Eight years after introducing liver resection at the Oncology Institute of Vojvodina

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SUMMARY

Background: *Hepatectomies are mostly performed for the treatment of hepatic benign or malignant neoplasms, intrahepatic gallstones, or parasitic cysts of the liver. The most common malignant neoplasms of the liver are metastases from colorectal cancer. Anatomic liver resection involves two or more hepatic segments, while non-anatomic liver resection involves resection of the metastases with a margin of uninvolved tissue. The aim of this manuscript was to show results of hepatectomies performed at the Oncology Institute of Vojvodina.*

Methods: *We performed 133 liver resections from January 1997 to December 2013. Clinical and histopathological data were obtained from operative protocols, histopathological reports, and patients' medical histories.*

Results: *We did 80 metastasectomies, 51 segmentectomies, and 18 radiofrequent ablations (RFA). Average number of colorectal cancer metastases was 1.67 per patient. We also made 10 left hepatectomies. In all cases, we made non-anatomic resections.*

Conclusion: *Decision about anatomic versus non-anatomic resections for colorectal metastasis and primary liver tumors should be made before surgical exploration. Preservation of liver parenchyma is important with respect to liver failure and postoperative chemotherapy treatment.*

Key words: *Hepatectomy; Carcinoma, Hepatocellular; Liver Neoplasms; Neoplasm Metastasis, Colorectal Neoplasms; NoN MeSH: Oncology Institute of Vojvodina*

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INTRODUCTION

A good knowledge of the liver anatomy is a prerequisite for modern liver surgery (1).

The liver is divided into four lobes: right, left, quadrate, and caudate (1-8). Falciform ligament divides liver into right and left anatomic lobes (anterosuperior surface). On the visceral surface of the liver, the fissures of the ligamentum venosum and ligamentum teres provide the demarcation.

The right and left lobes of the liver are of equal size (9). The plane of division is not the falciform ligament but a plane passing through the bed of the gallbladder and the notch of the inferior vena cava (IVC). Based on arterial blood supply, portal venous blood supply, biliary drainage, and hepatic venous drainage, the liver is divided into functional lobes and segments (I-VIII). The best-known and most widely employed concepts of hepatic segmentation are those by Couinaud (1954) (10).

Hepatectomies were mostly performed for the treatment of hepatic neoplasms (benign or malignant), intrahepatic gallstones or parasitic cysts of the liver. Colorectal cancer (CRC) metastases are the most common malignant neoplasm of the liver, and hepatocellular carcinoma (HCC) is the most common primary malignant tumor of the liver (10-16).

Preoperative neoadjuvant chemotherapy, based mainly on 5-fluorouracil, enables most patients suitable for resection (12). Preoperative chemotherapy, pre-existing liver disease, tumor burden, and risk of recurrence will affect the extent of liver resection (13-19).

Van der Pool and colleagues demonstrated that repetition of local treatment (non-anatomic resection, radiofrequency ablation, or stereotactic radiation) due to recurrence of intrahepatic disease with local therapies could be performed safely and with good median overall survival (37 months). An overall 5-year survival rate was 35% in their series (20).

Increasing variety of tools used in liver resection has especially been represented in the field of parenchymal transaction and ablation. The methods range from basic finger or clamp fracturing of the tissue to devices based on more complex technology, such as ultrasonic or radiofrequency energy, water jet and tissue-sealing devices, and surgical staplers. These instruments help to reduce blood loss and transfusion requirements, and postoperative complications associated with each. The use of one tool over the others will vary according to the type of resection. It is important to be familiar with many strategies and be able to apply them in the most appropriate setting (21-26).

The aim of this study was to show the results of hepatectomies performed at the Oncology Institute of Vojvodina.

PATIENTS AND METHODS

This retrospective study comprised the period from January 1997 to December 2013. All surgical procedures were performed at the surgical department of the Oncology Institute of Vojvodina. In specified period, we did 133 liver resections.

Sixty-three percent of patients was male, and 37% was female. Average age of patients was 58.3 years (range: 47 to 73 years).

Clinical and pathological data were obtained from operative protocols, histopathological reports, and patients' medical histories. Publication of these results was approved by Ethics committee of the Oncology Institute of Vojvodina.

Preoperative explorations included clinical examination, ultrasonography or abdominal computerized tomography (CT), and in some cases intraoperative ultrasonography and whenever required magnetic resonance imaging (MRI). Indications for resection were primary or secondary liver tumors in all patients.

The liver was approached either through right subcostal or medial incision. Liver transection was performed using an ultrasonic dissector (Ethicon Endo-Surgery, Cincinnati, OH, USA), water jet (ERBEJET 2, ERBE USA Inc, Marietta, GA, USA), and/or RFA (Habib 4X, Angiodynamics, Queensbury, NY, USA).

RESULTS

The liver was approached through right subcostal incision in 92 patients (69.2%) and in 41 patients (30.8%), medial incision approach was made. The most common indications for hepatic resection were metastases from colorectal cancer followed by primary hepatic tumor. Eighty-nine patients (54.60%) were with CRC metastases and 18 had HCC. Re-resection after primary resection of CRC metastases was made in 11.04% of patients (Figure 1).

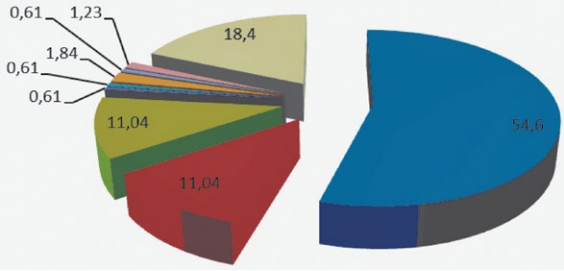

Figure 1. Origin of liver metastases

The most common CRC metastases originated from rectal cancer (47.19%) (Table 1).

Majority of metastases were localized in the VI segment of the liver. We did 80 metastasectomies, 51 segmentectomies, and 18 RFA resections of liver. Average number of CRC metastases was 1.67 per patient (Table 2). We also made 10 left hepatectomies.

Table 1. Primary site of colorectal cancer

Tumor site	Number (%)
Right colon	12 (13.48)
Transversal colon	5 (5.62)
Left colon	9 (10.11)
Sigmoid colon	21 (23.60)
Rectum	42 (47.19)
Total	**89 (100)**

Table 2. Localization of colorectal metastases in liver by segments

Liver segments	Metastasectomy No (%)	Segmentectomy No (%)	Radio frequent ablation No (%)	Total No (%)
I	0 (0)	0 (0)	0 (0)	**0 (0)**
II	11 (7.38)	4 (2.68)	2 (1.34)	**17 (11.41)**
III	6 (4.03)	4 (2.68)	1 (0.67)	**11 (7.38)**
IVa	7 (4.70)	2 (1.34)	2 (1.34)	**11 (7.38)**
IVb	8 (5.37)	3 (2.01)	2 (1.34)	**13 (8.72)**
V	14 (9.40)	12 (8.05)	3 (2.01)	**29 (19.46)**
VI	17 (11.41)	17 (11.41)	5 (3.36)	**39 (26.17)**
VII	17 (11.41)	9 (6.04)	3 (2.01)	**29 (19.46)**
Total	**80 (53.69)**	**51 (34.23)**	**18 (12.08)**	**149 (100)**

DISCUSSION

Two thirds of patients included in this study were middle-aged men. We approached the liver through right subcostal incision in the majority of patients, which is in accordance with other authors (1-8, 12-26). In our study, the most common indication (89 out of 113 patients) for liver resection were metastases from colorectal cancer. There were only eighteen patients with hepatocellular carcinoma.

Some patients with CRC liver metastases were initially considered unsuitable for radical liver surgery in our study. After neoadjuvant chemotherapy, these patients were able to undergo potentially curative surgery.

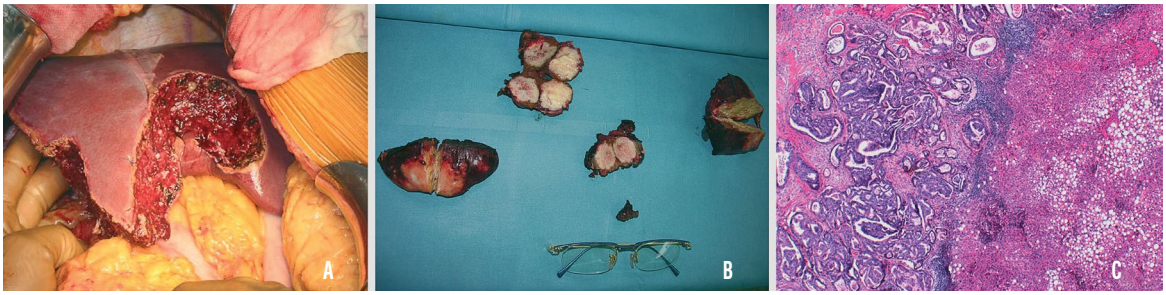

Figure 2. Liver after resection of CRC metastases (A) and CRC metastases *ex vivo* (B). Histopathological findings (C) - dense lymphocytic infiltrate along the border between normal liver tissue and tumor tissue (hematoxylin and eosin, 40x).

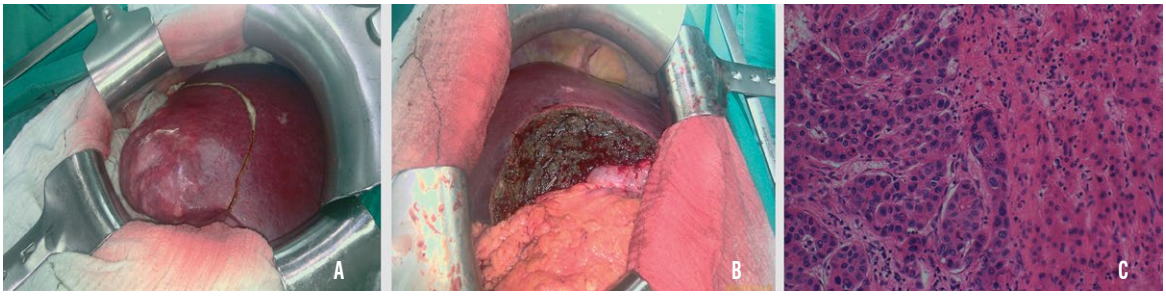

Figure 3. Hepatocellular carcinoma in non-cirrhotic liver (A) and after liver resection (B). Histopathological findings (C) - tumor cells (left) show a low level of cytologic atypia compared to the preserved hepatocytes (hematoxylin and eosin, 200x).

That combined approach has been reported in many studies (2-4, 12, 13, 17, 18). It is therefore important to reconsidering liver resection in all patients who are at first not candidates for primary surgical excision, but who respond well to chemotherapy. Among the patients with colorectal liver metastases, resection is the only treatment offering a chance of long-term survival (20).

An important decision in any liver resection is to choose the amount of parenchyma to be removed. Anatomic resections involve two or more hepatic segments, while non-anatomic resection involves resection of the metastases with a margin of uninvolved tissue (3).

In our study, CRC metastases were mostly localized in the VI liver segment. Huges et al. have reported similar results (13). We performed 80 metastasectomies, 51 segmentectomies and 18 RFA resections of liver. Average number of CRC metastases per patient was 1.67. In addition, we made 10 left hepatectomies (segments I and II of the liver).

For liver resection, we used three methods: water jet, harmonic scalpel, and radio frequent ablation. In some cases were combined two methods in liver resection.

The harmonic scalpel procedure is associated with decreased operative time and a trend toward decreased blood loss and transfusion requirement. However, it is also associated with a frequent increase of postoperative bile leaks (21, 22).

The radiofrequency probe causes a greater amount of tissue necrosis than the other techniques, which may lead to the infectious complications. In addition, theoretically, there is a potential for thermal insult to major biliary structures. Radiofrequency ablation is generally reserved for ablating liver tumors that are unresectable. However, it is not effective in tumors next to portal vessels due to the heat sink cause by blood flow. The liver parenchyma in these situations will not be high enough to cause the coagulation necrosis of the tumor (14, 15, 24).

Water-jet dissection technique employs a high-pressure water jet to break apart the liver tissue and selectively isolate small vascular and biliary structures, potentially decreasing the blood loss. These vessels and ducts must then be ligated and divided individually according to preference. It is that necessary second step that may put this technique at a time disadvantage to others, which offer simultaneous transection and hemostasis. Additionally, this technique spares the surrounding tissue from any thermal damage.

Several studies have shown that patients with small resectable tumors, who had not cirrhosis or other serious health problems, were likely to do well if their cancers were removed. Their overall 5-year survival was over 50%. For people with early-stage liver cancers who were able to have a liver transplant, the 5-year survival rate was in the range of 60% to 70% (12-20).

In summary, the success of liver surgery is owed not only to improved transection techniques, but also to advances in perioperative/postoperative care and anesthesia. Decisions about anatomic versus non-anatomic resections for colorectal metastasis and primary liver tumors should be made before surgical exploration. Also liver parenchyma preservation is important, since many patients will receive postoperative chemotherapy and risks of liver failure are much higher. A frequent use of one technique allows a surgeon to become comfortable in that method, and because of that, number of complications rapidly decreases. It is important that surgeons understand the risks, benefits, and costs of various surgical approaches of liver resection for colorectal metastases and primary liver tumors. In an era where focus is placed on cost savings in medicine, comparing the cost benefit of the different techniques in liver resection will play an important role in how we can manage these patients.

Conflict of Interest

We declare no conflicts of interest.

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