



ORIGINAL ARTICLE

Challenge of safety margin in laparoscopic liver resection for hepatocellular carcinoma



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Summary *Background:* Advances in minimally invasive surgical techniques and instrumentation have facilitated their application in the management of hepatic tumors. However, determination of the optimal safety margin can be challenging for liver surgeons. The present study used a case-matched analysis to evaluate the surgical margins and survival rates in patients with liver cancer treated using either laparoscopic or traditional liver resection.

Methods: All of the enrolled patients were diagnosed with hepatocellular carcinoma (HCC) after surgical resection, which was performed according to clinical practice guidelines. The indications for laparoscopy included the detection of a tumor at the anterior peripheral region of Segments III, IV, V, and VI, with a diameter of < 5 cm. Of all the enrolled patients, 86 (63 men and 23 women) underwent laparoscopic liver resection (Group I), whereas the remaining 91 (67 men and 24 women) underwent traditional open resection (Group II) based on case-matched study.

Results: The resection margins were ≥ 10 mm, 5–9 mm, and ≤ 4 mm in 1 patient, 70 patients, and 15 patients in Group I and 3 patients, 41 patients, and 47 patients in Group II, respectively. The safety margin was ≥ 10 mm in 15 Group I patients (17.4%) and 47 Group II patients (51.6%), respectively, ($p = 0.001$). The feasibility of wide resection was probably limited by the location of the tumor based adjacent to the main vessels. Overall, in Group I, the 1-, 3-, and 5-year survival rates were 84.2%, 67.3%, and 57.7% for a 5–9-mm safety margin and 93.3%, 86.7%, and 78.0% for a ≥ 10 -mm safety margin, respectively; however, these differences were not statistically significant ($p = 0.139$). Similarly, in Group II, no significant differences were observed regarding the survival rates for varying safety margins (5–9 mm and 10 mm; $p = 0.57$).

Conclusion: Securing an appropriate safety margin for laparoscopic liver resection while dissecting using laparoscopic instruments was challenging without any tactile sensation by the

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surgeon. Moreover, no significant differences were observed in the postoperative survival of both Group I or II patients with a safety margin of ≥ 5 mm.

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1. Introduction

Hepatocellular carcinoma (HCC) is one of the prevalent diseases in Taiwan.¹ An increasing number of current clinical reports have deemed laparoscopic hepatic surgery as a feasible procedure. The laparoscopic approach has been used for liver resection in liver cancer since 1998 in our hospital.^{2,3} Subsequently, several advances in this minimally invasive surgical technique and instrumentation have facilitated laparoscopic surgery as one of the surgical procedures of choice for liver cancer.^{4,5} Particularly, laparoscopic ultrasound could be used for tumor staging, which could be considerably beneficial in avoiding an unnecessary laparotomy even in patients undergoing a complete preoperative work-up. In addition, in our experiences, laparoscopic examination and laparoscopic ultrasonography were indispensable for identifying an appropriate safety margin through the precise determination of the segmental tumor location and the distance of the tumor from the adjacent vascular or biliary structures.

No significant differences were observed in the overall survival and disease-free survival rates in patients with HCC who underwent a major or limited open resection.⁶ Shimada et al⁷ reported that a major hepatectomy was not recommended for patients with a solitary small HCC with a diameter of ≤ 3 cm in diameter. In our previous study, no significant differences were observed between the overall survival rates of patients with HCC who underwent a major (≥ 2 segments) or minor (≤ 1 segment) hepatectomy with laparoscopic liver resection.³ Nevertheless, the postoperative tumor recurrence rates in patients with HCC remain high, with no definitive method for prevention.⁸ The association of the extent of surgical resection with the tumor recurrence and survival rates remains controversial. Yu et al⁹ reported that regarding intrahepatic recurrence in HCC in Taiwan, patients with a tumor resection margin of <5 mm exhibited poorer prognosis than did those who underwent open resection. Moreover, to date, limited studies have discussed the results of a surgical safety margin in patients with HCC undergoing traditional open laparotomy.^{10–13}

Laparoscopic liver resection has obvious advantages over the traditional open procedure in certain patients.^{14,15} Because of the lack of tactile feedback during the laparoscopic approach, maintaining a safety margin away from the resection plane during liver dissection is challenging. Limited clinical studies have focused on resection margins in patients with HCC treated using the laparoscopic approach for liver resection. Therefore, this study conducted a retrograde evaluation of the surgical margin and survival rates in patients with HCC treated using laparoscopic or traditional liver resection for a tumor located at

Segments II, III, IVb, V, and VI based on a case-matched study.

2. Patients and methods

All patients were diagnosed with HCC after surgery between 1998 and 2006 and followed-up for at least 5 years. The laparoscopic or traditional liver resection procedures were performed following the clinical practice guidelines. The indications for laparoscopic liver resection were tumors at Segments II, III, IVb, V, and VI, with a diameter of < 5 cm. In total, based on the case-matched method, 86 patients (63 men and 23 women) underwent laparoscopic liver resection (Group I), and 91 patients (67 men and 24 women) underwent traditional open resection (Group II) during the same time period. Table 1 presents the clinical discrepancies in the demographic factors between the two patient groups.

Four trocars had to be inserted to achieve an optional operative manipulation depending on the tumor location. The abdominal pressure was maintained low (8–12 mmHg) in addition to abdominal lifting as required. An arbitrary laparoscopic microwave coagulation line was drawn to determine a resection plane after laparoscopic ultrasound examination. The necrotic plane produced by the microwaves was usually approximately 1-cm thick. Dissection was initiated using a cavitation ultrasonic surgical aspirator (CUSA; Valleylab Co., Colorado, USA) along the

Table 1 Profile of the patients treated with laparoscopic and traditional approaches.

Variable	Laparoscopic Group I; <i>n</i> = 86	Traditional Group II; <i>n</i> = 91	<i>p</i>
Age	59.0 ± 12.4	58.4 ± 11.2	0.734
Sex			
Male	72 (83.7)	67 (73.6)	0.147
Female	14 (16.3)	24 (26.4)	
Section			
1 segment	15 (17.4)	3 (3.3)	0.004
≥ 2 segments	71 (82.6)	88 (96.7)	
Margin			
≤ 4 mm	1 (1.2)	3 (3.3)	<0.001
5–9 mm	70 (81.4)	41 (45.1)	
≥ 10 mm	15 (17.4)	47 (51.6)	
Tumor size			
≤ 1.9 cm	28 (32.6)	8 (8.8)	<0.001
2–5 cm	58 (67.4)	83 (91.2)	

Data are presented as *n* (%) or mean ± SD.

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