CLINICAL OUTCOME OF MAJOR HEPATIC RESECTION IN BENIGN HEPATIC LESIONS

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Article History: Received: 05.04.2023 **Revised:** 12.05.2023 **Accepted:** 18.05.2023

Abstract

Background A wide range of neoplastic and regenerative processes are present in benign hepatic tumors. The study's objective is to investigate the mortality and morbidity of Major liver resection of benign hepatic lesions to evaluate the surgical outcome of hepatic resection procedures.

Methods This was prospective and retrospective descriptive research (2015–2022) conducted on patients with benign hepatic focal lesions at the Suez Canal University Hospital in Ismailia, Egypt, and the National Liver Institute in Menufia, Egypt.

Results Of the participants, 86.8% underwent open procedures, and only 17.5% required a blood transfusion. The most common type of resection was non-anatomical hepatectomy (66.1%), followed by formal left hepatectomy (38.8%). Approximately 25% of the patients had associated operations, with cholecystectomy being the most frequent (15%). Additionally, 16% of patients experienced intraoperative complications, with intraoperative bleeding being the most common (12.3%).

Conclusions When performed in high-volume centers, the fundamental risk of elective liver resections is low, comparable to, or lower than the risk associated with other elective abdominal surgeries. Therefore, unless an additional extrahepatic treatment is necessary, it is reasonable to broaden the criteria for liver resection in patients with benign lesions growing on a healthy liver.

Keywords: HEPATIC RESECTION, HEPATIC LESIONS.

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DOI: 10.48047/ecb/2023.12.5.261

1. INTRODUCTION

Benign hepatic tumors encompass a wide range of genuine neoplastic and regenerative processes. Due to advancements in imaging techniques like MRI, CT scan, and ultrasound, a significant percentage of patients can receive a precise diagnosis without laparotomy or resection [1]. Hemangioma, focal nodular hyperplasia (FNH), and hepatocellular adenoma (HCA) are the three most common types of solid benign liver tumors [2]. Most patients with benign liver tumors have no symptoms and require no therapy, but some may experience abdominal discomfort or pressure from nearby tissues. Malignant transformation and hemorrhage are the most two significant side effects [3].

The Couinaud classification remains the primary method used to define the various liver segments (I to VIII). Major liver resection is defined as the removal of three or more continuous liver segments based on this classification. In a right hepatectomy or right hemihepatectomy, the resected segments include V to VIII, while in a left hepatectomy or left hemihepatectomy, segments II to IV are removed, with or without the inclusion of Section I. Extended right hepatic surgery, also known as right trisectionectomy surgery, entails the removal of segments IV to VIII, while extended left hepatectomy, or left trisectionectomy, involves resection of segments II to V and VIII. It should be noted that the extension of the segment I may or may not be included in these extended resections [4].

Although surgery can relieve patients' pain, it poses several risks. The objective of the study is to measure the mortality and morbidity of major liver resection of benign hepatic lesions to determine the surgical outcomes of hepatic resection surgery.

2. PATIENTS AND METHODS

This is prospective and retrospective descriptive research (2015–2022) conducted on patients with benign hepatic focal lesions at the Suez Canal University Hospital in Ismailia, and the National Liver Institute in Menufia, Egypt.

Inclusion criteria

Patients exhibiting symptoms such as a mass effect on the biliary tree or gastrointestinal tract, an inflammatory response, spontaneous rupture, or

pedunculated lesions presenting a risk of pedicle torsion. Patients were also included if a definitive diagnosis could not be made using available imaging modalities.

Hepatic Adenoma

Hepatic adenomas should be removed regardless of the size or subtype, especially in male patients due to the increased risk of cancer. In females, adenomas greater than 5 cm in size or those presenting with signs of inflammation should also be considered for removal.

Exclusion criteria

Patients with ASA III and IV, cardiopulmonary disease, small benign lesion cirrhotic liver, and those who are asymptomatic are excluded from the study.

METHODS

In this study, 114 consecutive patients with benign hepatic lesions underwent hepatectomy at the National Liver Institute in Minufeia and the surgical departments of Suez Canal University Teaching Hospital, consecutively.

Diagnostic methods and preoperative hepatic functional evaluation were performed using ultrasound, CT, and MRI imaging modalities. Lab tests were also conducted to assess patients' fitness for surgery. Hemangiomas were identified on ultrasonography as well-defined hyperechoic masses with sharp borders and acoustic amplification. However, larger lesions often exhibited an unusual appearance due to calcifications or lumen obstruction by thrombi. Contrast-enhanced exams, such as contrast-enhanced CT, and MRI, were used when normal ultrasonography was unable to provide a clear diagnosis. These exams revealed rapid peripheral and nodular enhancement on arterial phases, followed by centripetal filling of the lesion, allowing differentiation of hemangiomas from other lesions.

Surgical Technique

A bilateral subcostal incision with a vertical midline extension to the xiphoid cartilage was used for large or central tumors. Costal margins were elevated using an Omni-tract or Thompson fixed body wall retractor.

Intraoperative ultrasound was used to determine the tumor's connection to vascular structures such as the portal veins, hepatic veins, and inferior vena cava. Peritoneal attachments were divided to mobilize the liver as necessary for the intended resection. The appropriate hemiliver was completely mobilized for right-sided sectoral resections and hemihepatectomy procedures, exposing the retrohepatic IVC and extrahepatic hepatic veins. The plane of the intended parenchymal transection was delineated on the surface of the liver using diathermy and a Cavitron Ultrasonic Surgical Aspirator (CUSA) Söring Ultrasonic Generator Sonoca 300, Germany.

The transected liver surface was examined for bile leakage and repaired with fibrin sealant or an Argon beam laser. Closed silastic suction drains were used to drain the resection area routinely. Intermittent calf compression stockings and subcutaneous Clexane (40 mg daily) were used as a preventative measure against deep vein thrombosis.

Anesthetic management

Radial artery and central venous catheters were inserted to monitor arterial and central venous pressures (CVP) throughout the procedure. The cumulative fluid deficit was restored upon completion of parenchymal transection to maintain intravascular volume and preserve renal function.

Postoperative management

The hospital course and early postoperative morbidity were assessed, and postoperative follow-up was conducted using ultrasonography on the first day after surgery before drain removal. Clinical examinations, serological tests, abdominal ultrasonography, and, in some cases, CT scans and liver function tests were used to monitor all patients.

PATIENTS

Extended right hepatectomy for giant right lobe hemangioma (Figs. 1,2).

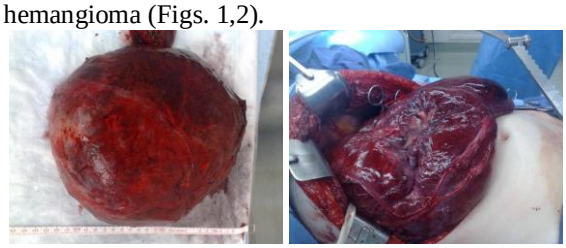

Fig. (1) Intraoperative giant hepatic haemangioma.

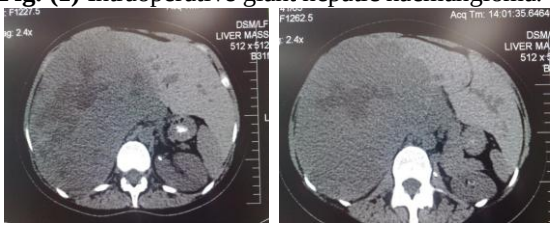

Fig. (2) CT abdomen showing huge right lobe hemangioma.

Postoperative follow-up for patients with hemangiomas was conducted over an 18-month period. Monthly outpatient visits were scheduled for all patients, and no recurrence of hemangiomas or significant complications were observed during the follow-up period.

3. RESULTS

This descriptive cross-sectional study aimed to investigate the postoperative morbidity and mortality rates of patients with benign hepatic lesions who underwent major hepatic resection at Suez Canal University Hospital and the Hepatobiliary Department of the National Liver Institute in Egypt. The study enrolled 114 patients

and their baseline characteristics are summarized in **Table 1.**

Baseline Characteristics:

The mean age of the patients was 56.96 ± 10.06 years, and 80% of the patients were males. These results are in line with previous studies that reported a higher incidence of hepatic lesions in males and older patients. The patients had various benign hepatic lesions, and major hepatic resection was performed in all cases.

Table (1): Demographic and clinical characteristics of patients

Variables	**n = 114**
Age (years), mean ± SD	56.96 ± 10.06
Gender, n (%)	
Male	91 (79.8)
Female	23 (20.2)
Body weight (kg), mean ± SD	77.98 ± 13.72
Data are presented as number (%) or mean (SD).	

Clinical and Radiological Characteristics:

Table 2 summarizes the clinical and radiological characteristics of the patients. Radiological measures showed that about 90% of the hepatic tumors were solitary. The mean length of stay in the ICU was 1.89 ± 1.45 days, while the mean length of stay in the hospital was 5.54 ± 4.11 days.

Table (2): Clinical characteristics of the studied patients

Variables	**n =114**
Tumor number, n (%)	
Solitary	102 (89.5)
More than one	12 (10.5)
Tumor size (cm), mean ± SD	5.54 ± 3.07
ICU stay time	
mean ± SD	1.89 ± 1.45
median (range)	2 (0 – 8)
Hospital length of stay	
mean ± SD	5.54 ± 4.11
median (range)	4 (2 – 29)
Data are presented as number (%) or mean (SD).	

Laboratory Measures:

The evaluation of laboratory measures is an essential component of postoperative care for patients who undergo major hepatic resection for benign hepatic lesions. In this study, Table 3 provides a comparison of pre-and postoperative laboratory results, with all preoperative cases classified as CHILD A. Table 3 shows that the hepatic procedure resulted in a significant increase in serum bilirubin levels (0.81 ± 0.31 vs 1.4 ± 0.83 mg/dl, p<0.001). Furthermore, the procedure caused a significant decrease in both serum albumin (3.8 ± 0.38 vs 3.03 ± 0.44 gm/dl, p<0.001) and platelet count (150.96 ± 81.12 vs 141.88 ± 69.53, p<0.001).

Table (3): Laboratory measures before and after the procedure

Clinical characteristics	**Time**		**test value**	**P-value**
	Preoperative	**Postoperative**		
Bilirubin, mg/ dl	0.81 ± 0.31	1.4 ± 0.83	7.4	<0.001 [a]
Albumin (gm/ dl)	3.8 ± 0.38	3.03 ± 0.44	-9.1	<0.001 [a]
Serum Creatinine, mg/ dl	0.79 ± 0.22	0.79 ± 0.24	-0.37	0.26 [a]
PLT count	150.96 ± 81.12	141.88 ± 69.53	-3.1	<0.001 [a]
INR	1.12 ± 0.13	-	-	-
PC (%)	74.84 ± 12.15	-	-	-
Hemoglobin	14.49 ± 12.16	-	-	-

a p-values are based on Wilcoxon Signed Ranks Test. Statistical significance at P < 0.05.

Operative Characteristics

Table 4 summarizes the operative characteristics among the 114 patients who underwent major hepatic resection for benign hepatic lesions. The results show that 86.8% of the patients had open procedures, while the rest had laparoscopic procedures. Moreover, only 17.5% of the patients required blood transfusion during the procedure.

The most frequent type of resection was non-anatomical hepatectomy, accounting for 66.1% of the cases, followed by formal left hepatectomy, accounting for 38.8% of the cases. Additionally, 25% of the patients had associated operations, with cholecystectomy being the most frequent one, accounting for 15% of the cases. Intraoperative complications occurred in about 16% of the patients, with intraoperative bleeding being the most frequent one, accounting for 12.3% of the cases.

Table (4): Operative characteristics among the studied patients

Variables	**n =114**
Type of operation, n (%)	
Open	99 (86.8)
Laparoscopic	15 (13.2)
Type of resection, n (%)	
Non-anatomical	58 (66.1)
Formal Right hepatectomy	20 (22.8)
Formal left hepatectomy	34 (38.8)
Extended right hepatectomy	2 (2.3)
Blood transfusion, n (%)	
Absent	94 (82.5)
Present	20 (17.5)
mean ± SD	2.88 ± 1.17
Operative time, mean ± SD	3.79 ± 1.15
Associated operations, n (%)	
Absent	**86 (68.1)**
Present	**28 (31.9)**
Cholecystectomy	23 (19.7)
Hernial repair	4 (3.5)
Splenectomy	1 (1)
Intraoperative complication, n (%)	
Absent	**96 (84)**
Present	**18 (16)**
Bleeding	14 (12.4)
Diaphragmatic tear	2 (1.8)
LHD injury	2 (1.8)
Data are presented as number (%) or mean (SD).	

Postoperative complications:

Table 5 depicts that the postoperative complications rate among the studied patients was 32.5%, with post-hepatectomy liver failure being the most prevalent complication. As previously mentioned, 14.1% (n=16) of the cases experienced PHLF, of which 6.1% were grade A, resolving spontaneously without clinical intervention.

Table (5): Postoperative complications among patients

Variables	**n (%)**
Absent	77 (67.5)
Present	37 (32.5)
Chest infection	5 (4.4)
Post hepatectomy liver failure (PHLF)	16 (14.1)
Grade A	7 (6.1)
Grade B	9 (8)
Wound infection	6 (5.2)
Bile leak (grade I)	5 (4.4)
Cardiac complications	5 (4.4)
Data are presented as numbers (%).	

Data are expressed as mean ± SD. number (%). p> 0.05= not significant. *p< 0.05= significant.

Types of hepatic lesions:

The histopathological analysis shown in Table 6 indicates that hemangioma was the most common type of hepatic lesion, accounting for 54.2% of cases, followed by a hydatid cyst at 44%.

Table (6): Types of hepatic lesions according to histopathological analysis

Variables	n (%)
Hemangioma	62 (54.2)
Hydatid cyst	50 (44)
Biliary cystadenoma	1 (0.9)
Caroli cyst	1 (0.9)
Data are presented as numbers (%)	

Furthermore, those who developed complications had a statistically significant longer length of stay in both the ICU (p<0.001) and hospital (p<0.001) as shown in Figure 3.

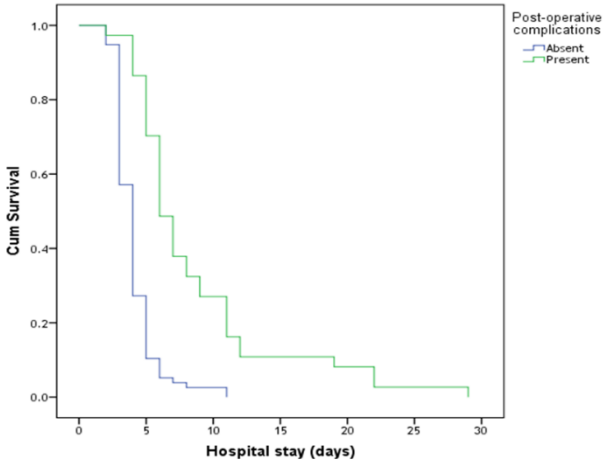

Fig. 3 Time to discharge in patients with and without complications

4. DISCUSSION

The data presented in this study provides clear evidence that the excision of benign tumors can be performed safely with minimal postoperative morbidity and mortality in appropriately selected patients. All preoperative patients in this study were categorized as CHILD A. The hepatic operation resulted in a statistically significant increase in blood bilirubin levels (0.81±0.31 vs 1.4±0.83 mg/dl, p<0.001), as well as a significant reduction in serum albumin levels (3.8±0.38 vs 3.03±0.44 gm/dl) and platelet count (150.96±81.12 vs 141.88±69.53). Most patients experienced complete or partial remission of their symptoms, which is consistent with previous research findings [5]. These results have implications for the management of patients with benign liver tumors, which are typically managed in one of two ways: either as previously reported benign liver lesions that have grown in size with clinical symptoms or as newly discovered liver lesions with a questionable diagnosis [6].

The primary indication for removing benign solid liver tumors is the presence of clinical symptoms that significantly impact the patient's quality of life. Before surgery, all other potential causes of the symptoms must be ruled out. In our study, patients were more likely to undergo resection if they had large lesions that caused clinical complaints. Lesion size and symptom intensity were positively correlated in our investigation. After surgery, there was a significant improvement in the general health state and symptoms of the patients, which is consistent with previous published accounts [7].

The prevalence of postoperative complications among patients in our series was 32%, with chest infection (5%) being the most common complication, likely exacerbated by the COVID-19 pandemic, and post-hepatectomy liver failure (14%) being the second most common complication. Six patients (6.1%) had grade A liver failure that resolved spontaneously without clinical intervention. Comparable data were recently published by Lordan et al. [8], showing that the risk of significant complications in a group of 79 liver resections was 1.3%, and there were no postoperative fatalities. These findings suggest that specialized hepatobiliary centers can safely perform even major hepatic resections of benign liver tumors. This knowledge may impact how patients with benign liver tumors decide to proceed

with treatment. No mortality was recorde in our study.

Morbidity rates of 25-30% should not be tolerated in benign liver resections. While the potential risks of not treating a patient with a deadly illness must be weighed against the postoperative morbidity and mortality that follow liver resections for malignant diseases, benign liver tumors do not fall under these criteria. As a result, more patients with benign tumors may be candidates for liver resection, because of the minimized impact of surgery on patients (8). The need for blood transfusions was required by 17% of our patients, and it is an important endpoint for evaluating the risk of liver surgeries.

5. CONCLUSION

The presented evidence supports the low-risk nature of elective liver resections in high-volume centers, compared to other elective abdominal surgeries. Thus, it is reasonable to expand the criteria for liver resection in patients with benign lesions on a normal liver, unless an additional extrahepatic treatment is required. Our study showed no intraoperative or in-hospital mortality in patients with benign diseases, and both transfusion needs and morbidity rates were extremely low. Therefore, it is no longer appropriate to evaluate the risk of liver resections in unclassified patients based solely on in-hospital death.

ACKNOWLEDGMENT

The National Liver Institute team and data base.
Suez Canal university spechialized hospital.

FUNDING

This work did not receive any financial support from any organization.

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