Evaluation of Hepatic Resection Procedures for Benign and Malignant Focal Liver Lesions

Musafir Atea Hashim (F.I.B.M.S)[1], **Bashar Abbas Abdul-Hassan** (F.I.B.M.S)[2] **and Salah Obaid Hamad** (F.I.B.M.S)[3]

Abstract

Background: Liver resection is the curative treatment for focal liver lesions. It is one of the high risk surgical procedures performed by experienced surgeons.

Objective: To evaluate the different types of liver resections methods and associated factors related to morbidity and mortality in Gastroenterology Hospital and Baghdad Teaching Hospital.

Patients and Methods: This prospective study included 35 patients (age range 28-58 years, 15 male and 20 female) with focal liver lesions during the period from November, 2013 to February 2016. Fourteen patients were asymptomatic while the other patients were complaining form different symptoms. Preoperative assessment included liver and renal function tests, tumor markers and radiological investigations. Patients were followed up for one month for postoperative short-term complications.

Results: Bleeding was the most serious perioperative complication and all patients required blood transfusion. Eight hepatic resection methods were employed, and 8 types of lesions were detected, of which metastatic colorectal adenocarcinoma and cavernous hemangioma are the most prevalent (34.29% and 22.57% respectively). The duration of surgery ranged from 100 min in wedge resection to 300 min in different types of hepatectomy with average 8 days hospital stay. The most prevalent short-term complications were fever and atelectasis and wound infection (37.14% and 22.57% respectively).

Conclusion: Most evaluation criteria are comparable with that reported in global series, and accordingly, our center could perform different types liver resection.

Key words: Hepatic resection, focal liver lesions.

Corresponding Author: basharabass@yahoo.com

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[1,3]Gastroenterology and Hepatology-Teaching Hospital-Medical City-Baghdad- Iraq.
[2] College of Medicine- Al-Nahrain University- Baghdad- Iraq.

Introduction

Focal liver lesions (FLLs) are a group of liver pathologies with solid or liquid-containing masses in the liver. They comprised most common reasons for consultation for hepatobiliary services.Most frequently, these lesions are detected in

patients with liver cirrhosis or those with colorectal cancer[1].However, with the advent of advanced imaging modalities such as ultrasonography (US), computed tomography (CT), and magnetic resonance imaging (MRI), a large number of cases can be incidentally discovered during investigations for other complains. In one report, FLLs were recorded in up to 33% of radiological studies [2].

The most commonly benign FLLs include cysts, hemangiomas, focal nodular hyperplasia (FNH), and hepatocellular adenomas (HCA) [3]. On the other extreme, the most commonly malignant lesions are metastases[4],while primary liver malignancies including hepatocellular carcinomas (HCC), and to less extend intrahepatic cholangiocarcinomas (IHC) are also prevalent [5].

The critical components of evaluating an FLL are a detailed history, physical exam, radiological tests, and pathology. Different imaging modalities as well as laboratory investigations are being used to reach a definitive diagnosis [6]. Liver resection is indicated treatment for symptomatic FLLs with tumor-specific symptoms and for uncertain diagnosis especially in patients with family history of malignancy. Otherwise, the strategy of "watch and wait" is recommended [7].

Despite the introduction of laparoscopic surgery in 1987 with all its known advantages, traditional open surgery is still the gold standard for performing liver resection [8]. Data regarding the outcomes of hepatic resection in Iraq are very rare. Thus, this study aimed to evaluate the different types hepatic resection (open surgery) for management of benign and malignant focal liver lesions among Iraqi patients and to identify factors associated with morbidity and mortality. Such evaluation could guide surgeon to choose the proper hepatic resection method.

Patients and Methods

The Study Population

During the period from November, 2013 to February, 2016, a total of 35 patients with FLL who referred to Gastroenterology and Hepatology Teaching Hospital and to Baghdad Teaching Hospital/ Medical City were eligible for prospective study. The inclusion criteria were all patients with FLL (benign and malignant) that needs surgical liver resection, and those with class I or II American Society of Anesthesiologists (ASA). Exclusion criteria were patients with end stage cancer, those who refused treatment, cases of sever cardiorespiratory problems that cannot withstand major hepatic surgery, and those with chronic liver cirrhosis. The preoperative demographic and clinical characteristics are presented in table (1). Fourteen patients were asymptomatic and discovered accidently during imaging for other complains, while [16] patients had abdominal pain usually in the right upper quadrant or epigastric pain.

Table (1): Preoperative demographic and clinical base line of the study population.

Characteristics	Values
Age, years(mean±SD)	37.8±10.12
Sex (M/F)	15/20
Asymptomatic	14(40%)
Abdominal pain	16(45.71%)
Abdominal mass	10(28.57%)
Fever	4(11.43%)
Jaundice	9(25.71%)
Loss of weight	9(25.71%)
Nausea and vomiting	4(11.43%)
Other variable symptoms	5(14.29%)

Preoperative assessment included liver function test, renal function test, clotting profile and tumor markers (alfa feto protein [α-FP], carcino-embryonic antigen [CEA] and carbohydrate antigen [CA19-9]). All patients were underwent radiological investigation including routine abdominal ultrasound (US) and computed topography (CT). Other radiologic investigations were applied for selected patients; magnetic resonance imaging (MRI) for 17 patients, oesophagogastroduofenoscopy (OGD) with colonscopy for 9 patients suspected to have colorectal metastases, endoscopic retrograde cholangiopancreatography (ERCP) for 6 patients with hydatid cyst and biliary leakage. Two patients with colorectal liver metastasis were having positron emission tomography(PET) scan abroad.

Nine (25.71%) patients were found to have abnormal values for liver function test represented by elevated total serum bilirubin, SGOT, SGPT and alkaline phosphatase, 11 (31,43%) patients (with colorectal liver metastasis) had high CEA, 3(8.57%) patients were with coagulation abnormalities, and only 1(2.86%) patient was positive for hepatitis C virus.

Surgical Techniques

All procedures were done under general anesthesia and were performed by the same team. The operations were performed according to the technique described by Bismuth [9].Patients were positioned in supine with both arms were out to allow anesthesia to access IV's. Based on the affected anatomical area of the liver, several types of incisions were used. These surgical incisions were subcostal incision (Kocher) with midline extension over xiphoid in 10 patients (allows excellent exposure for the right lobe), midline incision in 11 patients (offers good exposure for left lobe), roof top (chevron) in 7 patients, J shape in 3 patients,and Mercedes benz incisions in 4 patients. The Thompson retractor and Morise was used for upward retraction of ribs to allow excellent exposure and ease dissection of suprshepatic and infrahepatic inferior vena cava of the liver right lobe.

Once the approach of liver dissection was determined, the liver was mobilized and

inflow and outflow vessels were controlled. For centrally located lesions which required either right or left hepatoctomy, extrahepatic ligation of epsilateral portal vein and hepatic artery was achieved. For lesions located away from the bifurcation of the portal pedicles, there was intrahepatic pedicle ligation. When either right or left hepatoctomy was required there would be outflow control.

Crush-clamp method was generally used for transection of liver paranchyma. However, LigaSure, harmonic knife and cavitron ultrasonic surgical aspirator (CUSA) were also used for the same purpose. Intraparanchymal control of large vessels was achieved with clips or suture, and with bipolar cautery for small vessels. Once the lobe or segment was removed, argon beam coagulation was applied for further hemostasis. Biliary leak was controlled with suture ligature. Surgical drains was routinely placed in the surgical bed and removed in the third day postoperation. Postoperative analgesia consisted of a non-steroidal anti-inflammatory drug and i/v acetaminophen.

Evaluation criteria included duration of surgery, blood transfusion, and postoperative hospital stay. Furthermore, all patients were followed up for 30 days postoperation, and postoperative complications were recorded.

Results

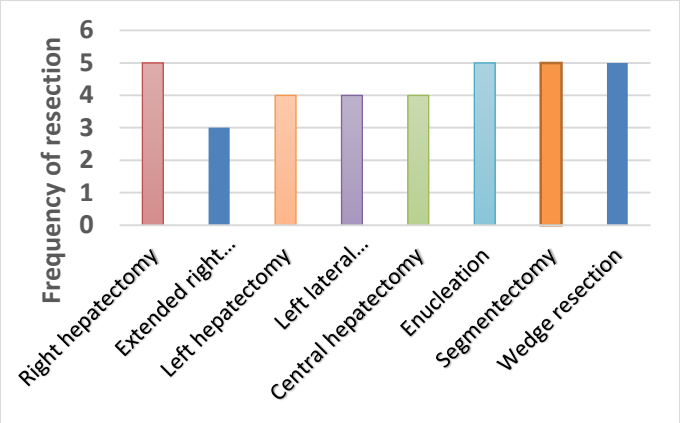
Perioperative Results

Bleeding was the most serious intraoperative complication, and 4 patients (11.42%) required more than 3 units, 12 patients (34.28%) required 3 units, while 19 patients (54.28%) required less than 3 units of blood. Moreover, in all patients, Pringle maneuver was applied intermittently for 15-10 minutes with intervals of 5 minutes.

The average size of the lesions was 45mm (range 20 to 110mm). In 22 patients, the lesions were found in hepatic segment II-III, while in 13 patients the lesions were in IV segment. The lesions were solitary in 31 patients, and double in 4 patients.

Resection Methods

Eight types of anatomic resections (AR) were used (figure 1). Sixteen patients had major liver resection including right or left hepatectomy with or without extension.



Figure(1): types of liver resection methods. Each of right hepatectomy, enucleation, segmentecomy and Wedge resection were used five times, while each of left hepatectomy, left lateral hepatectomy and central hepatectomy were used four times. Extended right hepatectomy was the least freuently used resection with only three times.

Postoperative Results

The pathology reports of liver lesion post operatively showed that metastatic colorectal adenocarcinoma was the most common lesion involving 12(34.29%) patients, followed by cavernous haemangioma,8(22.57%) patients, hydatid cyst, 7(20%) patients, cholangiocarcinoma, 3(8.57%) patients, hepatocellular carcinoma, 2(5.71), hepatic sarcoma, adenocarcinoma of gall bladder and metastatic neuroendocrine of small bowel each with 1(2.86%) patient.

The duration of surgery varies according to the type of liver resection and pathological nature of the lesion. Generally, this duration ranged from 100 min in wedge resection and 120 min in segmentectomy to around 300 min in each of right, left and central hepatectomy. In between values were recorded in other types; in enuleation, 100-240 min, in left lateral hepatectomy 180 min, and in extended right hepatectomy 180 min.

The mean postoperative hospital stay was 8 days. The patients were kept in the intensive care unit for 24 to 48 hrs then they transferred to ward once they became stable. All patients received prophylactic antibiotic and short acting heparin during hospital stay.

Two patients (5.71%) died during the 30 days follow up. The first one died due to sudden cardiac standstill. This patient was suffering from obstructive jaundice and right side cholangiocarcinoma and was undergone left hepatectomy with roux-en-hepaticojejunostomy. The other one had right hepatectomy for radical treatment of hydatid cyst and died due to multiorgan failure. Patients were discharged to their home when they fully mobilized, started free oral intake and free of operative-related symptoms.

Almost all patients had encountered at least one or more of the short-term

complications. A total of 10 of these complications were recorded (figure 2), among which fever and atelectasis and wound infection involved 21 (60%) patients.

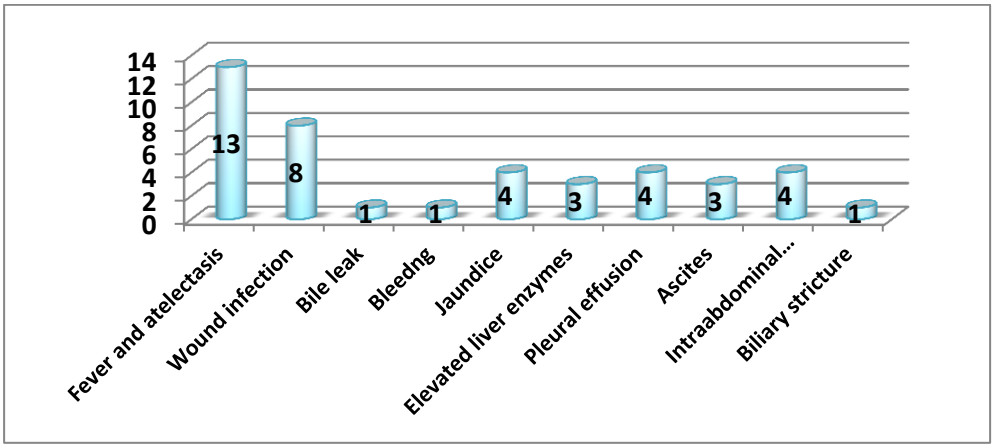


Figure (2): short-term complications. Fever and wound infection are the most frequent complication, while bile leak, bleeding and biliary stricture were the least ones**.**

Discussion

Liver resection is now considered to be the most effective treatment for patients with benign or malignant hepatic lesions. Thanks for wide spread of modern imaging modalities, large number of cases with FLL are discovered in otherwise asymptomatic patients and even in healthy individuals. In this series, 40% of cases were asymptomatic and were detected incidentally during imaging for other pathologies. Choi et al. [10] used ultrasonography to examine a total of 2670 asymptomatic Korean patients. Among those, 840(31.5%) were found to have FLLs, the vast majority of which were benign. Other previous studies have detected FLL in 10%-33% [11, 12]. This variation in percentage could be referred to many factors such as patient characteristics, imaging technique, and imaging interpretation [2].

In the current study, OLR was exclusively used for surgical treatment of all referred patients with FLL. In many centers, OLR procedures are still dominated over LLR for two main reasons. The first reason is attributed to technical aspects in that many of these centers lack the essential equipment for performing LLR. The second reason refers to long duration and difficulty in performing LLR [13]. Furthermore, in overall evaluation, it seems that OLR compatible to LLR. In a recent meta-analysis of 3702 patients in 49 studies, Jackson *et al*[14]. Showed that OLR is as safe as and as efficacious as LLR with similar operative time and cost. In another very recent study, Koga *et al.* [15] reviewed

several papers compared OLR vs LLR. They found that in long-term outcome, there was quite equivalent between the two categories.

Anatomic resection was adopted in the majority operations in the current study, while non-anatomical wedge resection and enucleation were done for hemangiomas and small tumors. In fact, AR resection is superior to non-anatomic from the oncologic and anatomic aspects [16]. In addition, anatomic resection is usually associated with better hemostasis and control of bile leakage compared to non-anatomic [17]. However, AR is considered technically more demanding and often requires a wider extent of parenchymal sacrifice [18]. Moreover, a moderate increase in operation time for AR was recorded [13], although the operation type is the main determinant of this factor.

Perioperative bleeding is one of the most important disadvantages of open surgery. In average, about three units of blood were required for each patient, and Pingle maneuver was applied frequently to control the blood loss in this study. As compare with other studies, Siniscalchi et al. [19] reported that 27.4% of their patients who underwent open hepatic resection required blood transfusion. In another series, only 6.6% of patients needed for blood transfusion, and Pingle maneuver was applied for 53% of patients for a mean of 23.6 min [20]. This variation may be attributed to the type of available facilities and preoperative care.

Eight resection approaches were used in this series. Generally, selection of resection approach largely depends on the patient condition, number and size of hepatic lesion and the available resources [21]. In this regard, Gobardhan et al. [22] reported that no single method for parenchymal resection has proven better than the others.

The duration of surgery recorded in this series varied widely (100 to 300 min) depending basically on the resection type. These durations are comparable to some global studies. Clarke et al. [23] reported that this duration ranged from 45 to 450 min (average 215 min). Greater duration was reported by Marwah et al. [24] who used OLR for 241 Indian patients and recorded an average of 330 min (range 110-840 min) operation time.

Mean PO hospital stay in this study was 8 days, which is comparable to many other series with similar circumstances such as those conducted by Seleem and Ali [25] and Marwah et al. [23] who reported PO hospital stay of 5.14-10.2 days.

The mortality rate in the current series was 5.71% which is relatively higher than those reported in other series. In a study involving 326 hepatic resections Andres et al. [26] recorded only 0.7% mortality, and almost similar rate was reported by Kazaryan et al. [13] in their series on 139 patients. The high figure of mortality in the current study can be explained by the presence of underlying morbidity in those patients which could not be detected during preoperative investigations.

Almost all patients involved in the current series experienced one or more short-term complications. Most of these complications like bile leakage, ascites, wound infection, plural effusion and biliary stricture were frequently recoded in global studies [13,24,25]; however, in all these studies the rate of PO complications did not exceed 50%. But this does not mean a high rate of complications in the current study. Rather, there is no definite list of complications in all studies. In fact, many studies exclude large number of items from their list and take only major complication into account [25]. For example, fever and atelectasis, elevated liver enzymes and jaundice are not considered in these studies. These complications account for about 50% of the current study complications. Thus, the results are comparable the other studies. The other point is that all these complications were easily managed. Interestingly, bleeding and biliary leakage are among the least encountered short-term complications in the current study. This reflects the surgeon's experience and surgical skills.

Conclusion

Due to complexity of liver surgery, this approach should be served for specialized institution that are involved in not only doing these cases routinely, but training other surgeon in minimally invasive techniques as well. Most evaluation criteria are comparable with those recorded globally. Thus, different types of liver resection could be performed in our center; however, laparoscopic hepatic resection should be practiced in the center and compare the outcomes of the two method (OLR vs LLR) to finally adapt one method more than the other.

References

[1]Algarni AA, Alshuhri AH, Alonazi MM, Mourad MM, Bramhall S. Focal liver lesions found incidentally. World J Hepatol 2016;8(9):446-451.

[2]Boutros C, Katz SC, Espat NJ. Management of an incidental liver mass. Surg Clin North Am. 2010 Aug; 90(4):699-718.

[3]Cogley JR, Miller FH MR imaging of benign focal liver lesions. Radiol Clin North Am. 2014 Jul; 52(4):657-82.

[4] Bastati N, Feier D, Wibmer A, et al. A Noninvasive differentiation of simple steatosis and steatohepatitis by using gadoxetic acid-enhanced MR imaging in patients with nonalcoholic fatty liver disease: a proof-of-concept study.Radiology. 2014 Jun; 271(3):739-747.

[5]Fowler KJ, Brown JJ, Narra VR. Magnetic resonance imaging of focal liver lesions: approach to imaging diagnosis. Hepatology. 2011 Dec; 54(6):2227-2237.

[6]Marrero JA, Ahn J, Rajender RK. ACG clinical guideline: the diagnosis and management of focal liver lesions. Am J Gastroenterol 2014;109(9):1328-1347.

[7]Ehrl D, Rothaug K, Herzog P, Hofer B, Rau H. Incidentaloma of liver: management of a diagnostic and therapeutic dilemma. Hepato-PancreatBiliarySur2012;ID891787.

[8] Aragon RJ, Solomon NL. Techniques of hepatic resection. J Gastrointest Oncol 2012;3(1);28-40.
[9]Bismuth H. Surgical anatomy and anatomical surgery of the liver. World J Surg 1982;6(1):3-9.
[10] Choi SH, Kwon H, Lee S, Park HJ, Kim MS, Sohn JH, Chung EC, Park HW. Focal hepatic solid lesions incidentally detected on initial utrasonography in 542 asymptomatic patients. Abdom Radiol 2016;41:265-272.
[11] KuszyK BS, Bluemke DA, Urban BA et al. Portal-phase contrast-enhanced helical CT for the detection of malignant hepatic tumors: sensitivity based on comparison with intraoperative and pathologic findings. AJR Am J Roentgeno 1996;166(1):91-95.
[12] Schwartz LH, Gandras EJ, Colangelo SM, Ercolani MC, Panicek DM. Prevalence and importance of small hepatic lesions found at CT in patients with cancer. Radiol 1999;210(1):71-74.
[13]Kazaryan AM, Marangos IP, Rosseland AR. Laparoscopic liver resection for malignant and benign lesions: ten-year Norwegian single-center experience. Arch Surg 2010;145(1):34-40.
[14] Jackson NR, HauchA, Hu T, Buell JF, Slakey DP, Kandil E. The safety and efficiency of approaches to liver resection: a meta-analysis. JSLS 2015;19(1):e2014.00186.
[15] Koga Y, Beppu T, Kuramoto K et al. Comparison of laparoscopic versus open liver resection for hepatocellular carcinoma using propensity matching. Ann Laparosc Endosc Surg 2017;2:105.
[16] Tanaka K, Shimada H, Matsumoto C, Matsuo K, Nagano Y, Endo I, Togo S. Anatomic versus limited nonanatomic resection for solitary hepatocellular carcinoma. Surgery. 2008;143(5):607-615.
[17]Schwartz SI. Hepatic resection. Ann Surg. 1990;211(1):1-8.
[18]Fan ST, Lo CM, Liu CL, Lam CM, Yuen WK, Yeung C, Wong J. Hepatectomy for hepatocellular carcinoma: toward zero hospital deaths.Ann Surg. 1999 ; 229(3):322-30.
[19]Siniscalchi A, Ercolani G, Tarozzi G *et al.*Laparoscopic versus open liver resection: differences in intraoperative and early postoperative outcome among cirrhotic patients with hepatocellular carcinoma- a retrospective observational study. HPB Surgery 2014;2014:ID871251.
[20]Morino M, Morra I, Rosso E, Miglietta C, Garrone C. Laparoscopic vs open hepatic resection: a comparative study. Surg Endosc 2003;17(12):1914-1918.
[21]Delis SG, Dervenis C. Selection criteria for liver resection inpatients with hepatocellular carcinoma and chronic liver disease. World J Gastroenterol 2008;14(22):3452-3460.
[22]Godbardhan PD, Subar D, Gayet B. laparascopic liver surgery: an overview of the literature and experiences os a single centre. Clin Gastroenterol 2014;28(1):111-121.
[23]Clarke DL, Currie EJ, Madhavean KK, Parks RW, Garden OJ. Hepatic resection

for benign non-cystic liver lesions. HPB 20-4;6(2):115-119.

[24]Marwah S, Khan MMR, Chaudhary A, Gupta S, Negi SS, Soin A, Nundy S. Two hundred and forty-one consecutive liver resections: an experience from India. HPB 2007;9:29-36.

[25]Saleem MI, Ali NA. Laparoscopic liver resection for hepatocellular carcinoma in patients with cirrhosis: an Egyptian single center experience. Clin Case Rep Rev 2017;3(1):1-3

[26]Andres A, Toso C, Moldovan B *et al.* Complications of elective liver resections in a center with low mortality: a simple score to predict morbidity. Arch Surg 2011;146(11):1246-1252.