description of the segmental anatomy of the liver, the amazing development of the medical imaging techniques in the last years (abdominal ultrasonography, computed tomography, magnetic resonance imaging, hepatic arteriography) and also the identification and use of tumoral markers in the follow-up of high risk population (cirrhotic, operated patients for colorectal cancer) have made possible the diagnosis of small size tumoral hepatic injuries, thus increasing the indications of limited regulated hepatectomies.[1-4] Major hepatectomies are still recommended for the treatment of tumoral hepatic injuries which cannot be extirpated through limited resections due to their dimensions, number or vascular report. The actual basic principles of the hepatic resection surgery are: the total extirpation of the tumoral tissue, the preservation of a maximum of tumor free hepatic parenchyma, and

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the increasing of the safety of the surgical intervention by avoiding the excessive blood-loss and the possible vascular or billiar accidental injuries of the remaining portion of the liver.[3,5]

Notions of surgical anatomy of the liver

The anatomy of the liver described in the majority of the anatomy treatment consecutive to its examination ex-vivo, presents essential differences towards the surgical anatomy in-vivo, due to the plasticity of this organ.[1] The surgical anatomy is defined through the distribution and the relations of the three (supra) hepatic veins and the four sectorial portal pedicles, which alternatively inbed.[1,3] In this way, the three hepatic veins split the liver in four sectors, each sector receiving a separate portal pedicle. The main or middle portal scissurae lies from the middle of the vesicle bed (anterior) to the left side of the vena cava (posterior), thus splitting the liver in a right and a left liver. The main portal scissurae also called the Cantlie line corresponds to the route of the median hepatic vein.[1,2] The right and also the left liver are divided by the hepatic left and right veins in two sectors: anterior and posterior. The portal vein is divided at the level of the main portal scissural plan in a branch for the right liver (length 1-2 cm) and a branch for the left liver (length 3-5 cm). These also divide in order to irrigate the two sectors of each liver (right and left) to the level of sectors, dividing again in order to irrigate two segments.[1,2]

PATIENTS AND METHODS

From July 1997 to July 2005, 92 patients underwent major liver resections at Timisoara Clinical Emergency Municipal Hospital. The patients hospitalized for hepatic tumors in whom the hepatic resection has been unadvisable were taken out of the study. In this study, the contraindications hepatic resections were considered the following: the presence of multiple tumoral injuries and disseminated in both lobes, the detection of abdominal lymph node metastasis at the CT scan, the presence of invasion and/or convergence or the portal vein trunk or inferior vena cava thrombosis, the presence of other non resecable tumors, liver cirrhosis patients found in the Child-Pugh class B and C, in whom preoperative total billirubin was constantly over 2.2 mg/dL. The indications for liver resection have been represented by the benign and malign tumoral injuries found in the liver. The volume and the quality of the remaining hepatic parenchyma have represented the resectability criteria. Thus, in patients without liver cirrhosis, the estimated remaining liver volume at the CT scan was at least 25-30 % from the total volume, while in patients with liver cirrhosis in Child-Pugh class A, the remaining volume was at least 50 % of the total liver volume. In patients with liver cirrhosis Child-Pugh class B, the intervention was limited to segmentectomy.

The most frequently used clamping method was the selective one, through the hillar dissection of the portal branch and the hepatic artery, corresponding to the resected portion. (Fig. 1) In the case of the anatomic hepatectomies, left or right, the portal branch and the one of the hepatic artery corresponding to the resected territory, they were either ligatured, either permanently clamped. (Fig. 2) The branches of portal pedicle from the same side were intermittently clamped and the sectorial and segmental pedicle ligation was made at the level of the transection surface in case of segmentectomy. (Fig. 3) The corresponding supra-hepatic veins were dissected and isolated. (Fig. 4) Intermittent clamping for non-cirrhotic patients was performed by alternating 15 minutes of ischemia with 5 minutes of reperfusion, and for the cirrhotic patients by alternating 10 minutes of ischemia with 5 minutes of reperfusion, but without overcoming a number of three rounds.

Figure 1. Hillar dissection.

Figure 2. Continuous clamping of hepatic artery and portal vein branches.

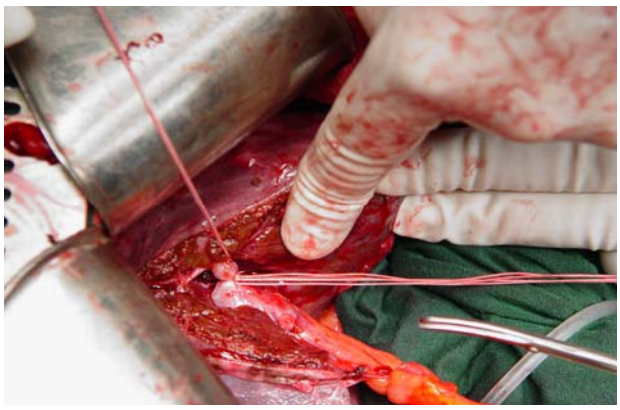

Figure 3. Sectorial pedicle ligation.

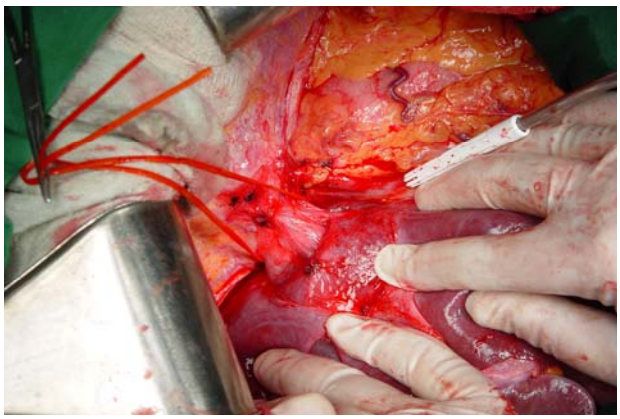

Figure 4. Dissection of suprahepatic veins.

The transsection of the hepatic parenchyma is carried out through kellyclazy with hemostasis by electrocautery for the elements under 2 mm and by ligation for the elements over 2 mm or with the ultrasound dissector.

Hemostasis and billistasis on the transsection surface was finalized by the suture with "x" wires and through coagulation by electrocautery or argon-beam and by "U" wires, or in mattress. (Fig. 5,6)

Figure 5. Argon beam hemostasis.

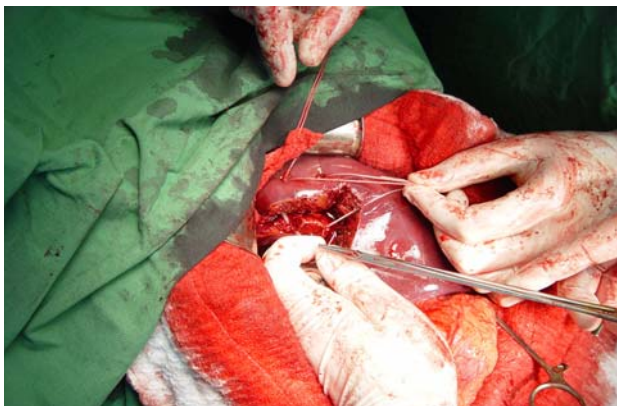

Figure 6. "U" wires.

The abdominal drainage was placed along the transsection surface and optionally through an under-hepatic or over-hepatic drain. In selected cases, when the transsection surface could be sutured using mattress wires, there was no aspiration drain used. Intraoperative transfusions and the blood losses were recorded.

Postoperative, the following clinical parameters have been evaluated: general condition, conscience status, skin color, ascites, blood pressure and pulse, and also the quantity and quality of drainage. The biological parameters that have been daily measured in the first postoperative 10 days were: allanin-amino-transpherase (ALAT), aspartate-amino-transpherase (ASAT), total billirubin (TB), direct billirubin (DB). The abdominal ultrasonography has been performed 3 days after the surgery in order to identify the possible collections or hepatic necrosis areas. The hemorrhage complications were represented by coagulation defects, superior digestive hemorrhage in context of cirrhosis and the blood exteriorization on the intraperitoneal drain, greater than 500 ml/24 h. the billiary leakage was noticed by bile exteriorization through aspiration drain. Postoperative hepatic failure was defined through: total billirubin increase with over 2 mg/dL/24 h, large ascites (over 0.5 L/day) and hepatic encephalopathy.

The statistical comparison was performed for the postoperative hepatic failure incidence in the patients with liver cirrhosis versus the non-cirrhotic ones using the SPSS Software.

RESULTS

The median age of patients was 58.3 (28-72 years), and the male to female ratio was 55:37. From the 92 patients from this study, 40 (43.4%) presented cirrhotic liver and the rest of 52 (56.6%) presented normal macroscopic liver; 21 (22.8%) of these latter

had serological and histopathological diagnosis ofpersisting or active chronic hepatitis with B or C virus. In 23 (21.1%) patients, the histopathological exam of the resected specimen showed benign injuries (hepatic adenoma, hemangioma, focal nodular hyperplasia). The cholangiocellular carcinoma (CCC) was diagnosed in 16 (14.7%) patients, hepatocellular carcinoma was found in 2 (1.84 %) cases, hepatic metastasis in 16 (14.7%) and in 1 (0.9%) patient gallbladder cancer was found, with the invasion of the fifth hepatic segment.

The anatomic hepatic resections performed included right hepatectomy – 7 (7.6%), left hepatectomy – 8 (8.7%), trisegmentectomy – 7 (7.6%), bisegmentectomy – 33 (35.8%) and segmentectomy – 37 (40.2%). All patients had histological exams from resected specimen and also from the remaining portion of the liver.

The mean intraoperative blood loss was 700 ml (range 300-2500 ml). The mean necessary transfused blood was 2 units/patient (range 0 - 8 units/patient). The mean hospitalization stay in the Intensive Care Unit was 3 days (range 0-7 days).

There was no perioperative mortality (in the first 30 days after the surgery), 29 (31.5%) from the patients developed complications: coagulation defect (mucosal bleeding, echimosis and hematoma at the postoperative wound level), 5 (5.4%) patients had intraperitoneal hemorrhage, noticed on the aspiration drain in quantity greater than 500 ml/24 hours and 3 (3.2%) patients had billiary leakage with a flow of under 300 ml/24 hours. Another complication was represented by the postoperative hepatic failure that developed in 3 (5.7%) patients from the non-cirrhotic group and in 17 (42.5%) patients from the cirrhosis group. In all these patients the hepatic failure was reversed with the treatment of sustaining the liver function.

The evolutions of the following biological parameters were compared: ASAT and TB, in the patients that had postoperative hepatic failure versus the ones that did not have this complication both in the cirrhosis group and in the non cirrhotic group. (Fig. 7,8)

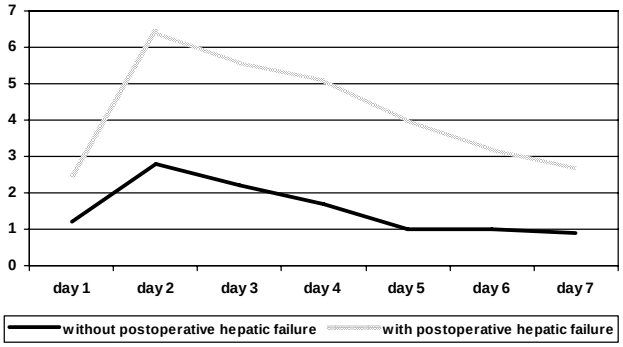

Figure 7. TB evolution: patients with/without postoperative hepatic failure.

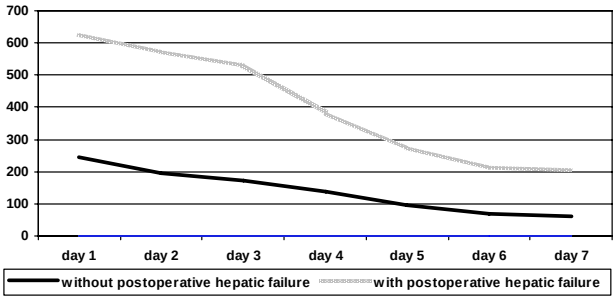

Figure 7. ASAT evolution: patients with/without postoperative hepatic failure.

DISCUSSION

In the case of benign hepatic tumors, the resection is indicated usually for adenomas,while surgical indication for the hemangiomas and focal nodular hyperplasiais made only when they become symptomatic.[6,7] In the present study the resection indication for hepatic hemangiomas was: the size greater than 10 cm and the apparition of some symptoms connected to the compression exercised by these on other organ and also the apparition of hemorrhages. The hepatic resection was done for focal nodular hyperplasia in order to diagnose the uncertain etiology of the symptomatic hepatic tumors. The relative high prevalence of surgical interventions made in this study for benign tumors (21.1%) was also influenced by the limited possibilities to preoperative establish a certain diagnosis of the hepatic tumors. In the case of hepatic trauma, the adopted attitude must be as conservative as possible, indicating only the removing devascularised and/or necrosis hepatic parenchyma. In hepatolithiasis, the resection indication is established only when the bile duct obstruction determines repetitive cholangitis, abcesses or major atrophy at the level of the drained parenchyma.[8]

Billiary cyst and the hepatic policystosis are just relative indications of the resection that can be associated to fenestration, in the case of asymmetrical disposition of the cysts. In such cases, hepatectomies are difficult and have a high hemorrhagic risk due to the modification of the anatomical plans by the cysts.

The hepatocellular carcinoma (HCC) patients with healthy liver have either indication for segmentectomy in the case of tumoral lesions smaller than 3 or 5 cm, or for hepatic resection extended to more segments (up to 70% of the liver volume) depending on: the size of the tumors (larger than 3 – 5 cm), the existence of multiple vascular invasion.[9,10] Because HCC determines early portal invasion, the hepatic resection will remove out not only the tumor but also the

invaded portal branch, always passing over the portal tumoral thrombus. HCC is associated most frequently with a cirrhotic liver, in which case the major hepatic resection (hemihepatectomy) is indicated only for the Child A group patients, while for patients in the Child B group intervention is limited at segmentectomy, at the most.[9,10] The foreseen volumetrically evaluation of the remaining liver after hepatectomy and also the establishing of the indocyanine green clearance specify the parenchyma volume that can be resected. Although it has limited results, the hepatic resection is the only efficient treatment for the cholangiocellular carcinoma and the indication of liver transplant is still debated.[11,12] For the hepatic metastases of some therapeutically controlled tumors, the latest therapy consists of surgery limited to separate and multiple resections, so that the future development of hepatic metastases to allow the reintervention resection.[13] Segmentectomy becomes a logical intervention in the case of a single metastases situated at the level of a single hepatic segment. Hepatic resection can be extended depending of the size and the number of the hepatic metastases and also depending of the intrahepatic vessels position. We had a situation where left hepatectomy extended to segment I was realized in the same time with sigmoid primary tumor resection, Hartmann resection type. In the proximal carcinoma of the extrahepatic bile ducts (Klatskin tumor) type I or II, associated to biliary resection, the resection of the segment I it is also indicated (due to the frequent invasion of the caudate lobe through small bile ducts), while for the type III tumors (left or right) hemihepatectomy extended to segment I, associated with biliary resectionis indicated.[12] Current international literature indicates segmentectomy V and partially IV (anterior subsegmentectomy) for gallbladder carcinoma histologically proven.[12,14]

The typical hepatectomies can be done using different techniques:[15]

1. Vascular primary section hepatectomy (Lortat-Jacob technique). The advantage of this technique is that the resection of the hepatic parenchyma will be realized following the division line of the devascularised parenchyma, thus limiting the blood loss. The technique has two major inconveniences: the risk of producing an accidental wound of the right hepatic vein (a hemorrhage hard to control or gas embolisation) and the risk of devascularization of the remaining liver, by accidental ligation of a portal pedicle branch fated to the left liver (real risk if we consider the frequency of the anatomical anomalies from this level).

2. Primary section of the hepatic parenchyma technique (Ton That Thung technique). This technique begins with the hepatic parenchyma section, the portal pedicle elements and the hepatic vein being ligatured and intrahepatic sectioned. Blood losses can be important (even with the intermittent pedicle clamping use), the surgical team rapidity being justified, but the risk of producing an accidental wound of the intrahepatic great vessels and also the risk of devascularization of the remaining liver are low.

3. The combined techniques (used by the Prof. Bismuth – Paul Brousse Hepatobiliary Center, Villejuif). The left or the right retrohepatic vena cava is released (depending on the type of the expected hepatectomy), without insisting to dissect the respective vein.

The next step is to dissect the hilar region,followed by the clamping (not ligation) of the hepatic artery and the portal vein, on the same side with the hepatectomy.[16] Then the section of the parenchyma begins , similar to the Ton That Tung technique. The use of this technique by the authors surely represents an explanation for the absence of perioperative mortality reported in this study, and also for the absence of devascularisation lesions of the remaining portion of the liver.

The lack of mortality was bounded also by the settlement of the hepatic resection indications which considered the severity of the preoperative hepatic failure and also the relative incapacity of the cirrhotic liver for regeneration.[2]

Thus, it was considered that for the cirrhotic patients Child-Pugh class A, B, C, the volume of the functional parenchyma is estimated to 70%, 50% and 10%, respectively. Furthermore, the experience of the Japanese teams in the surgery of the hepatocellular carcinomas on the liver cirrhosis background considers as an absolute operatory contraindication a level of serum bilirubin greater than 2.2 mg%.[17]

Although in this study the most frequent anatomic resections used were limited to one or two segments (76%), and the most frequent used clamping was the selective one, the rate of postoperative hepatic failure was 42.5% in cirrhotic patients, close to the upper limit of the numbers reported in the international literature.[18]

This fact cannot be explained by the clamping duration, which was maximum 30 minutes on the cirrhotic patients, and most likely it was due to the greater number of the patients who were blood transfused (76%), comparing with a reported average of approximately 50%, in situations where the average postoperative blood loss rate was 700 ml.[18,19] Postoperative hepatic failure was reversible in

almost all cases, even if it turned up like a frequent complication, and the values of the studied hepatic biological variables showed moderate increasing.[20,21]

The transsection surface hemorrhage greater than 500 ml/24 h appeared in 5 patients, and billiary leakage bellow 300ml/24 h appeared in 3 patients, even if it spontaneously stopped, and represent explicable technique complications, which are similar to other published studies results.[18-20]

The diffuse coagulation defect syndrome, that appeared in 31.5% cases, and consisted of mucosal bleeding and operative wound hematoma, was the consequence of the global hepatic failure in patients with liver cirrhosis with preliminary Quick time alterations and moderate thrombocytopenia, but disappeared after vitamin K administration and transfusions of packed red cells.

The lack of perioperative mortality was due to the technique used and to the accurate pre- and perioperative evaluation of the hepatic parenchyma quantity that can be resected for each patient, and also the result of sustained postoperative therapy for each appeared complication.[22]

CONCLUSIONS

1. Even if not so long ago, the hepatectomies represented high mortality interventions, both standardizing the hepatectomies techniques and the training of some overqualified teams in these techniques, permitted the hepatic resection achievement with a usual manner and zero mortality after understanding the vascular anatomy and plasticity of the liver.

2. Postoperative hepatic failure and the coagulation defect hemorrhages are the most frequent complications in liver cirrhotic patients.

3. The excessive use of blood transfusions, in moderate blood loss conditions, may lead to an increase in postoperative morbidity in patients with liver cirrhosis.

4. In most cases, the indications for the hepatic resections in non-cirrhotic patients were symptomatic benign hepatic tumors and had a meaningful statistic lower postoperative morbidity than in liver cirrhosis patients situation ($p < 0.05\%$).

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