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Laparoscopic Hepatic Resection Versus Laparoscopic Radiofrequency Ablation for Subcapsular Hepatocellular Carcinomas Smaller Than 3 cm: Analysis of Treatment Outcomes Using Propensity Score Matching

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Objective: To compare the therapeutic outcomes of laparoscopic hepatic resection (LHR) and laparoscopic radiofrequency ablation (LRFA) for single subcapsular hepatocellular carcinoma (HCC).

Materials and Methods: We screened 244 consecutive patients who had received either LHR or LRFA between January 2014 and December 2016. The feasibility of LRFA in patients who underwent LHR was retrospectively assessed by two interventional radiologists. Finally, 60 LRFA-feasible patients who had received LHR and 29 patients who had received LRFA as the first treatment for a solitary subcapsular HCC between 1 cm and 3 cm were finally included. We compared the therapeutic outcomes, including local tumor progression (LTP), recurrence-free survival (RFS), and overall survival (OS) between the two groups before and after propensity score (PS) matching. Multivariable Cox proportional hazard regression was also used to evaluate the difference in OS and RFS between the two groups for all 89 patients.

Results: PS matching yielded 23 patients in each group. The cumulative LTP and OS rates were not significantly different between the LHR and LRFA groups after PS matching ($p = 0.900$ and 0.003, respectively). The 5-year LTP rates were 4.6% and 4.4%, respectively, and OS rates were 100% and 90.7%, respectively. The RFS rate was higher in LHR group without statistical significance ($p = 0.070$), with 5-year rates of 78.3% and 45.3%, respectively. OS was not significantly different between the LHR (reference) and LRFA groups in multivariable analyses, with a hazard ratio (HR) of 1.33 (95% confidence interval, 0.12–1.54) ($p = 0.818$). RFS was higher in LHR (reference) than in LRFA without statistical significance in multivariable analysis, with an HR of 2.01 (0.87–4.66) ($p = 0.102$).

Conclusion: There was no significant difference in therapeutic outcomes between LHR and LRFA for single subcapsular HCCs measuring 1–3 cm. The difference in RFS should be further evaluated in a larger study.

Keywords: *Laparoscopy; Resection; Radiofrequency ablation; Hepatocellular carcinoma; Survival*

INTRODUCTION

Percutaneous radiofrequency ablation (RFA) has been widely used for patients with very early or early-stage hepatocellular carcinoma (HCC), which is not suitable for surgical resection. In addition, in patients with very early-stage HCC in favorable locations, it can be adopted as a first-line therapy [1,2]. Although RFA is usually performed

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using a percutaneous approach, it is not always feasible because of the invisibility of the tumor through guiding modalities or unfavorable tumor location [3,4]. In terms of tumor location, subcapsular or subphrenic HCCs might not be good candidates for percutaneous ultrasound (US)-guided RFA because of its technical difficulty and a higher risk of local tumor progression (LTP) [4-7]. Hence, laparoscopic RFA (LRFA) has been utilized for treating subcapsular tumors that are technically challenging with the percutaneous approach. Previous studies have reported that LRFA is effective and safe for treating subcapsular HCCs [8-11].

Meanwhile, laparoscopic hepatic resection (LHR) has gained attention because of its advantages of lesser blood loss, faster recovery, and shorter hospital stay than open hepatectomy [12,13]. However, well-designed comparative studies between LHR and LRFA are rarely available. In previous studies [14,15], tumor location (subcapsular vs. non-subcapsular) has not been considered. In addition, tumor characteristics, including tumor size and number, were different between the LHR and LRFA groups, making it difficult to compare the two treatments. Furthermore, the studies were performed over a relatively long period (2000–2014). Since both surgical and RFA techniques have evolved, treatment outcomes should be assessed using recent data.

Therefore, the purpose of this study was to compare the therapeutic outcomes of LRFA and LHR for treating single subcapsular HCCs in a recent single-center cohort.

MATERIALS AND METHODS

Patients

This comparative study was conducted as a retrospective analysis of patients who underwent either LRFA or LHR at a single tertiary referral center, Samsung Medical Center. Our Institutional Review Board approved the study, and the need for written informed consent from the patients was waived due to the retrospective nature of the study (IRB No. 2020-05-076-001). The study was conducted ethically in accordance with the World Medical Association Declaration of Helsinki. We searched our institution's database to identify patients who underwent either LHR or LRFA between January 2014 and December 2016. A total of 142 consecutive patients were treated with LHR. Among them, 38 patients were excluded for the following reasons: previous history of HCC (n = 22), loss to follow-up (n = 4), multiple HCCs (n = 3), HCCs > 3 cm (n = 4), HCCs < 1 cm (n = 2), portal vein invasion on pretreatment images (n = 2), and other concurrent cancers (n = 1). Two radiologists retrospectively evaluated pretreatment CT/MR images of the remaining 104 patients treated with LHR and determined whether LRFA was technically feasible. In general, LRFA was considered feasible when the tumor could be localized on visual inspection with laparoscopy or with laparoscopic US. Therefore, LRFA was attempted for subcapsular HCC, defined when the distance between the tumor margin and liver surface was < 10 mm [5]. If the subcapsular tumors were located near the posterior side of the liver, and were thus, poorly accessible with laparoscopy, they were regarded as LRFA-infeasible cases. Eventually, LRFA was considered infeasible in 44 patients due to its non-subcapsular location. Finally, 60 LRFA-feasible patients with treatment-naïve solitary subcapsular HCC 1–3 cm were included in the LHR group.

During the same period, 102 patients were treated with LRFA at our institution. Among them, 73 patients were excluded for the following reasons: previous history of HCC (n = 66), multiple HCCs (n = 4), advanced HCCs with either bile duct invasion or lung metastasis at diagnosis (n = 2), and HCC > 3 cm (n = 1). Finally, 29 patients were included in the LRFA group. A flowchart of patient selection is shown in Figure 1. HCC diagnosis was based on current clinical guidelines [16].

Laparoscopic Hepatic Resection, Laparoscopic Radiofrequency Ablation, and Follow-Up

The details are included in Supplement (Supplementary Materials).

Comparison of Therapeutic Outcomes

Therapeutic outcomes, including LTP, recurrence-free survival (RFS), and overall survival (OS) were compared between the LHR and LRFA groups before and after propensity score (PS) matching. RFS was defined as the time from initial treatment to tumor recurrence (LTP, intrahepatic distance, or extrahepatic recurrence) or death. OS was defined as the time from the initial treatment to death or the last date of the follow-up visit before May 31, 2020. Liver transplantation was considered censored at the date of surgery.

Statistical Analyses

Patient demographics and clinical characteristics were compared between the LHR and LRFA groups using the Wilcoxon rank-sum test for continuous variables and Fisher's exact test for categorical variables.

The cumulative LTP, RFS, and OS rates were estimated

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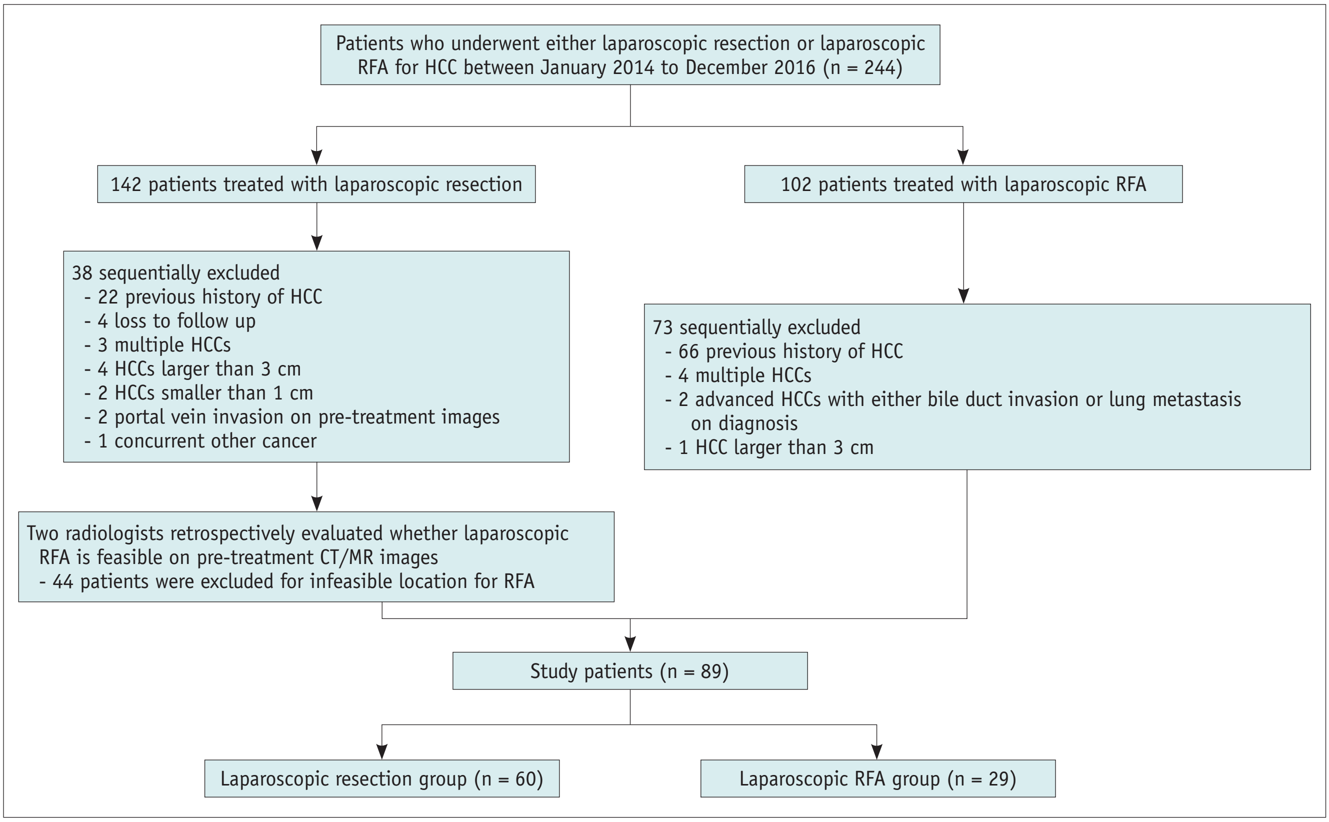

Fig. 1. Flow diagram of patient selection for the study. HCC = hepatocellular carcinoma, RFA = radiofrequency ablation

using the Kaplan-Meier method, and differences in curves between the LHR and LRFA groups were compared using the log-rank test before and after PS matching. We estimated PS using logistic regression and performed 1:1 patient matching by greedy matching with 0.25 caliper. Variables that showed significant differences between the two groups were included in the PS model. Log transformation was performed for serum alpha-fetoprotein (AFP) because of its large scale and difficulty in matching. The standard mean difference was calculated to determine the balance of the matched data. Additionally, univariable and multivariable Cox proportional hazards regression analyses were used to evaluate the association between the treatment methods and RFS or OS. The analysis was performed for all LHR patients and the non-anatomic resection (NAR) subgroup of LHR patients. Statistical analyses were performed using R version 3.5.0 (The R Foundation for Statistical Computing). A p value < 0.05 was considered statistically significant.

RESULTS

Treatments

In the LHR group, NAR was performed in 25 (41.7%) and anatomic resection (AR) in 35 (58.3%) patients. In the LRFA group, multiple RF electrodes were used in 19 (65.5%) patients: triple electrodes (n = 18) and two electrodes (n = 1). In the remaining 10 (34.5%) patients, a single RF electrode was used. Multiple repositioning of the electrodes was performed in both single (median 3, range 2–4) and multiple (median 4, range 3–7) electrodes to create a sufficient ablative margin.

Baseline Characteristics

The baseline characteristics of all 89 patients included in the analysis are summarized in Table 1. The median follow-up period was 50.1 months (range, 3.7–75.4) in the LHR group and 44.7 months (range, 3.9–74.6) in the LRFA group (p = 0.349). Patients in the LRFA group were more likely to be classified as having poorer liver function than those in the LHR group, except for albumin and albumin-bilirubin (ALBI) grades. Serum AFP levels were significantly higher in the LHR group (p = 0.009), whereas serum protein induced by vitamin K absence-II level was not significantly different between the two groups. Tumor size was significantly larger in the LHR group than in the LRFA group (p = 0.007). Most tumors abutted the liver capsule in the LHR and LRFA

Table 1. Demographic and Clinical Characteristics of Study Patients

Variable	Laparoscopic Resection (n = 60)	Laparoscopic RFA (n = 29)	*P*
Age at enrollment, years*	55.8 ± 9.0	60.0 ± 9.8	0.079
Male patients	42 (70.0)	24 (82.8)	0.301
Cause of liver disease			0.765
HBV	42 (70.0)	18 (62.1)	
HCV	4 (6.7)	2 (6.9)	
Others	13 (21.7)	9 (31.0)	
Both HBV and HCV	1 (1.7)	0 (0.0)	
AFP, ng/mL	313.1 ± 823.2	13.9 ± 25.0	0.009
Log, AFP*	3.5 ± 2.3	2.0 ± 1.0	0.001
PIVKA-II†, mAU/mL	25.5 (11–269)	29.5 (11–7661)	0.324
Platelet count, x 10^9/L†	149 (68–368)	109 (29–246)	< 0.001
Total bilirubin, mg/dL†	0.7 (0.2–1.9)	0.9 (0.2–2.1)	0.036
Albumin, g/dL	4.5 (3.3–5.1)	4.3 (3.2–4.9)	0.132
ALBI grade			
1, 2	54 (90.0), 6 (10.0)	21 (72.4), 8 (27.6)	0.059
Prothrombin time, INR†	1.04 (0.9–1.32)	1.09 (0.96–1.35)	0.004
Creatinine, mg/dL†	0.88 (0.48–15.03)	0.93 (0.54–2.31)	0.150
Tumor size, cm†	2.1 (1.0–2.9)	1.6 (1.0–2.8)	0.007
Number of tumors abutting liver capsule	57 (95.0)	25 (86.2)	0.209
Tumor distance from capsule, cm	0.0 (0.0–0.5)	0.0 (0.0–0.3)	0.183
Tumor location (Couinaud segment) II, III, IV, V, VI, VII, VIII	7 (11.7), 14 (23.3), 9 (15.0), 11 (18.3), 7 (11.7), 2 (3.3), 10 (16.7)	2 (6.9), 4 (13.8), 9 (31.0), 1 (3.4), 3 (10.3), 0 (0.0), 10 (34.5)	0.210

Unless indicated otherwise, the data is the number of patients, with percentages in parentheses. *Data are presented as means ± standard deviations, †Data are medians, with ranges in parentheses. AFP = alpha-fetoprotein, ALBI grade = albumin-bilirubin grade, HBV = hepatitis B virus, HCV = hepatitis C virus, INR = international normalized ratio, PIVKA-II = protein induced by vitamin K absence-II, RFA = radiofrequency ablation

groups (95.0% and 86.2%, respectively; p = 0.209), and the tumor distance from the liver capsule was not significantly different between the two groups. Log (AFP), platelet count, total bilirubin, prothrombin time, and tumor size were significantly different between the two groups; thus, they were used as variables for PS matching.

Comparison of Therapeutic Outcomes Before PS Matching

The crude comparison between the LHR and LRFA groups before PS matching showed a significant difference in RFS (p = 0.010) but not in LTP (p = 0.900) and OS (p = 0.900) (Fig. 2). Further details are provided in Supplement (Supplementary Results).

Comparison of Therapeutic Outcomes After Propensity Score Matching

Cumulative LTP Rate

Twenty-three patients were matched in each group, and the matched variables were relatively well balanced between the two groups (Table 2). When using matched data, the cumulative LTP rates were not significantly different between the two groups (p = 0.900 by log-rank test), with the rates at 1, 3, and 5 years estimated to be 0.0%, 4.6%, and 4.6%, respectively, for the LHR group and 4.4%, 4.4%, and 4.4%, respectively, for the LRFA group (Fig. 3A).

RFS and OS

The RFS rates were not significantly different between the two groups (log-rank test, p = 0.070); the rates at 1, 3, and 5 years were 95.7%, 78.3%, and 78.3%, respectively, for the LHR group and 77.4%, 63.4%, and 45.3%, respectively, for the LRFA group (Fig. 3B). The OS rates were not significantly different between the two groups (log-rank test, p = 0.300), and the rates at 1, 3, and 5 years were all 100%, for the LHR group and 100%, 90.7%, and 90.7%, respectively, for the LRFA group (Fig. 3C).

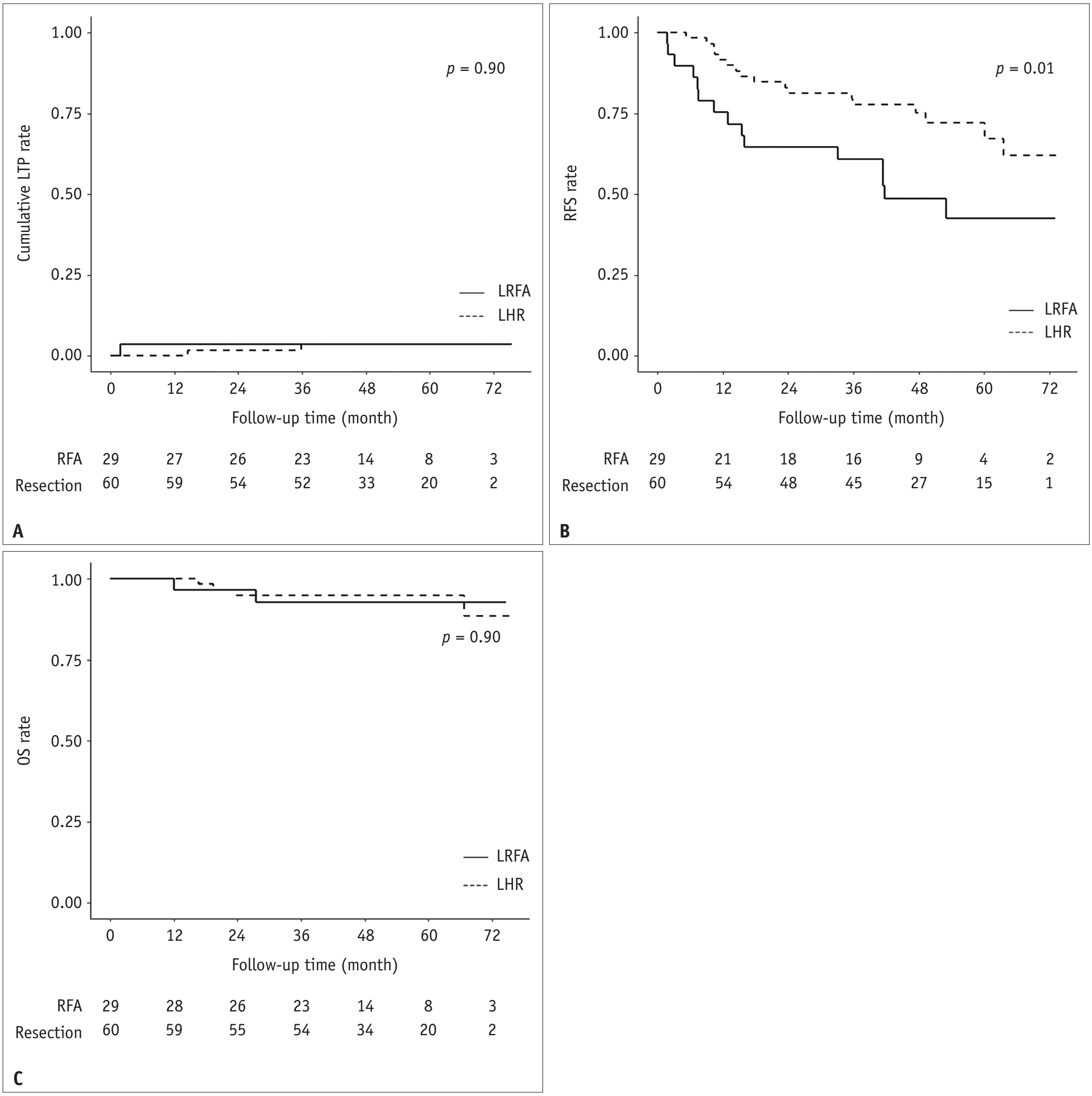

Fig. 2. LTP, RFS, and OS between LRFA and LHR in all 89 patients before propensity score matching.
A. Cumulative LTP rates were not significantly different between the LHR and LRFA groups. **B.** RFS rates were significantly better in the LHR group than in the LRFA group. **C.** OS rates were not significantly different between the LHR and LRFA groups. LHR = laparoscopic hepatic resection, LRFA = laparoscopic radiofrequency ablation, LTP = local tumor progression, OS = overall survival, RFA = radiofrequency ablation, RFS = recurrence-free survival

Multivariable Analysis of Factors Associated with Survival Outcomes

RFS

Univariable analysis of all study patients (n = 89) showed that treatment type (LRFA) was the sole significant factor for poor RFS (hazard ratio [HR] 2.36; 95% confidence interval [CI] 1.32–4.23, p = 0.016) (Supplementary Table 1). Therefore, we included variables used for PS matching (total bilirubin, prothrombin time, platelet count, log [AFP], and tumor size) as covariates in the multivariable analysis to further account for potential

Table 2. Balance Check before and after Propensity Score Matching

Variables	Before Matching LHR (n = 60), LRFA (n = 29)		After Matching LHR (n = 23), LRFA (n = 23)	
	SMD	*P*	SMD	*P*
Log, AFP	-0.828	< 0.001	0.075	0.596
Platelet count, x 10^9/L	-0.932	< 0.001	-0.171	0.392
Total bilirubin, mg/dL	0.500	0.104	-0.034	0.940
Prothrombin time, INR	0.693	0.040	-0.070	0.764
Tumor size, cm	-0.639	0.004	0.061	0.736
Age	0.447	0.164	0.460	0.546
Sex	-0.300	0.175	0.000	1.000
Cause of liver disease	0.153	0.564	-0.091	0.984
Log, PIVKA_II	0.273	0.200	0.607	0.050
Albumin, g/dL	-0.353	0.218	-0.070	0.944
ALBI grade	0.455	0.066	0.103	0.658
Creatinine, mg/dL	-0.076	0.070	0.362	0.094
Number of tumors abutting liver capsule	0.300	0.223	0.379	0.077
Tumor distance from capsule, cm	0.161	0.176	0.372	0.138
Tumor location (Couinaud segment)	0.303	0.210	0.320	0.128

AFP = alpha-fetoprotein, ALBI grade = albumin-bilirubin grade, INR = international normalized ratio, LHR = laparoscopic hepatic resection, LRFA = laparoscopic radiofrequency ablation, PIVKA-II = protein induced by vitamin K absence-II, SMD = standard mean difference

confounding effects. RFS was not significantly different between the LHR and LRFA groups (HR, 2.01; 95% CI 0.87–4.66, p = 0.102). Subgroup analysis between the NAR and LRFA groups showed no statistically significant difference (Table 3).

OS

Tumor abutment of the liver capsule (HR 8.29; 95% CI 1.51–45.39, p = 0.015) and tumor distance from the liver capsule (HR, 674.14; 95% CI, 8.29–54838.56; p = 0.004) were found to be significant factors for OS by univariable analysis. However, multicollinearity between the two variables was considered to be present; thus, the tumor distance from the capsule was not included in the multivariable analysis. Treatment type (LHR vs. LRFA) did not show statistical significance (HR, 1.16; 95% CI 0.28–4.86, p = 0.862) (Supplementary Table 1). Thus, multivariable analysis was performed after adjusting for tumor abutment of the liver capsule and matching variables (total bilirubin, prothrombin time, platelet count, log [AFP], and tumor size). There was no statistically significant difference between the LHR and LRFA groups (HR, 1.33; 95% CI 0.12–1.54; p = 0.818) (Table 3). On subgroup analysis between the NAR and LRFA groups, no significant difference was observed (Table 3).

Complications and the Length of Hospital Stay after Each Treatment

Major complications were found in eight (13.3%) and two (6.7%) patients in the LHR and LRFA groups, respectively (p = 0.489). In the LHR group, complicated fluid collection was found at the resection margin in three patients, which was managed with conservative treatment (n = 2) or percutaneous catheter drainage (n = 1). In the remaining five patients, persistent drainage from the operation site through surgical drains led to delayed patient discharge.

In the LRFA group, percutaneous catheter drainage was required in one patient due to dyspnea caused by right pleural effusion. In the other patient, a hepatic abscess was found at the LRFA site 8 months post-treatment, which was managed with conservative treatment.

In terms of hospital stay, the duration was significantly different between the two groups (LRFA: median, 5 days; range, 3–11 days vs. LHR: median, 8 days; range, 4–16 days; p < 0.001).

DISCUSSION

In this study, we compared treatment outcomes for subcapsular HCCs < 3 cm. Although RFS was better in the LHR group than in the LRFA group before PS matching, it became statistically insignificant after PS matching. In

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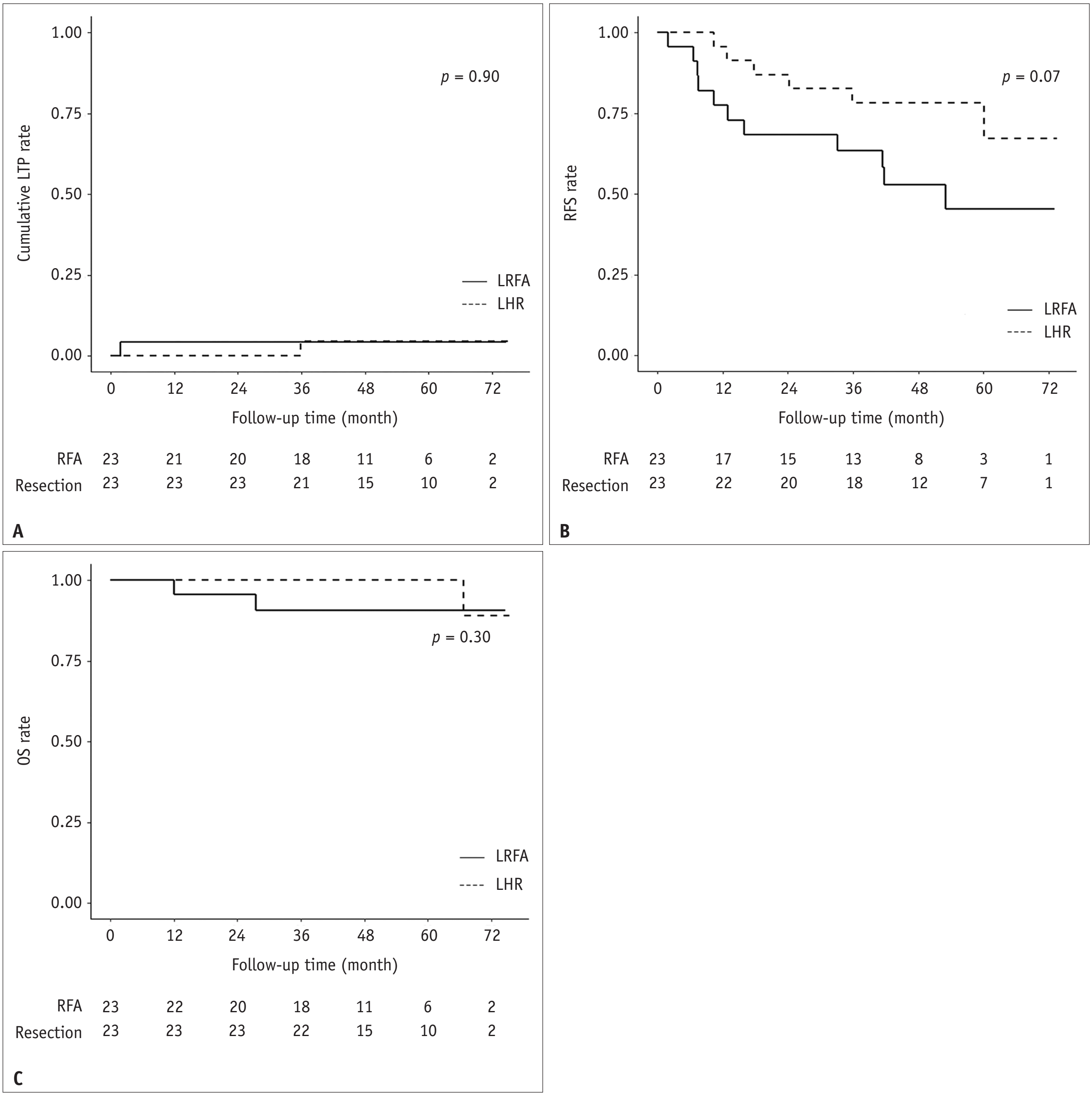

Fig. 3. LTP, RFS, and OS after propensity score matching.
A. Cumulative LTP rates were not significantly different between the two groups. **B.** RFS rates were not significantly different between the two groups. **C.** OS rates were not significantly different between the two groups. LHR = laparoscopic hepatic resection, LRFA = laparoscopic radiofrequency ablation, LTP = local tumor progression, OS = overall survival, RFA = radiofrequency ablation, RFS = recurrence-free survival

addition, OS was not significantly different between the LHR and LRFA groups before and after PS matching. Although RFS was significantly different between the LHR and LRFA groups on univariable analysis, it was not significant in the multivariable analysis. These results imply that treatment outcomes may be comparable between the LRFA-feasible LHR and LRFA groups for subcapsular HCCs < 3 cm.

Theoretically, surgical resection can remove both the index tumor and potential venous thrombi or satellite nodules. Therefore, it may yield better oncologic outcomes than local ablation therapy [15,17-19]. However, in previous studies, the baseline characteristics were quite different between the LHR and LRFA groups. Therefore, it is difficult to reach a definite conclusion regarding treatment

Table 3. Univariable and Multivariable Analysis for Survival Outcomes for All 89 Patients

Variable	Univariable Analysis				Multivariable Analysis			
	Recurrence-Free Survival		Overall Survival		Recurrence-Free Survival		Overall Survival	
	HR (95% CI)	*P*	HR (95% CI)	*P*	HR (95% CI)	*P*	HR (95% CI)	*P*
Treatment type: [LHR] vs. LRFA	2.36 (1.32–4.23)	0.016	1.16 (0.28–4.86)	0.862	2.01 (0.87–4.66)	0.102	1.33 (0.12–1.54)	0.818
Treatment type: [NAR] vs. LRFA	1.95 (0.95–4.00)	0.128	1.03 (0.20–5.40)	0.975	2.19 (0.81–5.95)	0.123	0.22 (0.01–6.87)	0.388

The numbers in parentheses are 95% CIs. Univariable and multivariable Cox proportional hazards models were used for recurrence-free survival and overall survival. Multivariable analysis was adjusted by matching variables (total bilirubin, prothrombin time, platelet count, log [alpha-fetoprotein], and tumor size) and tumor abutment of the liver capsule. The multicollinearity between the tumor abutment of the liver capsule and tumor distance from the liver capsule was considered to be present; thus, the latter was not included in the multivariable analysis. Subgroup analysis was also performed between NAR and LRFA. The reference category for each categorical variable is in the square brackets in the first column. CI = confidence interval, HR = hazard ratio, LHR = laparoscopic hepatic resection, LRFA = laparoscopic radiofrequency ablation, NAR = non-anatomic resection

outcomes between the two treatments.

A recent comparison study reported that tumor recurrence and OS were unfavorable in the laparoscopic ablation group compared with the LHR group for single HCC ≤ 3 cm [18]. However, the choice of the two treatments was biased, favoring LHR as the first choice if the tumor was located in a resectable segment. If not, local ablation therapy was considered as an alternative treatment. Laparoscopic ablation therapy was also performed for deeply located tumors. As deeply located tumors are technically challenging for LRFA compared with subcapsular HCCs [8,9], it is not surprising that the treatment outcomes of laparoscopic ablation therapy were inferior to those of LHR. Furthermore, in a previous study [18], a single electrode was used for 77.6% (159/205) of LRFA cases, which might have resulted in a higher LTP rate than the LHR group (15% vs. 0%, p = 0.002). Consequently, treatment outcomes, including tumor recurrence and survival, were also unfavorable in local ablation therapy compared with LHR, even in superficially located tumors [18].

Meanwhile, in our study, only suitable candidates for LRFA among patients who underwent LHR were included. Furthermore, we applied PS matching to balance the baseline characteristics between the LRFA and LHR groups. It is notable that treatment outcomes, including tumor recurrence and survival, were not significantly different between the LRFA-feasible LHR and LRFA groups. These results may be attributed to the fact that most tumors abutted the liver capsule, and thus could be easily identified by visual inspection during laparoscopy. In addition, we used multiple RF electrodes in approximately two-thirds (19/29, 65.5%) of the patients. Even in patients treated with a single electrode, multiple overlapping ablations (median 3, range 2–4) were performed. Consequently, a large ablation zone encompassing the tumor would have resulted in a low rate of LTP in our study. Our results are in line with those of a previous study in which no LTP was found after applying laparoscopic multipolar RFA using multiple RF electrodes [20]. Therefore, LRFA using multiple RF electrodes or overlapping ablations may be used as an alternative treatment for LHR of HCCs < 3 cm at a favorable location.

In the present study, RFS tended to be better in the LHR group than in the LRFA group, even after PS matching (p = 0.070). Given that baseline liver function was better in the LHR group and absolute standard mean differences of platelet count and ALBI grade were > 0.10 after PS matching, more impaired liver function may have resulted in more frequent distant intrahepatic tumor recurrence in the LRFA group.

In terms of surgical methods, unlike AR, the tumor-bearing hepatic territory is not entirely removed in NAR. Therefore, after NAR of HCC, there is a higher risk of tumor recurrence [1]. Therefore, AR is known to be a favorable factor for both OS and RFS in patients with single HCC with microscopic portal vein invasion [21]. In this context, LRFA may be similar to NAR in terms of the removed hepatic volume. In the present study, there were no significant differences in LTP, RFS, and OS between NAR and LRFA for subcapsular HCC < 3 cm. Similar treatment outcomes between the two treatments may be attributed to the fact that the present study included only early-stage HCC. Given that patients with a single HCC < 3 cm may have less aggressive tumor biology, they may benefit from local ablation therapy. Our results are in close agreement with those of a previous study in which long-term therapeutic outcomes were not significantly different between percutaneous RFA and NAR as the first-line treatment in patients with single HCC ≤ 3 cm [22].

In the present study, we used a rather aggressive treatment approach in the LRFA group. As subcapsular tumors are far from large portal vein branches or bile ducts, the major complication rate was lower in the LRFA group than in the LHR group. However, this difference was not statistically significant (6.7% vs. 13.3%, p = 0.489). This result may be due to the small sample size. The less invasive nature of LRFA over LHR is supported by the shorter hospital stay in the LRFA group than in the LHR group (p < 0.001), which is in line with the results of previous studies [14,18].

Our study has some limitations. First, it was a retrospective single-center study, and selection bias could have occurred. However, we performed PS matching to minimize the bias. Second, the sample size was relatively small because only subcapsular HCCs were included in this study during the 3 years of the study period. Considering recent advances, especially in RFA, including multiple electrodes, multipolar energy deposition, and centripetal or no-touch RFA, a comparison using recent data may reflect the current therapeutic outcomes of small HCCs. Therefore, we believe that our data provide some insight for treating subcapsular HCCs because studies comparing LHR and LRFA for subcapsular HCCs after matching the baseline characteristics of patients are rare.

In conclusion, the therapeutic outcomes were not significantly different between LRFA and LRFA-feasible LHR in subcapsular HCCs < 3 cm. LRFA may be considered an alternative treatment option when LRFA is feasible in candidates for LHR. The difference in RFS should be further evaluated in a larger study.

Supplement

The Supplement is available with this article at https://doi.org/10.3348/kjr.2021.0786.

Availability of Data and Material

The datasets generated or analyzed during the study are available from the corresponding author on reasonable request.

Conflicts of Interest

Min Woo Lee who is on the editorial board of the *Korean Journal of Radiology* was not involved in the editorial evaluation or decision to publish this article. All remaining authors have declared no conflicts of interest.

Author Contributions

Conceptualization: Min Woo Lee. Data curation: all authors. Formal analysis: Soohyun Ahn. Investigation: Seong Eun Ko, Min Woo Lee, Soohyun Ahn, Kyoung Doo Song, Ji Hye Min. Methodology: Min Woo Lee. Project administration: Min Woo Lee. Resources: all authors. Visualization: Seong Eun Ko, Min Woo Lee. Writing—original draft: Seong Eun Ko, Min Woo Lee. Writing—review & editing: all authors.

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