

**Supplementary Table 1.** Comparisons of preoperative and operative variables among patients with different gross subtypes of HCC.

|                                  | Levels         | I (N=118)              | II (N=129)             | III (N=101)            | IV (N=52)              | P                   |
|----------------------------------|----------------|------------------------|------------------------|------------------------|------------------------|---------------------|
| Sex                              | Female         | 29 (24.6%)             | 33 (25.6%)             | 22 (21.8%)             | 6 (11.5%)              | 0.203               |
| Age                              | Mean ± SD      | 58.6 ± 10.3            | 58.4 ± 10.3            | 57.5 ± 10.6            | 54.2 ± 9.5             | 0.061               |
| ASA stage                        | I              | 3 (2.5%)               | 0 (0%)                 | 1 (1%)                 | 2 (3.8%)               | 0.331               |
|                                  | II             | 87 (73.7%)             | 105 (81.4%)            | 80 (79.2%)             | 42 (80.8%)             |                     |
|                                  | III            | 28 (23.7%)             | 24 (18.6%)             | 20 (19.8%)             | 8 (15.4%)              |                     |
| Smoking                          | yes            | 44 (37.3%)             | 59 (45.7%)             | 42 (41.6%)             | 29 (55.8%)             | 0.142               |
| Drinking                         | yes            | 41 (34.7%)             | 48 (37.2%)             | 27 (26.7%)             | 20 (38.5%)             | 0.326               |
| BMI, kg/m <sup>2</sup>           | Median (IQR)   | 24.0 (21.8 to 26.6)    | 23.5 (21.7 to 26.4)    | 24.0 (22.0 to 26.9)    | 24.1 (22.3 to 26.1)    | 0.912               |
| Macrovascular invasion           | yes            | 3 (2.5%)               | 8 (6.2%)               | 5 (5%)                 | 25 (48.1%)             | <0.001 <sup>+</sup> |
| Microvascular invasion           | M0             | 90 (76.3%)             | 56 (43.4%)             | 51 (50.5%)             | 6 (11.5%)              | <0.001 <sup>+</sup> |
|                                  | M1             | 22 (18.6%)             | 53 (41.1%)             | 37 (36.6%)             | 19 (36.5%)             |                     |
|                                  | M2             | 6 (5.1%)               | 20 (15.5%)             | 13 (12.9%)             | 27 (51.9%)             |                     |
| Bile duct invasion               | yes            | 2 (1.7%)               | 2 (1.6%)               | 4 (4%)                 | 11 (21.2%)             | <0.001 <sup>+</sup> |
| Satellite                        | yes            | 5 (4.2%)               | 16 (12.4%)             | 16 (15.8%)             | 21 (40.4%)             | <0.001 <sup>+</sup> |
| AFP value                        | AFP≥400        | 22 (18.6%)             | 28 (21.7%)             | 25 (24.8%)             | 15 (28.8%)             | 0.467               |
| Largest tumor size               | Median (IQR)   | 30.0 (23.0 to 47.0)    | 37.0 (25.0 to 49.0)    | 45.0 (30.0 to 75.0)    | 57.5 (40.5 to 85.0)    | <0.001              |
| Presentation                     | Symptomatic    | 21 (17.8%)             | 26 (20.2%)             | 23 (22.8%)             | 20 (38.5%)             | 0.023 <sup>#</sup>  |
| ES-grade                         | I              | 9 (7.6%)               | 1 (0.8%)               | 4 (4%)                 | 1 (1.9%)               | <0.001 <sup>+</sup> |
|                                  | II             | 97 (82.2%)             | 103 (79.8%)            | 74 (73.3%)             | 31 (59.6%)             |                     |
|                                  | III            | 12 (10.2%)             | 25 (19.4%)             | 21 (20.8%)             | 18 (34.6%)             |                     |
|                                  | IV             | 0 (0%)                 | 0 (0%)                 | 2 (2%)                 | 2 (3.8%)               |                     |
| Tumor envelope                   | Non/Incomplete | 58 (49.2%)             | 94 (72.9%)             | 61 (60.4%)             | 45 (86.5%)             | <0.001 <sup>+</sup> |
| Preoperative neoadjuvant         | no             | 118 (100%)             | 125 (96.9%)            | 100 (99%)              | 51 (98.1%)             | 0.233               |
| TNM staging                      | I              | 90 (76.3%)             | 64 (49.6%)             | 54 (53.5%)             | 4 (7.7%)               | <0.001 <sup>+</sup> |
|                                  | II             | 22 (18.6%)             | 54 (41.9%)             | 41 (40.6%)             | 23 (44.2%)             |                     |
|                                  | III            | 6 (5.1%)               | 11 (8.5%)              | 6 (5.9%)               | 25 (48.1%)             |                     |
| BCLC staging                     | A              | 106 (89.8%)            | 110 (85.3%)            | 87 (86.1%)             | 20 (38.5%)             | <0.001 <sup>+</sup> |
|                                  | C              | 12 (10.2%)             | 19 (14.7%)             | 14 (13.9%)             | 32 (61.5%)             |                     |
| pre-ALT                          | Median (IQR)   | 27.0 (19.4 to 41.8)    | 29.5 (17.5 to 48.8)    | 30.8 (20.3 to 53.8)    | 35.1 (24.5 to 64.9)    | 0.095               |
| pre-AST                          | Median (IQR)   | 30.6 (23.2 to 40.7)    | 29.3 (22.6 to 40.8)    | 32.0 (24.7 to 48.2)    | 37.3 (24.0 to 52.5)    | 0.150               |
| pre-AKP                          | Median (IQR)   | 78.2 (64.5 to 96.3)    | 83.8 (66.7 to 103.1)   | 88.1 (67.7 to 116.2)   | 88.6 (68.7 to 113.8)   | 0.040               |
| pre-γGT                          | Median (IQR)   | 42.8 (26.8 to 75.3)    | 48.0 (30.7 to 83.4)    | 55.5 (31.6 to 92.0)    | 70.2 (36.1 to 136.6)   | 0.021               |
| Cirrhosis                        | yes            | 59 (50%)               | 64 (49.6%)             | 59 (58.4%)             | 36 (69.2%)             | 0.061 <sup>#</sup>  |
| HBV (+)                          | yes            | 75 (63.6%)             | 89 (69%)               | 68 (67.3%)             | 48 (92.3%)             | 0.002 <sup>#</sup>  |
| HCV (+)                          | yes            | 23 (19.5%)             | 14 (10.9%)             | 13 (12.9%)             | 2 (3.8%)               | 0.032 <sup>#</sup>  |
| Child-Pugh grade                 | A              | 112 (94.9%)            | 120 (93%)              | 93 (92.1%)             | 49 (94.2%)             | 0.845               |
|                                  | B              | 6 (5.1%)               | 9 (7%)                 | 8 (7.9%)               | 3 (5.8%)               |                     |
| Intraoperative blood transfusion | yes            | 25 (21.2%)             | 39 (30.2%)             | 29 (28.7%)             | 21 (40.4%)             | 0.075 <sup>#</sup>  |
| Operation time                   | Median (IQR)   | 184.5 (145.0 to 233.0) | 200.0 (155.0 to 242.0) | 203.0 (170.0 to 240.0) | 215.0 (158.5 to 256.5) | 0.079               |
| Postoperative adjuvant therapy   | yes            | 29 (24.6%)             | 53 (41.1%)             | 41 (40.6%)             | 30 (57.7%)             | <0.001 <sup>+</sup> |

+: Linear-by-linear association,  $P < 0.001$ ; #:  $P < 0.05$  and  $P \geq 0.001$

ASA, American Society of Anesthesiologists; BMI, Body mass index; AFP, Alpha-fetoprotein; ALT, Alanine aminotransferase; AST, Aspartate aminotransferase; AKP, Alkaline phosphatase; γGT, γ-glutamyl transpeptidase; HBV, Hepatitis B virus; HCV, Hepatitis C virus; IQR, Interquartile range.