# Comparison of laparoscopic liver resection for hepatocellular carcinoma located in the posterosuperior segments or anterolateral segments: A case-matched analysis

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***Background.*** *Laparoscopic liver resection is an attractive option for treating liver tumors. Laparoscopic liver resection is more difficult for hepatocellular carcinomas located in the posterosuperior segments than for hepatocellular carcinomas in the anterolateral segments. We compared perioperative and long-term outcomes between laparoscopic liver resection for hepatocellular carcinomas located in the posterosuperior and anterolateral segments.*

***Methods.*** *We retrospectively reviewed the clinical data for 230 patients who underwent laparoscopic liver resection for hepatocellular carcinomas between September 2003 and July 2014. Of these, 116 patients were selected by case-matched analysis using age, sex, tumor number and size, Child-Pugh class, and extent of liver resection. Patients were classified into 2 groups according to tumor location: the anterolateral group* (n = *58) and the posterosuperior group* (n = *58).*

***Results.*** *Operation time (355 minutes vs 212 minutes,* P < *.005), intraoperative blood loss (600 mL vs 410 mL,* P < *.001), and hospital stay (8.5 days vs 7 days,* P = *.040) were significantly greater in the posterosuperior group than in the anterolateral group. The open conversion (13.8% vs 10.3%,* P = *.777), postoperative complication (17.2% vs 10.3%,* P = *.420), 5-year overall survival (88.5% vs 85.7%,* P = *.370), and 5-year, recurrence-free survival (47.6% vs 40.9%,* P = *.678) rates were not significantly different between the posterosuperior and anterolateral groups.*

***Conclusion.*** *Although laparoscopic liver resection is more difficult for hepatocellular carcinomas located in the posterosuperior segment, there were no differences in the short- and long-term outcomes between the posterosuperior and anterolateral groups. The perceived impact of tumor location on patient outcomes could be overcome by experience and technical improvements. (Surgery 2016;■:■-■.)*

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Laparoscopic liver resection (LLR) has become an indispensable operative method for treating hepatocellular carcinoma (HCC).[1,2] Reports indicate that LLR provides perioperative outcomes similar to or better than open procedures in terms of operative time, estimated blood loss, complication rate, and hospital stay.[3] Regarding survival outcomes, LLR for HCC had overall survival (OS) and recurrence-free survival (RFS) equivalent to those of open procedures.[4,5] Although LLR is indicated for solitary lesions, tumors of <5 cm in diameter, and peripheral lesions located in the anterolateral (AL) segments (according to the

Louisville consensus statement), the indications for LLR have been extended to include more complicated lesions, a consequence of accumulated experience and advances in operative equipment.[6]

LLR is generally contraindicated for tumors located in the posterosuperior (PS) segments; however, several experienced centers have documented the safety and feasibility of LLR for HCC located in these segments.[7,8] We previously reported the feasibility of performing LLR for tumors located in segments I, VII, VIII, and the superior part of IV,[9,10] but little is known about the long-term outcomes of LLR for HCC located in the PS segments. Therefore, the aims of the present study were to evaluate and compare the perioperative and long-term outcomes after LLR for HCC located in the AL or PS segments.

## METHODS

**Patients and study design.** Between September 2003 and July 2014, 230 patients underwent LLR for HCC at Seoul National University Bundang Hospital (Seongnam, South Korea) and were included in the present study. All of the patients were diagnosed with HCC on the basis of computed tomography or magnetic resonance imaging findings. The patients were divided into 2 groups according to the location of the HCC. The AL group ($n$ = 170) consisted of patients whose tumor was located in the AL segments, including segments II, III, V, VI, and the inferior part of IV. The PS group ($n$ = 60) consisted of patients whose tumor was located in the PS segments, including I, VII, VIII, and the superior part of IV.

To reduce potential bias attributed to the retrospective study design, the patients in both groups were matched on a 1:1 basis for the following preoperative variables: age, sex, tumor size, number of tumors, Child-Pugh class, and extent of liver resection. Finally, 116 patients were selected in the AL ($n$ = 58, 50%) and PS ($n$ = 58, 50%) groups. All of the patients underwent preoperative laboratory tests, including measurement of tumor markers and indocyanine green retention rate at 15 minutes (ICG-R15). The type of operation was selected based on tumor location. Parenchymal-sparing liver resection was performed wherever possible.

Both groups in this study included patients with multiple tumors or a large solitary tumor. The patients who had multiple tumors underwent transarterial chemoembolization (TACE) preoperatively or radiofrequency ablation (RFA) intraoperatively.[11] Select patients with a large solitary tumor underwent LLR.[12] Informed consent was obtained from the patient before the operation. Major complications were defined as complications of grade III or above, according to the Clavien-Dindo classification. This study was approved by our institutional review board.

**Operative techniques.** The operative techniques used for LLR in our institution have been described in more detail elsewhere.[10] After induction of general anesthesia, the patient was placed in the lithotomy position for right-sided liver resection. The patients were tilted into the 30° reverse Trendelenburg position with right-side-up adjustment according to the resection site. For left-sided liver resection, the patients were placed in the supine position. The surgeon stood between the patient's legs or at the patient's right side. The endoscopist and assistant stood at the patient's left side. A 12-mm camera port was placed in the subumbilical region. Usually, 2 main working 12-mm ports were inserted into the epigastrium and right upper quadrant of the abdomen along the subcostal area. Additional 5-mm ports were placed in the left subcostal area for the assistant.

Intraoperative ultrasonography was performed to localize the tumor, identify the adjacent vasculature, and maintain an appropriate resection margin. A laparoscopic Pringle maneuver was used occasionally to minimize bleeding during parenchymal transection. After the hepatoduodenal ligament was isolated, umbilical tape was placed around the ligament, and both ends of the umbilical tape were passed through the long tube, as in an open operation.[13] After controlling the corresponding pedicular structures, the superficial hepatic parenchyma was transected using ultrasonic shears, and deeper parenchymal transection was performed using a laparoscopic Cavitron Ultrasonic Surgical Aspirator ((CUSA); Integra Lifesciences, Plainsboro, NJ). Bleeding from small branches of the hepatic veins was controlled with endoclips and a sealing device. The resected specimen was inserted into a protective bag and retrieved through the extended trocar site, including the subumbilical port or suprapubic incision. After irrigating the operative field, a silastic drain was inserted, and the wound was closed in layers.

**Statistical analysis.** Data are expressed as the median. The $\chi^2$ test was used to compare categorical variables, and the Mann-Whitney $U$ test was used to compare continuous variables between the 2 groups. The survival was calculated using