Prognostic factors affecting disease-free survival after hepatic resection for hepatocellular carcinoma in cirrhotic liver

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Aims

Hepatic resections for hepatocellular carcinoma (HCC) in the cirrhotic liver are characterized by early recurrence. In this study, we analyzed several factors affecting disease-free survival after hepatic resection.

Settings and design

A retrospective and prospective study.

Materials and methods

From January 2002 to July 2012, 208 patients underwent hepatic resections for HCC in the cirrhotic liver in the Gastroenterology Surgical Center, Mansoura University, Egypt. There were 157 male (75.5%) and 51 female (24.5%) patients, with a mean age of 55.4 ± 9.3 years. Recurrence rates were analyzed using the Kaplan–Meier curve. The prognostic significance of the tested factors was investigated by univariate analysis using the log-rank test and by multivariate analysis using the Cox proportional hazards model. Statistical analysis was performed using SPSS18.

Results

Most patients were in Child–Pugh class A (88%). Major hepatic resection was performed in 73 patients (35.1%), segmentectomy was performed in 74 patients (35.6%), and localized resection was performed in 61 patients (29.3%). Hospital mortality occurred in 19 (9.1%) patients, whereas hospital morbidity occurred in 37% of the patients. The 1-, 3-, and 5-year survivals were 62.9, 25.9, and 19.1%, respectively. The prognostic factors predicting early tumor recurrence were the Child class, multifocality, portal vein (PV) invasion, perioperative blood transfusion, microvascular invasion, local spread, cut margin infiltration, lymph node infiltration, lack of a capsule, the tumor grade, the tumor stage, and preoperative alpha feto protein (AFP). However, tumor multifocality, perioperative blood transfusion, and cut margin infiltration were the main factors predicting early recurrence on multivariate analysis.

Conclusion

Factors predicting disease-free survival are different and multifactorial. However, the resection of HCC in a cirrhotic liver with preserved liver function is the treatment of choice and can be performed with favorable results.

Keywords:

hepatic resection, liver cirrhosis, localized, segmentectomy

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Introduction

Hepatocellular carcinoma (HCC) is a primary malignancy of hepatocellular origin [1]. It is the fifth most common tumor world-wide, and it is currently the third leading cause of cancer-related death [2,3], and accounts for more than 90% of all primary liver cancer. In the past, Egypt was similar to the western countries with an overall frequency of 2.3% among other types of cancer. However, currently, HCC appears to have been increasing over the last decade [4]. In Egypt, over a decade, there was nearly a two-fold increase in the proportion of HCC among chronic liver disease (CLD) patients, with a significant decrease in hepatitis B virus and a slight increase in hepatitis C virus (HCV) as risk factors. Increased detection of small lesions at presentation reflects increased awareness of the condition [5]. It is common in areas with endemic viral hepatitis B or C, which is the usual scenario in many African countries [6]. Hepatic resection and liver transplantation are the main stay of treatment with curative intent [7–9]. For patients with early HCC and decompensated cirrhosis, liver transplantation is the treatment of choice because the procedure potentially cures both the cirrhosis and the HCC, and the outcome after liver transplantation is universally accepted to be better than that after hepatic resection [9,10]. In Egypt, liver transplantation is performed, but the practice is still limited to a few centers due to shortage of living donors and legal handles with cadaveric transplantation, and because of the high technical and financial demands. Hence, hepatic resection is the main line of treatment presented for patients with HCC in most centers in our country. As reported previously, most of our patients developed HCC on the background of cirrhosis, and this poses a

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lot of challenges in their management [11,12]. Hence, only a few of these patients could benefit from liver resection because of the stage of the tumors and their clinical status at presentation.

Despite improved resection techniques and subsequent decreased operative morbidity and mortality in hepatic surgery, there are frequent intrahepatic recurrences of HCC after radical hepatic resections [12,13]. Several factors have been suggested to be responsible for the recurrence and the possible reduced survival after liver resection for HCC [14–16]. Liver cirrhosis has been documented to be an independent risk factor for reduced disease-free survival and overall survival in patients with HCC [17]. However, there are few reports about independent factors affecting the disease-free survival after hepatic resection for this group of patients with liver cirrhosis. Hence, the aim of this study was to determine factors affecting disease-free survival after hepatic resection for patients with HCC in a cirrhotic liver.

Participants and methods

From January 2002 to July 2012, 650 patients underwent hepatic resections for different malignant and benign lesions, of whom 208 patients had HCC in cirrhotic liver in the Gastroenterology Surgical Center, Mansoura University, Egypt.

Preoperative assessments

All the patients underwent clinical evaluation, laboratory investigations, and imaging studies. The imaging studies include ultrasonography (US), enhanced computed tomography scan (CT scan), Doppler examination, MRI, and occasional angiography using iodized oil (Lipiodol, Guerbet LLC, Bloomington, Indiana, US) as the contrast medium followed by CT. The aim of the imaging studies was to confirm the diagnosis of HCC and for its initial staging regarding the size, the number of lesions, the affected segments, and vascular invasion. Laparoscopic assessment was performed if the radiological assessments were inconclusive. A chest radiography was performed to rule out metastasis to the chest. Upper gastrointestinal endoscopies were performed routinely for all the patients, and obliteration of esophageal varices was carried out using injection sclerotherapy or band ligation. Patients were candidates for surgery if the serum total bilirubin level was below 2 mg/dl, the serum albumin above 3 g/dl, the prothrombin level above 60%, and there was an absence of ascites, main portal vein thrombosis, and extrahepatic metastasis. Patients considered to have potentially resectable tumors underwent cardiorespiratory evaluation and were also reviewed by the anesthesiologist.

Surgical technique and procedures

The surgery was performed through a bilateral subcostal incision with an upward midline extension when necessary. The operative field was kept open using special retractors. Thorough exploration of the liver with intraoperative US was performed after its partial mobilization, sectioning the falciform and the triangular ligaments, and pulling the liver caudally to better expose its diaphragmatic surface. Definition of the area to be resected and marking the dissection line were performed under intraoperative US guidance.

Child A patients had all types of resection mentioned according to the case, but Child B patients had only localized resection.

The types of hepatic resection were defined according to a recent consensus classification [Terminology Committee of the International Hepato-Pancreato-Biliary Association (2000)]. Right hepatectomy, left hepatectomy, extended right hepatectomy, and extended left hepatectomy were considered as major hepatic resections (three segments or more), whereas segmentectomy of one or two segments and nonanatomic wedge resection were classified as minor hepatic resections (two segments or fewer). For each patient, the extent of surgery was decided preoperatively on the basis of the radiologic characteristics of the tumor. This was however subjected to modification by the surgeon on the basis of intraoperative findings, such as the gross severity of cirrhosis and the size of the liver remnant. In general, minor hepatic resection was the preferred procedure if macroscopic tumor clearance could be achieved, but major hepatic resections were performed quite liberally for patients with more centrally located tumors close to a major portal vein or hepatic vein, provided their liver function reserve was considered adequate. Blood loss during the procedures was minimized by performing liver transection under warm ischemia, using the Pringle maneuver with clamping for 15 min at 5-min intervals and hemihepatic selective vascular occlusion. Liver dissection was performed using a harmonic scalpel and an ultrasonic device in the majority of the cases while artery forceps fracture in some cases. Bleeding from the cut surfaces of the liver was controlled using under-running stitches, electrocautery, and an argon plasma coagulator. Intraoperative cholangiography was performed to detect any intraoperative bile leakage and to assess the integrity of the biliary system.

Follow-up

All patients were followed up at the outpatient clinic monthly for the first 3 months and then three times monthly as long as the patients survived. At each follow-up, clinical, biochemical, and US assessments of patients were carried out. The level of the tumor marker, α-fetoprotein, was also measured. On suspicion of recurrence, an abdominal CT scan was performed.

Data and statistical analysis

The sociodemographic, clinical, laboratory, operative, and pathological data were recorded. The collected data were organized, tabulated, and statistically analyzed using SPSS (SPSS Ltd, Hong Kong) software statistical computer package, version 18. For quantitative variables, the range, the mean, and the SD were calculated. The difference in mean age was tested using analysis of variance. Most of the studied variables were not found to follow the normal distribution. For qualitative variables, the number and the percent distribution were calculated. Univariate analysis for factors predicting the time to recurrence (disease-free survival) was performed using the Kaplan–Meier product limit method. Variables that were significant by univariate analysis were subsequently analyzed using the Cox proportional hazard model. The log-rank (Mantel–Cox) test was used to test the significance. Significance was adopted at a *P* value less than 0.05 for the interpretation of results of tests of significance.

Results

Table 1 shows the clinical data of our patients. There were 157 male (75.5%) and 51 female (24.5%) patients, with a mean age of 55.4 ± 9.3 years (range from 26 to 75 years). The most common symptom was right hypochondrial dull aching pain in 152 (73.1%) patients and was accidentally discovered in 31 patients (14.9%); jaundice was found in four patients (1.9%) due to infiltration of the biliary system, weight loss, and internal hemorrhage, which account for 1% each. A total of 165 patients (79.3%) patients were positive for HCV markers, five patients (2.2%) were positive for hepatitis B virus surface antigens (HBsAg), whereas seven patients (3.4%) were positive for both virus markers. Most of the patients were in Child–Pugh class A [183 (88%)], and the other 25 (12%) patients were in Child–Pugh class B.

Table 2 shows operative data of the studied cases. Major hepatic resection was performed in 73 (35.1%) patients, Segmentectomy was performed in 74 (35.6%) patients, and localized resection was performed in 61 (29.3%) patients. The mean operative time was 3.1 ± 0.9 h. Blood transfusion was required in 131 (63%) patients.

As shown in Table 3, sizes of the tumors vary from less than 5 cm in 39 (18.8%) patients to more than 10 cm in 58 (27.9%) patients. Postoperative pathological examination revealed well-differentiated tumors in 48 (23.1%) patients, moderately differentiated tumors in 91 (43.7%) patients, and poorly differentiated tumors in 69 (33.2%) patients. All other pathological findings are shown in Table 3.

Table 1 Clinical data of the studied cases

Clinical data	*N* = 208 [*n* (%)]
Age (years)	
Range	26–75
Mean	55.4
SD	9.29
Sex	
Males	157 (75.5)
Females	51 (24.5)
Residence	
Urban	71 (34.1)
Rural	137 (65.9)
Clinical presentation at diagnosis	
Pain	152 (73.1)
Accidentally discovered	31 (14.9)
Mass	17 (8.2)
Jaundice	4 (1.9)
Weight loss	2 (1.0)
Internal hemorrhage	2 (1.0)
Past history of diseases	
Absent	159 (76.4)
Diabetes	28 (13.5)
Hypertension	18 (8.7)
Others	3 (1.4)
Past history of surgery	
Absent	157 (75.5)
Splenectomy	13 (6.2)
Cholecystectomy	9 (4.3)
Others	29 (13.9)
Sclerotherapy for esophageal varices	
No	204 (98.1)
Yes	4 (1.9)
Past history of anti-Bilharzial treatment	
Absent	108 (51.9)
Oral treatment	36 (17.3)
Injections	64 (30.8)
Viral hepatitis infection	
Absent	31 (14.9)
HCV	165 (79.3)
HBV	5 (2.4)
Both	7 (3.4)
Child classification	
A	183 (88)
B	25 (12)

HBV, hepatitis B virus; HCV, hepatitis C virus.

The mean hospital stay was 9.6 ± 4.7 days. Hospital morbidity includes acute liver cell failure in 20 patients (9.6%), bile leak in 10 patients (4.8%), and upper gastrointestinal bleeding in one patient (0.5%) due to rupture of esophageal varices, and were treated by emergency injection sclerotherapy. Pleural effusion on

Table 2 Operative data of the studied cases

Operative data	N = 208 [n (%)]
Type of resection	
Major hepatic resection	73 (35.1)
Segmentectomy	74 (35.6)
Localized resection	61 (29.3)
Blood transfusion	
No	77 (37)
Yes	131 (63)
Pringle's maneuver	
No	117 (56.2)
Yes	91 (43.8)
Operative time (h)	
Range	1–6
Mean	3.08
SD	0.94
Hospital stay (days)	
Range	4–32
Mean	9.04
SD	4.68

Table 3 Pathological data of the studied cases

Pathological data	N = 208 [n (%)]
Tumor's size (cm)	
<5	39 (18.8)
5–10	111 (53.4)
>10	58 (27.9)
Cut margin	
Free	168 (81.2)
Infiltrated	40 (18.8)
Microvascular invasion	
Absent	151 (72.6)
Present	57 (27.4)
LNs	
Negative	194 (93.3)
Positive	14 (6.7)
Tumor's capsule	
Absent	154 (74)
Present	54 (26)
Tumor grading	
I	48 (23.1)
II	91 (43.1)
II	69 (33.2)
Tumor stage	
I	133 (63.9)
II	31 (14.9)
IIIa	27 (13)
IIIb	4 (1.9)
IIIc	13 (6.2)
Local spread	
No	203 (97.6)
Yes	5 (2.4)

LNs, Lymph nodes.

the right side occurred in 15 patients (7.2%), which was treated by the insertion of a chest tube for 1 week. Wound infection occurred in only seven patients (3.4%). Hospital mortality occurred in 19 patients (9.1%) from liver cell failure: 10 of them were Child B and 9 of them were Child A (Table 4).

Table 4 Morbidity, mortality, and recurrence in the studied cases

Character	N = 208 [n (%)]
Postoperative complications	
Absent	132 (63.0)
LCF	20 (9.6)
Pleural effusion	15 (7.2)
Bile leak	10 (4.8)
Wound infection	7 (3.4)
Internal hemorrhage	6 (2.9)
Injury of diaphragm	7 (3.4)
Injury of CBD	2 (1.0)
DVT	3 (1.4)
Hematemesis	1 (0.5)
Abdominal collection	5 (2.4)
Recurrence	
Absent	120 (57.7)
Present	88 (42.3)
Site of recurrence	
Liver	68 (77.3)
Distant	8 (9.1)
Both	12 (13.6)
Treatment of recurrence	
RF	5 (5.7)
TACE	15 (17)
Medical	68 (77.3)
Mortality	
Hospital	19 (9.1)
Late	114 (54.8)
Cause of death (n = 133)	
LCF	70 (58.8)
Malignant cachexia	44 (37)
Others	19 (4.2)

Mean time presented as estimated mean ± SE, Median time presented as estimated median ± SE, Other factors such as age, sex, the type of resection, pringle maneuver, and the size of the tumor were not statistically significant, LCF, liver cell failure, RF, radiofrequency; DVT, deep venous thrombosis; TACE, trans arterial chemo embolization.

Disease-free survival

Late complications included recurrence of HCC in 88 (42.3%) patients. Most of the recurrences occurred within the first year (55 (62.5%) patients) compared with 33 (37.5%) cases after the first year. The most common site for recurrence was the liver in 68 (77.3%) patients, whereas distant metastasis occurred in 8 (9.1%) patients. Factors affecting the time to recurrence are shown in Tables 5 and 6.

Significant factors predicting early tumor recurrence in the univariate analysis were Child class B (16.3 ± 2.4 vs. 44.8 ± 3.7 months), tumor multifocality (19.6 ± 2.5 vs. 48.6 ± 4.1 months), PV invasion (10.4 ± 1.7 vs. 44.6 ± 3.9 months), perioperative blood transfusion (27.5 ± 2.2 vs. 59.4 ± 5.7 months), microvascular invasion (28.2 ± 4 vs. 47.5 ± 4.2 months), local spread (15.7 ± 6.8 vs. 44.8 ± 3.7 months), cut margin infiltration (16.9 ± 2.9 vs. 51.8 ± 3.4 months), lymph node infiltration (14.2 ± 1.8 vs. 46.5 ± 3.8 months), lack of a capsule

Table 5 Univariate analysis for factors predicting the time to tumor recurrence

Variable (*n* = 189)	Recurrence (*n* = 88) [*n* (%)]	Mean time of recurrence in months	Median time of recurrence in months	*P* value
Child class				
Child A (*n* = 174)	83 (47.7)	44.8 ± 3.7	36 ± 3.3	0.039
Child B (*n* = 15)	5 (33.3)	16.3 ± 2.4	17 ± 6.7	
Blood transfusion				
No (*n* = 76)	30 (39.4)	59.4 ± 5.7	52 ± 12.6	0.000
Yes (*n* = 113)	58 (51.3)	27.5 ± 2.2	24 ± 1.7	
Tumor multifocality				
Single (*n* = 157)	67 (42.6)	48.6 ± 4.1	38 ± 4.3	0.000
Multiple (*n* = 32)	21 (65.6)	19.6 ± 2.5	18 ± 3.3	
Portal vein invasion				
Free (*n* = 174)	80 (45.9)	44.6 ± 3.9	36 ± 5.7	0.007
Right portal vein invasion (*n* = 10)	5 (50)	46.1 ± 1.6	21 ± 1.8	
Left portal vein invasion (*n* = 5)	3 (60)	10.4 ± 1.7	12 ± 0	
Cut margin				
No (*n* = 153)	60 (39.2)	51.8 ± 4.3	39 ± 4.5	0.000
Yes (*n* = 36)	28 (77.7)	16.9 ± 2.9	12 ± 2.9	
Microscopic vascular invasion				
No (*n* = 137)	61 (44.5)	47.5 ± 4.2	36 ± 2.7	0.005
Yes (*n* = 52)	27 (51.9)	28.2 ± 4	20 ± 1.9	
Lymph nodes				
No (*n* = 177)	78 (44)	46.5 ± 3.8	36 ± 4.5	0.000
Yes (*n* = 12)	10 (83.3)	14.2 ± 1.8	13 ± 2.6	
Tumor capsule				
Present (*n* = 53)	12 (22.6)	78.2 ± 7.8	95 ± 25	0.000
Absent (*n* = 136)	76 (55.9)	31.6 ± 2.6	24 ± 1.7	
Tumor grade				
Grade I (*n* = 41)	12 (29.2)	70 ± 9.3	88 ± 35	0.000
Grade II (*n* = 83)	40 (48.2)	42.3 ± 4.5	36 ± 3.6	
Grade III (*n* = 65)	36 (55.4)	28.9 ± 4	18 ± 3.8	
Local spread				
No (*n* = 184)	84 (45.6)	44.8 ± 3.7	36 ± 3.5	0.013
Yes (*n* = 5)	4 (80)	15.7 ± 6.8	9 ± 3	
Stage of the tumor				
Stage 1 (*n* = 121)	45 (37.1)	55.7 ± 4.9	48 ± 6.3	0.000
Stage >1 (*n* = 68)	43 (63.2)	21.1 ± 3.4	14 ± 1.6	
Preoperative AFP				
<400 (*n* = 107)	43.2 (40.5)	14.7 ± 2.2	10 ± 1.7	0.012
>400 (*n* = 82)	40 (50.9)	11.8 ± 1.4	6 ± 0.8	

Table 6 Univariate and multivariate analyses for factors predicting the time to tumor recurrence

Variable	Univariate analysis	Multivariate analysis			
	P value	*P* value	Exp(*B*)	95% CI for Exp(*B*)	
				Lower	Upper
Child class	0.039	0.087	2.578	0.872	7.618
Tumor multifocality	0.000	0.037	2.184	1.048	4.555
PV invasion	0.007	0.822	0.921	0.451	1.881
Blood transfusion	0.000	0.013	2.023	1.163	3.518
Microvascular invasion	0.005	0.547	1.193	0.672	2.116
Local spread	0.013	0.496	1.657	0.387	7.097
Cut margin infiltration	0.000	0.015	1.984	1.142	3.449
Lymph node infiltration	0.000	0.939	0.942	0.204	4.353
Tumor capsule	0.000	0.179	0.574	0.255	1.291
Tumor grade	0.000	0.401	1.166	0.815	1.668
Tumor stage	0.000	0.589	1.123	0.737	1.710
AFP	0.012	0.223	1.373	0.825	2.286

CI, confidence interval.

(31.6 ± 2.6 vs. 78.2 ± 7.8 months), the tumor grade (28.9 ± 4 vs.70 ± 9.3 months), the tumor stage (21.1 ± 3.4 vs. 55.7 ± 4.9 months), and preoperative AFP (11.8 ± 1.4 vs. 14.7 ± 2.2 months); however, in the multivariate analysis, tumor multifocality (P = 0.037), perioperative blood transfusion (P = 0.013), and cut margin infiltration (P = 0.000) were the main factors predicting early tumor recurrence.

The treatment for recurrence was conservative in 68 (77.3%) cases, chemoembolization in 15 (17%) cases, and radiofrequency in five (5.7%) cases.

Discussion

The high incidence of recurrence has long been a challenge in the rationale for hepatic resection in patients with HCC in cirrhotic liver, which may be more than 50% within 5 years of resection [18,19]. The different timings of recurrence are thought to represent disease of differing biologies that have very different prognoses.

Early recurrence usually represents residual tumor spread from the primary main tumor and that left in the remnant liver, and is a poor prognostic sign. Significant risk factors for early recurrence include preoperative tumor rupture, venous invasion, and nonanatomic resection [20,21].

Late recurrence usually results from metachronous multicentric hepatocarcinogenesis. Possible risk factors for late recurrence include cirrhosis, a higher grade of hepatitis activity, a high preoperative aspartate aminotransferase level (especially in an HCV-positive patient), and multiple tumors [21–23]. As reported previously, most of the recurrence in our patients and in other series are multicentric in location and distant from the resection margin [11,18,19]. This implies that a wide resection margin does not convey much additional benefit in preventing recurrence [23]. Most surgeons advocate limited resection of the tumor, especially in patients with liver cirrhosis. However, some studies challenged this opinion. It is believed that HCC has a high propensity to metastasis through the portal veins even when diagnosed at an early stage [20,21,24].

This finding has empowered aggressive surgeons to carry out major resection in this group of patients so that proper clearance of the portal channels can be performed. However, Abdel Wahab *et al.* [11] found that there was no significant difference in the recurrence rate that occurred between major resection and minor or localized resection of the liver. Recurrence in the present study was about 42.3%. This was essentially similar to findings in previous reports. Most of the recurrences are found in the liver [18,19,25].

About 9% of the recurrence occurred at a site far away from the liver. This implies that there was possible systemic involvement before surgical interference. This was described by Jeng *et al.* [26] on the basis of the fact that patients with high circulating HCC cells had a high risk of early recurrence (Fig. 1).

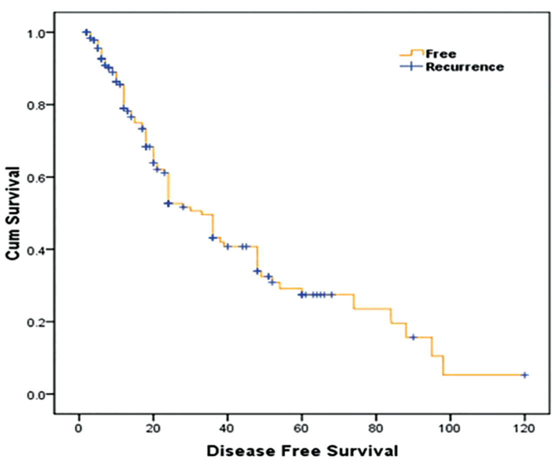
In our study, tumor multifocality was an independent factor for early tumor recurrence (Fig. 2).

In cases of tumor multifocality, tumor recurrence may reflect either residual tumor at the resection margin or persistent residual microscopic disease in the liver at the time of resection [27,28].

In this study, perioperative blood transfusion was found to be an independent risk factor for early recurrence (Fig. 3). The role of perioperative blood transfusion on the intrahepatic recurrence of HCC was first suggested by Yamamoto *et al.* [29], whereas Matsumata *et al.* [30] reported that the association between blood transfusion and recurrence-free survival was recognized, but only in patients without intrahepatic metastasis. Furthermore, Makino *et al.* [31] found that the association between perioperative blood transfusion and cancer-free survival could be detected only in HCC patients with portal vein invasion.

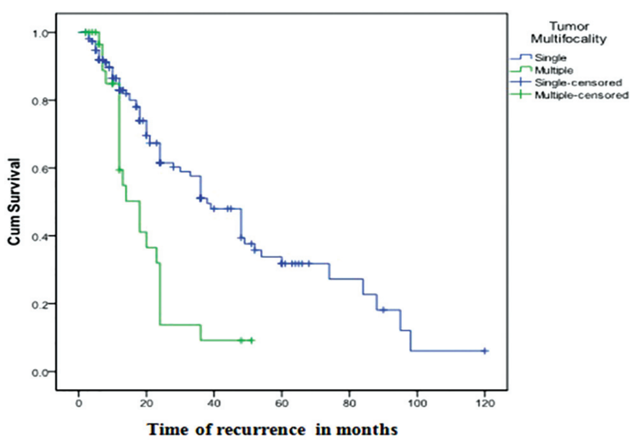
The detrimental effect of blood transfusion could be attributed to the induction of nonspecific immunosuppression [31,32]. To improve the prognosis of patients with resectable HCC, it is worthwhile to reduce intraoperative blood loss and avoid blood transfusion when possible.

Figure 1



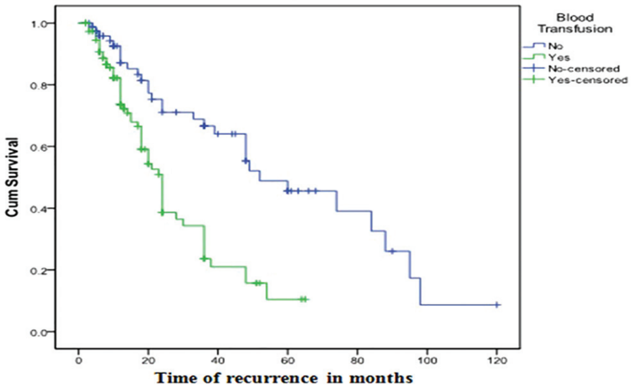
Disease-free survival rates by the Kaplan–Meier product limit method.

Figure 2



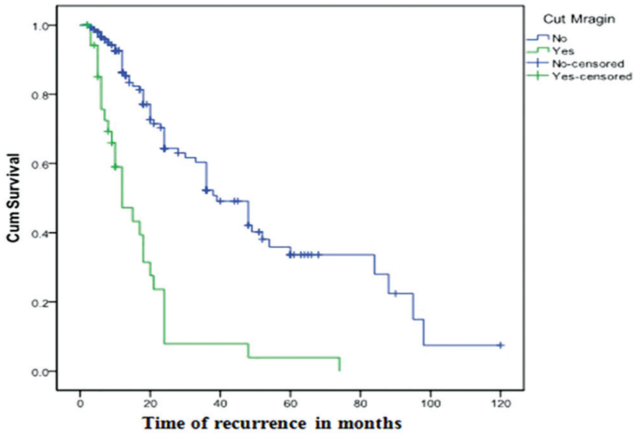
The Kaplan–Meier curve of recurrence in relation to tumor multifocality (*P* = 0.000).

Figure 3



The Kaplan–Meier curve of recurrence in relation to perioperative blood transfusion ($P = 0.000$).

Figure 4



The Kaplan–Meier curve of recurrence in relation to cut margin infiltration ($P = 0.000$).

We found that the resection margin is an independent factor affecting both disease-free survival and recurrence after hepatic resection (Fig. 4).

A few studies have shown that a resection margin smaller than 1 cm was an adverse prognostic factor for long-term survival [33,34]. However, others have found no correlation between the width of the resection margin and the long-term outcome. These seemingly conflicting results have resulted in a discrepancy among hepatic surgeons in the definition of curative resection for HCC. In general, it is thought that both the surgical curability and the postoperative hepatic functional preservation are crucial for the successful treatment of patients with HCCs [18–20,32]. Especially in patients with cirrhosis, smaller surgical margins would prevent postoperative complications better, including liver failure, although there is a concern of recurrence in the remnant liver. For patients with cirrhosis, the balance between the surgical curability and the preservation of function of the remnant liver is of considerable importance.

Shah and colleagues reported that despite the fact that a negative cut margin is one of the main risk factors for both tumor recurrence and disease-free survival, preservation of liver parenchyma to prevent hepatic decomposition, however, continues to be a much more important consideration than a negative margin. This is because even with positive resection margins, liver resection still provides the best survival when compared with other available treatment modalities for HCC patients [28].

Conclusion

The prognostic factors after resection for disease-free survival were different and multifactorial. However, resection of HCC in a cirrhotic liver with preserved liver function is the treatment of choice and can be performed with favorable results and long-term survival. In our study, the Child class, multifocality, PV invasion, perioperative blood transfusion, vascular invasion, local spread, cut margin infiltration, lymph nodes infiltration, lack of a tumor capsule, the tumor grade, the tumor stage, and preoperative AFP significantly predict disease-free survival in univariate analysis, whereas tumor multifocality, perioperative blood transfusion, and cut margin infiltration were the main factors predicting disease-free survival in the multivariate analysis.

Acknowledgements

Conflicts of interest

There are no conflicts of interest.

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