



## Original article

ACTA FAC. MED. NAISS. 2004; 21 (4): 179-183

Miroslav Stojanović<sup>1</sup>, Miroslav Jeremić<sup>1</sup>,  
Aleksandar Bogičević<sup>1</sup>, Milan Radojković<sup>1</sup>,  
Aleksandar Zlatić<sup>1</sup>, Ljiljana Jeremić<sup>1</sup>,  
Goran Stanojević<sup>1</sup>, Aleksandar Nagorni<sup>2</sup>,  
Vesna Brzački<sup>2</sup>, Suzana Raičević-  
Sibinović<sup>2</sup>, Daniela Benedeto-Stojanov<sup>2</sup>,  
Srđan Denčić<sup>3</sup>, Srđan Stamenković<sup>4</sup>

<sup>1</sup>Surgical clinic Clinical Center Niš  
<sup>2</sup>Gastroenterology and hepatology clinic  
Clinical Center Niš, <sup>3</sup>Medical Center Pirot,  
<sup>4</sup>Medical Center Argasi, Zakynthos,

## THE INFLUENCE OF NEW SURGICAL CONCEPT ON RESULTS OF LIVER RESECTION

## SUMMARY

The authors present the results of 44 liver resections performed in 4-years period after applying a new concept in liver surgery, comprising a profound knowledge of liver anatomy, introduction of intraoperative ultrasound, new techniques in liver mobilisation and vascular occlusion and new tools for liver parenchyma transection. The predominant indication for liver resection was metastatic colorectal cancer, which was found in 27 patients. Hepatocellular carcinoma was resected in 6 patients, gallbladder cancer in 2 patients and benign lesions in 8 cases (2 adenomas, 2 hemangiomas, 1 giant lipoma and 3 cases of the liver hydatidosis). Morbidity rate was about 20%. The most common complication was prolonged biliary secretion. During the aforementioned period, no perioperative deaths and no iatrogenic injury to the biliary tract or larger vessels were reported. All 36 patients operated on because of malignant disease were followed-up for at least 6 months. Complete remission was noted in 31 patients (86.11%). After one-year follow-up period, 85.71% of the patients were still alive. The authors conclude that precise indication for surgery and established operative procedure performed by a well-trained team are the basis of surgery with acceptable morbidity and no operative mortality.

*Key words:* liver resection, surgical concept, morbidity, and mortality.

## INTRODUCTION

In the beginning of 21<sup>st</sup> century, liver resection became a reasonable, safe and effective surgical procedure used for treatment of benign lesions and malignant tumors of the liver and biliary tract (1–3). Advances in surgical techniques and increase in indications for liver resection have resulted in an over growing number of liver resections. Half a century of detailed study of the anatomy of the liver has helped to build up a more profound knowledge of liver anatomy, while the introduction of intraoperative ultrasound has enabled surgeons to view through the liver, helping them to determine

real anatomy of the patient's liver, detect lesions that are undetectable by percutaneous US or CT scan and to determine the extent of tumour invasion (3). Liver transplantation techniques have given surgeons new experiences concerning mobilisation, vascular occlusion and extreme liver surgery procedures. New technology with different kinds of dissectors have made liver transection safer. The skill of surgeons and the support of anaesthetists and ICU specialists have contributed to the achievement of better results of surgical treatment and postoperative care. And a final but very important point is that a multidisciplinary approach to liver lesions enables patient selection to be made so that the decision as to

whether to undertake operative treatment of a hepatic lesion is optimised and liver resection can be planned in detail. Surgical procedure is becoming a component in the complex treatment of hepatobiliary pathology (4).

### PATIENTS AND METHODS

In the period 2001–2004 at the Surgical clinic, Clinical Center Nis, our team performed liver resections in a total of 44 patients (figure 1). The sample consisted of 30 men and 14 women. Ages ranged from 22–76 years (median age 59 years) in men and from 29 to 82 years (median age 60 years) in women. The predominant indication for liver resection was metastatic colorectal carcinoma, which was found in 27 patients. In just one case we resected metastases from noncolorectal origine (Ca PVU). With regard to primary tumours, the incidence of hepatocellular carcinoma (6 patients) was the highest in our population, gallbladder carcinoma was the second (2 patients), benign lesions were resected in 8 cases (2 adenomas, 2 hemangiomas, 1 giant lipoma and 3 cases of the liver hydatidosis).

Solid primary tumour sizes ranged from 35 to 190 mm. The diameter of metastases resected ranged from 9–110 mm. In total, we resected 54 metastases in 28 patients. Of all the metastases, 24 (44 %) were smaller than 20 mm, 18 (33%) varied in size from 20 to 50 mm and 12 (22 %) were larger than 50 mm. Solitary metastases were found in 13 patients (46.42%), 2–3 metastases in 9 patients (33.14%) and more than 3 metastatic areas were detected in 6 patients (21.42%).

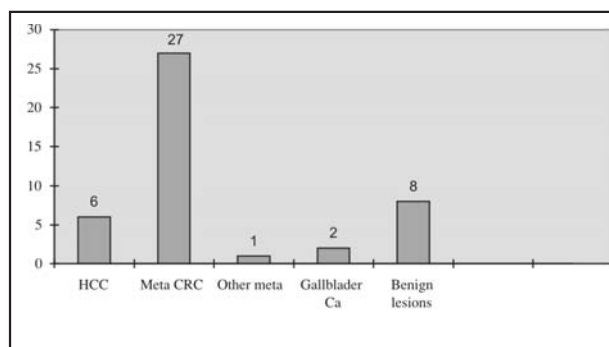


Figure 1. Indications for liver resection

Indications for liver resections are based on a standardised examination. In addition to common laboratory tests, relevant onco-markers were monitored. We do not utilise DSA (digital subtraction angiography) of the hepatic blood supply as a standard test of preoperative examination. Neoadjuvant chemotherapy was used just in 3 cases (6.18%) with successful downstaging of hepatic lesions.

Standard operative approach was J laparotomy with extension into the 10<sup>th</sup> intercostal space in 4 cases of large posterior tumors. Intraoperative ultrasonography (IOUS) was the standard procedure using Siemens SL-1 ultrasound and sectorial 7.5 MHz probe (figure 2).

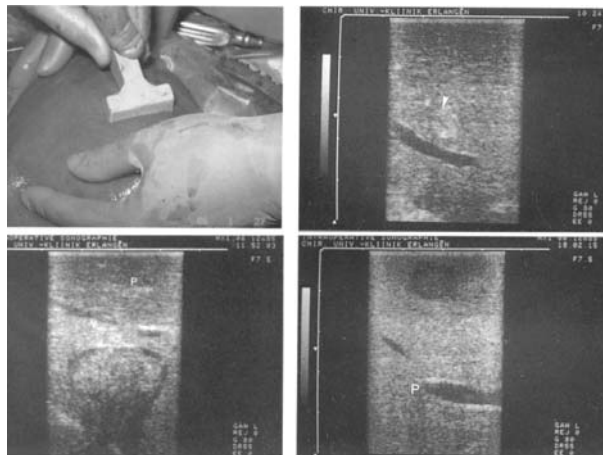


Figure 2. IOUS of the liver

Predominant method of inflow occlusion was intermittent clamping of the hepatoduodenal ligament. In the 6 cases we used total vascular exclusion with caval perfusion (TVECP), but we did not use the classical method of total vascular liver exclusion (TVE). Through careful preparation of the hilus and resections performed anatomically total blood loss was minimised. Anterior approach for right hepatectomy with Belghiti liver hanging manoeuvre was used in 2 cases of large posterior tumors. The technique of resection depended upon available equipment. In 28 cases we used the Kelly-clasia technique, and in 16 cases linear radiofrequency device -TissueLink DS 3.0 (figure 3).

Section surface of the liver was managed with fibrin glue in 14 pts (31.81%). The extent of surgery depended on the lesion size and localisation. We always utilised a minimal 10 mm zone of safety in performing our resections. Standard drainage of the



Figure 3. Liver transection using LRFD -Tissue Link DS 3.0.

resected bed was done until secretion became minimal. After liver resection, all patients were followed up at regular intervals and according to standard procedures in cooperation with oncologists, radiologists, pathologists etc.

RESULTS

During the period from 2001 to 2004 our team performed 44 liver resections. We increased the number of resections per year from the original of 6 per annum to 16 liver resections for nine-months period in 2004 (figure 4). Through this high number of resections we were able to minimise the incidence of postoperative complications otherwise found in work places with a lower frequency of such major surgeries.

The same team of surgeons performed all operations. Operations included all types of resections: extra-anatomical excisions -12 cases, 16 segmentectomies and 4 bisegmentectomies, 3 left lateral and 3 right posterior sectionectomies, 3 right hepatectomies, 3 left hepatectomies (figure 5). Fifteen patients (34.09%) had synchronous hepatic metastases and all of them were operated by one-time simultaneous hepatic and colon resection.

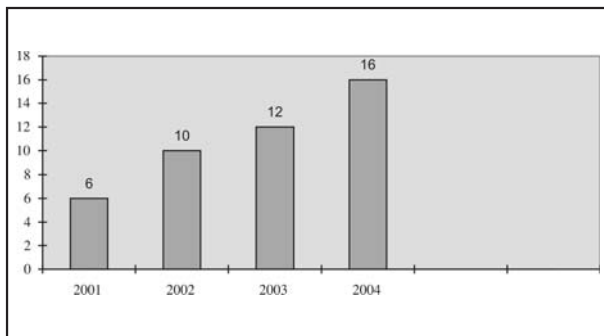


Figure 4. Annual number of operations

Segmentectomy and larger resections are always anatomical ones, with ligation of the relevant supply. Median duration of liver ischemia was 46.8 min. Liver reresections using LRFD were without ischaemia. Median liver parenchyma transection time in the kellyklasia and LRFD group was 2.9 cm<sup>2</sup> and 1.5 cm<sup>2</sup> respectively. Perioperative blood loss ranged from 0 to 1800 ml. Median blood loss was 420 ml, and in more than 30% of patients, blood loss was less than 200 ml. In the 6 cases of TVECP liver resection was absolutely bloodless. During the peri- and postoperative period following liver resection, transfusion was unnecessary in 48% of patients, and in only one patient 6 transfusion units were required for bleeding. Total average duration of hospitalisation was 15.1 days. The implementation of our study

on liver resection was later justified not only on the basis of long-term outcomes, but also on the low incidence of postoperative morbidity and mortality. In the 30-day period following resection, none of the patients died. Just one patient had to undergo surgical revision for perforated duodenal ulcer on the 9<sup>th</sup> postoperative day. The most common complication was prolonged biliary secretion (4 patients), which led to subphrenic abscesses in three cases. The abscesses in all cases were treated by US guided drainage. Surgical intervention was not necessary. During the aforementioned period, no iatrogenic injury to the biliary tract or larger vessels was reported (table 1).

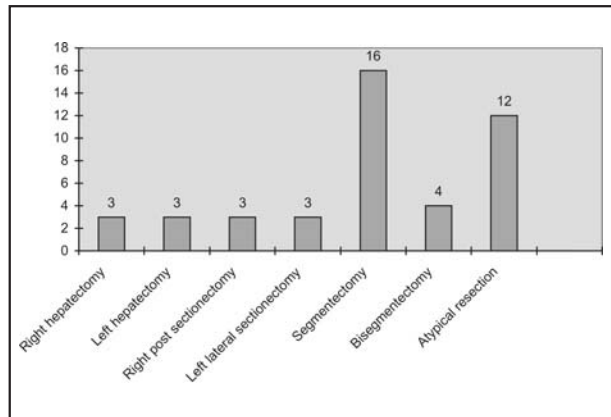


Figure 5. Modality of liver resection

Table 1. Liver resections from 2001 to 2004: Postoperative morbidity

Complication	Number	%
Subphrenic abscess	3	6.81%
Biliary fistula	1	2.27%
Pleural effusion	2	4.54%
Wound infection	1	2.27%
Pulmonary thromboembolism	1	2.27%
Perforated duodenal ulcer	1	2.27%
TOTAL	9	20.45%

Long-term follow-up after liver resection for malignancy is still limited by the number of performed surgeries in individual years. All 36 patients operated for malignant disease were followed-up for at least 6 months. Three of these 36 patients (8.33%) died from disease dissemination. Recurrence was reported in 2 patients (5.5%). Complete remission

was noted in of 31 patients (86.11%) followed up for more than 6 months. We were able to follow up 28 patients in one year, 24 of these (85.71%) were still alive (table 2). Dissemination was found most frequently in the interval from 0 to 6 months from primary resection.

Table 2. Intermediate results after liver resection

Folow-up period	Number	Survival rate	Recur-rence	Mortal-ity
6 months	36	33 (91.66%)	1 (2.77%)	3 (8.33%)
1 year	28	24 (85.71%)	2 (7.14%)	4 (14.28%)

Recurrences were registered in two cases (one after 5 months, one after 9 months) after liver resection. In one case, resection of the S5 liver segment for recurrence of rectal carcinoma metastases was performed 9 months after primary S7 and S4 segmentectomy.

## DISCUSSION

At the very beginning of our study of liver resection, it was necessary to address several concerns. Unequivocal indications for liver resection are primary resectable liver tumours, low differentiated gallbladder cancer, and resectable metastases of colorectal cancer (CRC) (1). However, we indicated resection in solitary metastases of other other solid tumours. The criteria for indications for attempting resection of metastasis in colorectal carcinoma are:

- 1) Presumed radical resection R0;
- 2) Presumed R1 or R2 resection with the possibility of using alternative therapies for the remnant tumour (alcoholisation, chemoembolisation, etc.);
- 3) Resection of previous unresectable metastasis after successful downstaging.

In addition to multiorgan involvement contra-indications to resection are foremost patient morbidity precluding the necessary operation (4). The most important imaging method in our study was helical CT and carefull intraoperative ultrasonography. Our

surgical team used kellyklasia and LRFD methods following bipolar coagulation for minor structures and ligation of structures larger than 3 mm by absorbable material for liver dissection. We agreed with Takayama, at al. that in comparison with teams using methods such as CUSA, argon-beam, Jet-cutter and others, the number of complications or perioperative blood loss has not been increased (5–8). We prefer anatomical resections (except for small lesions) to atypical resections, respecting arterial and portal branches (1,2,8,9). Maintaining a 10 mm macroscopic safety zone, and the minimisation of blood loss are the two prognostic factors, which may be influenced mostly by surgeons (1,2,10,11). We presume that perioperative mortality of 0% and morbidity of 20% reported in our population fulfilled the qualification for continuing our study. Adjuvant chemotherapy is not suggested as a standard approach after curative liver resections. Due to low or no therapeutic response, adjuvant chemotherapy is not indicated in primary liver lesions or gallbladder lesions. Surgical resection is therefore the only option for curative therapy. For the large part of metastatic CRC the role of adjuvant chemotherapy is not clear in case of metastatic liver disease. More extensive studies were performed, which did not show the benefit of adjuvant chemotherapy after R0 resections (12,3). Continued patient care by oncologists following curative resection of liver metastasis could help to answer this question. On the other hand, the capability of neoadjuvant therapy in terms of transforming non-resectable lesions to resectable ones is undisputed (1,2). We could not evaluate long-term outcomes in our 4-year study, because only 16 patients were followed up for more than 24 months.

## CONCLUSION

A precise indication for surgery and established operative procedure performed by the well-trained team applying the new concept of liver surgery are the basis of an acceptable morbidity and no operative mortality after liver resection. Multimodal cooperation of surgeons with mainly oncologists, radiologists and pathologists can ensure optimal standardised care to a growing number of patients with malignant liver diseases even in local conditions.

## REFERENCES

1. Poston G. The argument for liver resection in colorectal liver metastases. *Hepato-Gastroenterol* 2001;48:345–346.
2. Lehnert T, Golling M. Indikationen und Ergebnisse der Leber-metastasen-resection. *Der Radiologe* 2001;41:40–48.
3. Mazzioti A, Cavallari A. Techniques in Liver Surgery, Greenwich Medical Media, 1997: 353–361.
4. Heriot AG, Karanjia ND. A review of techniques for liver resection. *Ann R Coll Surg Engl* 2002; 84: 371–380.
5. Takayama T, Makuuchi M, Kubota K et al. Randomized comparison of ultrasonic vs clamp transection of the liver. *Arch Surg* 2001; 136: 922–928.
6. Nakajima Y, Shimamura T, Kamiyama T, Matsushita M, Sato N, Todo S. Control of Intraoperative bleeding during liver resection: Analysis of a questionnaire sent to 231 Japanese hospitals. *Surg Today* 2002; 32: 48–52.
7. Weber JC, Navarra G, Jiao LR, Nicholls J, Jensen SL, Habib NA. New technique for liver resection using heat coagulative necrosis. *Ann Surg* 2002; 236: 560–563.
8. Sturgeon C, Helton , Lamba A, Chejfec G, Espat J. Early experience using linear hepatic parenchima coagulation device. *J Hepatobiliary Pancreat Surg* 2003; 10:81–86.
9. Siperstein A et al. Local Recurrence After Laparoscopic radiofrequency thermal ablation of hepatic tumors. *Ann Surg Oncol* 2000; 7:106–113.
10. Curley SA, Izzo F, Delrio P et al. Radiofrequency ablation of unresectable primary and metastatic hepatic malignancies: results in 123 patients. *Ann Surg* 1999; 230: 1–8.
11. Wood TF, Rose M, Chung M, Allegra DP, Foshag LJ, Bilchik AJ. Radiofrequency ablation of 231 unresectable hepatic tumors: indications, limitations, and complications. *Ann Surg Oncol* 2000; 7(8): 593–598.

## UTICAJ NOVOG HIRURŠKOG KONCEPTA NA REZULTATE RESEKCIJE JETRE

Miroslav Stojanović<sup>1</sup>, Miroslav Jeremić<sup>1</sup>, Aleksandar Bogićević<sup>1</sup>, Milan Radojković<sup>1</sup>, Aleksandar Zlatić<sup>1</sup>, Ljiljana Jeremić<sup>1</sup>, Goran Stanojević<sup>1</sup>, Aleksandar Nagorni<sup>1</sup>, Vesna Brzački<sup>2</sup>, Suzana Raičević-Sibinović<sup>2</sup>, Daniela Benedeto-Stojanov<sup>2</sup>, Srđan Denčić<sup>3</sup>, Srđan Stamenković<sup>4</sup>

<sup>1</sup>Hirurška klinika KC Niš, <sup>2</sup>Klinika za gastroenterologiju i hepatologiju KC Niš, <sup>3</sup>Medicinski centar Pirot, <sup>4</sup>Medical Center Argasi, Zakynthos Greece

## SAŽETAK

Autori prikazuju rezultate 44 resekcije jetre, izvedene u četvorogodišnjem periodu – nakon uvođenja novog koncepta u hirurgiju jetre, koji se sastoji u primeni novih anatomskih saznanja, uvođenju intraoperativnog ultrazvuka i novih hirurških tehnika mobilizacije i vaskularne kontrola, kao i savremenih uređaja za transekciju parenhima jetre. Najčešće indikacije za resekciju jetre bile su metastaze kolorektalnog karcinoma, koje su operisane u 27 slučajeva. Hepatocelularni karcinom resecirano je kod 6 pacijenata, karcinom žučne kese u 2 slučaja, dok su benigne lezije bile predmet resekcije u 8 slučajeva (2 adenoma, 2 hemangioma, 1 gigantski lipom i 3 slučaja ehinokoka jetre). Postoperativne komplikacije su registrovane u 20% slučajeva. U navedenom periodu nije registrovan hospitalni mortalitet, kao ni jatrogene lezije velikih krvnih sudova i žučnih vodova. Svih 36 pacijenata operisanih zbog malignih oboljenja praćeno je najmanje 6 meseci. Kompletna remisija registrovana je u 86.11%. Jednogodišnji period preživelo je 87.51% pacijenata. Autori zaključuju da precizne indikacije za operativni zahvat, kao i striktno poštovanje uspostavljenih operativnih procedura od strane uvežbanog hirurškog tima, predstavljaju osnovu za bezbednu hirurgiju jetre, bez mortaliteta i sa prihvatljivom stopom morbiditeta.

**Ključne reči:** resekcije jetre, hirurški koncept, morbiditet, mortalitet.