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Nonanatomical resection is comparable with anatomical resection in solitary hepatocellular carcinoma <5 cm in the right posterior section

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Abstract

Anatomical resection (AR) is superior to nonanatomical resection (NAR) in theory, but the actual clinical benefit of AR for hepatocellular carcinoma (HCC) is controversial due to the substantial heterogeneity of HCC. Here, we retrospectively compared AR and NAR outcomes for solitary hepatocellular carcinoma (HCC) <5 cm in the right posterior section (RPS) and investigated the risk factors for HCC recurrence and liver-related mortality.

The study included 99 consecutive patients who underwent curative surgical resection of an HCC in the RPS (S6 and S7) between January 2003 and December 2009. Each patient had a solitary HCC <5 cm and a noncirrhotic liver.

The median estimated blood loss during operation and median operative time were significantly worse in the AR group. In addition, the median tumor size and incidence of microvascular invasion were significantly worse in the AR group. The 1-, 3-, and 5-year disease-free survival rates were 74.1%, 66.3%, and 58.2% in the AR group and 84.7%, 64.4%, and 48.2% in the NAR group, respectively ($P = 0.172$). The corresponding liver-related overall survival rates were 96.3%, 84.7%, and 77.0% in the AR group and 97.2%, 90.1%, and 88.7% in the NAR group, respectively ($P = 0.335$). NAR was not associated with HCC recurrence or liver-related mortality in multivariate analysis.

The outcomes of NAR for a solitary HCC <5 cm in the RPS are comparable to those achieved with AR with respect to long-term liver-related overall survival and disease-free survival.

Abbreviations: AR = anatomical resection, CT = computed tomography, CUSA = Cavitron Ultrasonic Surgical Aspirator, HCC = hepatocellular carcinoma, ICG = indocyanine green, MRI = magnetic resonance imaging, NAR = nonanatomical resection, PEI = percutaneous ethanol injection, RFA = radiofrequency ablation, ROC = receiver operating characteristics, RPS = right posterior section, TACE = transarterial chemoembolization.

Keywords: hepatectomy, hepatocellular carcinoma, prognosis, survival, tumor recurrence

1. Introduction

Liver resection is an established curative treatment for hepatocellular carcinoma (HCC). The outcomes of surgical resection have greatly improved with advances in the surgical technique and perioperative care. Nonetheless, the rate of long-term survival after hepatectomy remains unsatisfactory because of the high incidence of HCC recurrence.[1–4] The heterogeneity of HCC is the biggest obstacle in determining the clinical benefits of hepatectomy for HCC recurrence and survival. Moreover, the presence of liver cirrhosis, etiology of liver disease, tumor characteristics (number, size, and location), and operative procedure selected all considerably affect the accuracy of assessment. Portal vein tumor thrombosis and intrahepatic metastasis are considered to be the most important factors leading to recurrence and have been associated with poor prognosis.[1–3] Thus, when considering hepatectomy for HCC, anatomical resection (AR) has been proposed to lead to superior oncological outcomes because of the clinicopathological features of HCC, which often invade the portal vein and spread along its branches.[5–7]

In theory, this procedure is extremely effective in eradicating intrahepatic metastasis of HCC, and should lead to more favorable patient outcomes. AR is considered superior in theory to nonanatomical resection (NAR) and to be particularly essential for patients with HCC. However, although some reports have demonstrated the effectiveness of AR for HCC in terms of postoperative recurrence and survival, other reports found that the outcomes achieved with AR versus NAR were not significantly different.[8]

Due to these conflicting findings, the clinical benefit of AR for HCC is still controversial. In particular, studies comparing AR and NAR have reported that tumor location and operative

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procedure are particularly important because of significant differences in operative difficulty and patient clinical courses. In this study, we conducted a retrospective comparison of the outcomes achieved with AR versus NAR for a solitary HCC <5 cm in the right posterior section (RPS). We also investigated the risk factors for HCC recurrence and liver-related mortality to identify which resection method is more beneficial to patients.

2. Materials and methods

2.1. Patients

This study included 99 consecutive patients who underwent curative surgical resection of an HCC in the right posterior section (S6 and S7) between January 2003 and December 2009. Exclusion criteria were mixed HCC and cholangiocarcinoma on pathology; tumor size ≥5 cm; age <18 years; previous locoregional therapy, including hepatectomy, radiation, transarterial chemoembolization (TACE), radiofrequency ablation (RFA), and percutaneous ethanol injection (PEI); preoperatively diagnosed multiple tumors; intraoperative RFA; Child–Pugh class B or C classification; indocyanine green (ICG) score >15%; laparoscopic liver resection; positive resection margin or R1 resection; liver transplantation after HCC recurrence; other synchronous cancers; preoperative diagnosed portal vein tumor thrombosis; HCC in S6 and S7 and having undergone right hepatectomy; pathologically proven cirrhosis; follow-up loss after hepatectomy; and insufficient medical records. Demographic, preoperative laboratory, perioperative, pathologic, and postoperative data for all patients were collected from electronic medical records and retrospectively reviewed. None of the patients in either group (AR and NAR) received postoperative adjuvant therapy before recurrence. This study was approved by the Samsung Medical Center Institutional Review Board in Seoul.

2.2. Surgery and pathology

Liver function was evaluated using the Child–Pugh classification system. Consideration for tumor resection at our center required a single mass in the right posterior section (S6 and S7) visualized by preoperative imaging without any evidence of extrahepatic or nodal disease. Patients were required to have Child–Pugh A liver function. Patients who had serum total bilirubin levels ≥1.5 mg/dL, ICG scores ≥15%, or ascites were not considered for resection. Laboratory examinations were performed as described previously.[1] One surgeon performed nonanatomical resection when a single HCC <5 cm was diagnosed, whereas another surgeon performed anatomical resection.

AR was defined as resection of the HCC together with the related portal veins and the corresponding surrounding tissue. NAR was defined as resection with an adequate resection margin (~1 cm from the tumor, as circumstances permitted). Each surgeon was responsible for deciding between AR and NAR, but limited NAR was generally preferred for small and solitary HCC that was peripherally located or exhibited exophytic growth. For tumors located centrally and/or close to the major vessels, we performed anatomical resection when feasible and appropriate. When tumors were located close to the major vessels in patients with impaired liver function, we selected NAR with tumor surface exposure to preserve as much of the noninvolved functional liver as possible. During anatomical right posterior sectionectomy, we approached the root of the right posterior Glissonean pedicle. After clamping this pedicle, we resected the discolored area. Parenchymal transection was performed using a Cavitron Ultrasonic Surgical Aspirator (CUSA) with low central venous pressure and intermittent Pringle maneuvers.

Postoperative histologic assessment and reporting included the following parameters: tumor diameter, encapsulation, microvascular invasion, microscopic bile duct tumor thrombi, intrahepatic metastasis, and multicentric occurrence. Intrahepatic metastasis and multicentric occurrence were defined based on guidelines from the Liver Cancer Study Group of Japan.[9] The histologic grade of HCC was assigned according to the Edmonson–Steiner system as well differentiated (grade I), moderately differentiated (grade II), or poorly differentiated (grade III, IV).[10] Tumor recurrence and survival data were also recorded.[11]

2.3. Surveillance after surgical resection

Surveillance after hepatic resection was performed as previously described.[11] Laboratory and radiological examinations, such as computed tomography (CT), were performed every 3 months for the first 2 years in the postoperative period. When CT could not definitively diagnose HCC recurrence, magnetic resonance imaging, and/or positron emission tomography scanning were performed. Detailed information was recorded for each patient determined to have peritoneal recurrence.

Recurrence patterns were constructed from the locations of HCC recurrence (intrahepatic or extrahepatic metastasis), area of intrahepatic metastases (right lobe, left lobe, and whole liver), and number of intrahepatic recurrences (single or multiple). Patients with intrahepatic recurrence were treated with re-resection, RFA, TACE, or sorafenib according to their liver function reserve and the pattern of recurrence. Liver-related mortality was defined when HCC or liver failure was the causes of mortality in those patients. The follow-up duration was defined as the length of time from surgery to the last follow-up visit (February 1, 2015) or death.

2.4. Statistical analyses

Patient data were collected retrospectively from electronic medical records. Categorical variables were expressed as percentages and compared using Fisher's exact test. Continuous variables were expressed as median and range and compared using the Mann–Whitney *U* test. Patient survival and recurrence rates were calculated using the Kaplan–Meier method and compared using the log-rank test. The arbitrary cut-off value for each continuous variable was determined using the receiver operating characteristics (ROC) curve. Clinical and pathologic variables found to have prognostic significance in univariate analysis were entered into a Cox multivariate proportional hazards model to determine which factors were independently predictive of HCC recurrence and liver-related mortality. Significant factors or potentially important factors, including those not statistically significant in univariate analysis, were entered into the multivariate analysis. A P value < 0.05 was considered significant. Analysis was carried out using SPSS 22.0 (SPSS, Chicago, IL).

3. Results

3.1. Baseline characteristics

The baseline characteristics of the 2 groups of HCC patients are summarized in Table 1. The NAR and AR groups contained 72 and 27 patients, respectively. The 2 groups were not significantly different with respect to gender, etiology, age, serum total

Table 1

Baseline characteristics.

	Nonanatomical resection (n=72)	Anatomical resection (n=27)	*P*
Gender, male	56 (77.8%)	21 (77.8%)	>0.999*
Age	50 (28–70)	51 (24–78)	0.823†
Etiology			0.315*
HBV	61 (84.7%)	24 (88.9%)	
HBV, HCV	2 (2.8%)	0 (0%)	
HCV	8 (11.1%)	0 (0%)	
NBNC	1 (1.4%)	3 (11.1%)	
Platelet	141,000 (73,000–486,000)	155,000 (55,000–375,000)	0.119†
Total bilirubin	0.7 (0.2–1.5)	0.7 (0.3–1.4)	0.450†
ALT	42 (11–182)	36 (14–91)	0.434†
Albumin	4.0 (3.0–5.0)	4.0 (2.8–4.7)	0.468†
ICG-R15	9.4 (4.2–14.8)	7.3 (4.2–14.6)	0.097†
AFP	52.4 (1.4–221619.7)	25.4 (2.0–7213.4)	0.903†

AFP = alpha-fetoprotein, ALT = alkaline phosphatase, HBV = hepatitis B virus, HCV = hepatitis C virus, ICG-R15 = indocyanin green at 15 minutes, NBNC = non-B non C.
* Fisher's exact test.
† Mann–Whitney *U* test.

bilirubin levels, platelet count, alkaline phosphatase level), albumin level, indocyanine green 15-minute retention rate (ICG-R15), or alpha-fetoprotein level.

3.2. Perioperative and pathologic characteristics

The median blood losses during operation in the AR and NAR groups were 500 mL (range, 200–2400 mL) and 400 mL (range, 40–2000 mL), respectively. A significantly greater volume of blood was estimated to be lost in the AR group ($P<0.001$), but no differences were observed between the 2 groups with respect to postoperative complications. The operative time for the AR group was longer than that for the NAR group (302 minutes vs 212 minutes, $P<0.001$).

Each patient had a noncirrhotic background liver. Tumor size (3.5 cm in the AR group vs 2.7 cm in the NAR group; $P=0.017$) and the incidence of microvascular invasion (55.6% in the AR group vs 23.6% in the NAR group; $P=0.004$) were both significantly worse in the AR group. The 2 groups were not significantly different with respect to grade, encapsulation, microscopic bile duct tumor thrombi, intrahepatic metastasis, multicentric occurrence, or free resection margin.

The mean lengths of hospitalization after hepatectomy in the AR and NAR groups were 12 ± 4 days and 10 ± 8 days, respectively. Hospitalization in the AR group was significantly longer than in the NAR group ($P=0.002$). One patient in the AR group developed post-hepatectomy failure, but no in-hospital mortalities occurred (Table 2).

Table 2

Perioperative and pathologic characteristics.

	Nonanatomical resection (n=72)	Anatomical resection (n=27)	*P*
Perioperative characteristics			
Operative time, min	212 (110–360)	302 (180–492)	0.000*
Estimated blood loss during operation, mL	400 (50–2000)	500 (200–2400)	0.000*
Transfusion	1 (1.4%)	2 (7.4%)	0.180†
Postoperative complication	Fluid collection (1)	Fluid collection (1)	
	Paralytic ileus (1)	Liver failure (1)	
	Pneumothorax (1)	Pleural effusion (2)	
	Postoperative bleeding (1)		
Postoperative hospitalization, day	9 (7–72)	9 (7–27)	0.002*
	10.1 ± 8.0	11.5 ± 4.7	
Pathological characteristics			
Tumor size, cm	2.7 (1.0–5.0)	3.5 (1.4–4.8)	0.017*
Grade			0.948†
Well	6 (8.3%)	1 (3.7%)	
Moderate	63 (87.5%)	26 (96.3%)	
Poor	3 (4.2%)	0 (0%)	
Microvascular invasion	17 (23.6%)	15 (55.6%)	0.004†
Encapsulation	59 (83.1%)	19 (70.4%)	0.172†
Microscopic bile duct tumor thrombi	0 (0%)	1 (3.7%)	0.273†
Intrahepatic metastasis	3 (4.2%)	2 (7.4%)	0.612†
Multicentric occurrence	2 (2.8%)	0 (0%)	0.382†
Free resection margin, mm	10 (1–35)	11 (1–68)	0.436*

* Mann–Whitney *U* test.
† Fisher's exact test.

3.3. Outcomes

The median follow-up durations for the AR and NAR groups were 96 months (range, 7–139 months) and 93 months (range, 6–143 months), respectively. The recurrence patterns and secondary treatment types for the 2 groups are summarized in Table 3. The intrahepatic recurrence patterns were significantly different between the 2 groups; specifically, and recurrence in the right lobe was more prevalent in the NAR group. No difference was observed between the groups with respect to secondary treatment type.

The 1-year, 3-year, and 5-year disease-free survival rates were 74.1%, 66.3%, and 58.2% in the AR group and 84.7%, 64.4%, and 48.2% in the NAR group, respectively. The corresponding liver-related overall survival rates were 96.3%, 84.7%, and 77.0% in the AR group and 97.2%, 90.1%, and 88.7% in the NAR group. The disease-free survival rate in the AR group was better than that in the NAR group; however, neither of these trends was statistically significant ($P=0.172$ and $P=0.335$, respectively; Fig. 1).

3.4. Risk factors for disease-free survival and liver-related mortality

The results of univariate and multivariate analyses of HCC recurrence and liver-related mortality are shown in Tables 4 and 5. Multivariate analysis showed that a low serum albumin levels, advanced age, and increased ICG-R15 value were closely associated with HCC recurrence in patients with a solitary HCC <5 cm in the right posterior section. This analysis also showed that a decreased serum albumin level was predictive of liver-related mortality. NAR was not associated with HCC recurrence or liver-related mortality.

4. Discussion

Here, we evaluated the effect of AR for a solitary HCC <5 cm that was limited to a specific tumor location (segments 6 and 7). We found that the AR and NAR groups exhibited some differences in disease-free survival and liver-related overall survival rates, but that these differences were not statistically significant.

Comparison of surgical outcomes from AR versus NAR has been challenging because of substantial differences in the 2 groups. For example, 1 previous study demonstrated that tumors tended to be more advanced and liver function was more impaired in the NAR group compared to the AR group.[8,12–16] Multiple studies have demonstrated that AR is an independent prognostic factor for disease-free and overall survival and have also suggested that AR is superior to NAR.[12–15] However, other studies comparing the overall survival rates for patients with a solitary HCC <5 cm in have concluded that the outcomes of AR are comparable to those of NAR.[17,18] However, none of these reports was a randomized control study, and the studies focused only on tumor location and operation. Therefore, the question of superiority between AR versus NAR has not yet been resolved.

AR is generally regarded as a more technically demanding operation than NAR of an HCC in the right posterior section. Thus, we focused our analysis on HCC in the right posterior section. We made our comparison between AR and NAR outcomes in patients with a solitary HCC <5 cm in the right posterior section as precise as possible by selecting the patient population based on tumor size, tumor number, liver function, and tumor location.

The only 2 pathologic characteristics that were significantly different between 2 groups were tumor size and microvascular invasion. Specifically, the median tumor size for the AR group was larger than that for the NAR group (by about 1 cm) and the proportion of microvascular invasion in the AR group was double that in the NAR group. Therefore, it could be argued that the reason for the similar liver-related overall and disease-free survival with AR and NAR was due to unequal comparison of the tumor characteristics. The multivariate analysis in the present study showed that neither AR nor NAR was associated with HCC recurrence or liver-related mortality. Another study reported that estimated blood loss is a poor prognostic factor of hepatectomy for HCC,[19] but we did not find a significant association between blood loss during the operative procedure and survival.

Among the patients with intrahepatic recurrence, 22 out of the 43 (51.2%) patients in the NAR group experienced recurrence in the right liver lobe, whereas none of the patients in the AR group did. This finding is quite striking, considering that the AR group exhibited larger tumor sizes and a higher incidence of microvascular invasion. This observation suggests that AR prevents intrahepatic metastasis from the right posterior section

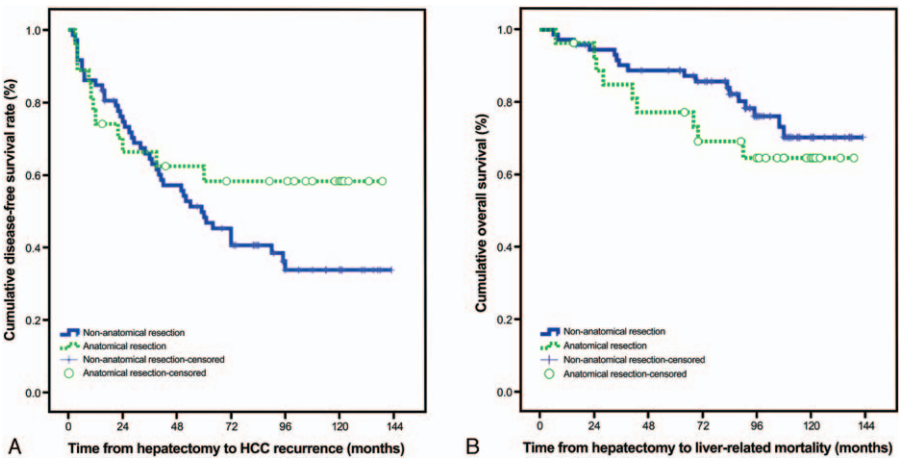

Figure 1. (A) Disease-free survival ($P=0.172$); (B) liver-related overall survival ($P=0.335$).

Table 3

Comparison between nonanatomical and anatomical resection in recurrent HCC patients.

	Nonanatomical resection	Anatomical resection	*P*
HCC recurrence	44	11	
Intrahepatic recurrence	43 (97.7%)	10 (90.9%)	0.363*
Intrahepatic recurrent tumor number			0.732*
Single	21 (48.8%)	4 (40.0%)	
Multiple	22 (51.2%)	6 (60.0%)	
Intrahepatic recur pattern			0.002*
Right lobe	22 (51.2%)	0 (0%)	
Left lobe	10 (23.3%)	8 (80.0%)	
Whole liver	11 (25.6%)	2 (20.0%)	
Treatments of intrahepatic recurrence			0.313*
Re-resection	2 (4.7%)	0 (0%)	
RFA	16 (37.2%)	4 (40.0%)	
RFA, Re-resection	1 (2.3%)	0 (0%)	
RFA, TACE, re-resection	1 (2.3%)	0 (0%)	
RFA, TACE	7 (16.3%)	3 (30.0%)	
TACE	16 (37.2%)	3 (30.0%)	
Extrahepatic recurrence	8 (18.2%)	2 (18.2%)	1.000*
Extrahepatic recurrent site			0.114*
Bone	2 (25.0%)	1 (50.0%)	
Lung	4 (50.0%)	0 (%)	
Lung and brain	0 (0%)	1 (50.0%)	
Others	2 (25.0%)	0 (0%)	
Extrahepatic metastatic treatments			0.138*
CTx and RTx	1 (12.5%)	0	
None	4 (50.0%)	0	
RTx	1 (12.5%)	1 (50%)	
RTx and Sorafenib	1 (12.5%)	1 (50%)	
Sorafenib	1 (12.5%)	0	

CTx = chemotherapy, HCC = hepatocellular carcinoma, RFA = radiofrequency ablation, RTx = radiotherapy, TACE = transarterial chemoembolization.
* Fisher's exact test.

Table 4

Risk factors for HCC recurrence in S6 and S7 single HCC.

Variables	OR	95% CI	*P*
Univariate			
Gender, male	1.047	0.551–1.989	0.889
Age	1.045	1.016–1.075	0.002
Platelet	0.995	0.989–1.000	0.066
ALT	0.996	0.986–1.006	0.411
Albumin	0.379	0.192–0.748	0.005
ICG-R15	1.080	0.983–1.185	0.108
AFP ≥200	0.730	0.387–1.375	0.329
Anatomical resection	0.635	0.327–1.231	0.179
Estimated blood loss during operation	1.000	0.999–1.000	0.305
Transfusion	0.046	0.000–13.227	0.287
Operative time	0.999	0.996–1.003	0.718
Postoperative hospitalization	0.993	0.940–1.048	0.794
Postoperative complications	1.157	0.461–2.905	0.756
Tumor size	1.098	0.837–1.440	0.500
Microvascular invasion	0.865	0.478–1.567	0.633
Encapsulation	1.185	0.596–2.356	0.628
Intrahepatic metastasis	2.813	1.115–7.098	0.028
Multicentric occurrence	2.338	0.568–9.621	0.239
Free resection margin	0.999	0.973–1.025	0.915
Multivariate			
Albumin	0.485	0.262–0.900	0.022
Age	2.140	1.139–4.022	0.018
ICG-R15	1.143	1.019–1.283	0.022

AFP = alpha-fetoprotein, ALT = alkaline phosphatase, CI = confidence interval, HCC = hepatocellular carcinoma, ICG-R15 = indocyanine green at 15 minutes, OR = odds ratio.

Table 5

Risk factors for liver-related mortality in S6 and S7 single HCC.

Variables	OR	95% CI	*P*
Univariate			
Gender, male	1.671	0.576–4.851	0.345
Age	1.034	0.991–1.080	0.123
Platelet	0.999	0.993–1.006	0.838
ALT	0.989	0.972–1.006	0.210
Albumin	0.227	0.084–0.608	0.003
ICG-R15	1.075	0.938–1.231	0.300
AFP ≥200	1.313	0.553–3.118	0.538
Anatomical resection	1.485	0.662–3.332	0.338
Estimated blood loss during operation	0.999	0.998–1.001	0.422
Transfusion	0.047	0.000–570.525	0.524
Operative time	0.999	0.994–1.004	0.737
Postoperative hospitalization	1.016	0.948–1.088	0.656
Postoperative complications	0.761	0.180–3.226	0.711
Tumor size	1.460	0.990–2.154	0.056
Microvascular invasion	1.308	0.583–2.936	0.515
Encapsulation	0.653	0.274–1.556	0.336
Intrahepatic metastasis	1.959	0.460–8.346	0.363
Multicentric occurrence	2.563	0.346–18.989	0.357
Free resection margin	1.020	0.987–1.053	0.238
Multivariate			
Albumin	0.256	0.090–0.726	0.010

AFP = alpha-fetoprotein, ALT = alkaline phosphatase, CI = confidence interval, HCC = hepatocellular carcinoma, ICG-R15 = indocyanine green at 15 minutes, OR = odds ratio.

to the right anterior section, but does not prevent multicentric recurrence or intrahepatic metastases from the right posterior section to the left lobe. We consider the risk of recurrence by local dissemination to be negligible, since most HCC recurrences that develop after curative resection are multicentric. Therefore, the present study indicates that other significant factors have greater influence that the operative procedure selected and that subsequent treatments after recurrence might exert an even stronger influence on overall survival than the initial resection method.

The choice of whether AR or NAR is optimal in patients with a single HCC <5 cm in the right posterior section is a difficult one because of the high risk of blood loss during the operative procedure, the long operative times, and the possibility of a multicentric de novo HCC recurrence. Although, anatomical right posterior sectionectomy is a more technically challenging procedure, we did not observe differences in the perioperative complication rates between the AR and NAR groups. Moreover, the postoperative complications were not significantly different between the 2 groups, although we note that 1 patient developed postoperative liver failure in the AR group, whereas none did in the NAR group.

Intrahepatic recurrent HCC after hepatectomy was treated with liver transplantation because the 5-year patient survival rate has been shown to range from 50% to 70% after liver transplantation.[20] Successful salvage liver transplantation was recently carried out at our center in a patient with an intrahepatic recurrent HCC who had a potential living donor.[21] Preservation of the hepatic artery, portal vein, and bile duct is important for anastomosis during recipient hepatectomy. However, AR has the potential to induce fibrosis and/or distort the liver hilum, and previous anatomical approaches might result in vascular and bile duct complications after salvage liver transplantation.

The choice of anatomical or nonanatomical approach is made in accordance with the extent of tumor progression and residual liver function for patients with a resectable HCC in a noncirrhotic liver. We note that our nonanatomical resection was not simply an enucleation of the tumor. Our nonanatomical resection procedure was based on the concept of resection with a wide surgical margin, performed as soon as possible. In this study, we demonstrated that NAR could reduce tumor recurrence and liver-related mortality rates compared with AR. Thus, we advocate the use of NAR for solitary HCC <5 cm in noncirrhotic livers, since NAR yields similar disease-free survival and liver-related mortality rates as alternative approaches and has the added benefit of potentially reducing complications after salvage liver transplantation.

This study did have several limitations. First, the data were obtained from a single-center. Second, the retrospective design of the study implies that patient population could potentially be biased. Third, the sample sizes for the 2 groups were not well-balanced for survival analyses. These size limitations may have masked differences in clinical outcomes between the 2 groups. Therefore, a sufficiently powered prospective study is required to confirm that NAR result in similar postoperative survival and recurrence rates as AR.

In conclusion, our data indicate that anatomical right posterior sectionectomy results in more bleeding and has a longer operative time than NAR, but is still a safe option. Importantly, NAR achieves an adequate tumor resection margin compared to AR. Our findings suggest that NAR can effectively achieve long-term liver-related overall survival and disease-free survival rates comparable to those achieved with AR for solitary HCC <5 cm in the right posterior section.

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