# Supplementary materials

## Table S1. Baseline characteristics of patients among three cohorts before first TACE treatment.

|                        | derivation cohort | internal testing cohort | multicenter testing cohort | P-value |
|------------------------|-------------------|-------------------------|---------------------------|---------|
| N                      | 597               | 562                     | 358                       |         |
| Age                    | 53.3 ± 12.2       | 53.3 ± 11.7             | 51.2 ± 12.0               | 0.014   |
| Gender                 |                   |                         |                           | <0.001  |
| male                   | 547 (91.6%)       | 130 (23.1%)             | 297 (83.0%)               |         |
| female                 | 50 (8.4%)         | 432 (76.9%)             | 61 (17.0%)                |         |
| ALB (g/L), missing data=23 | 38.9 ± 5.6       | 38.9 ± 4.9              | 38.8 ± 5.7                | 0.946   |
| Log T Bil (umol/L), missing data=46 | 1.3 ± 0.2 | 1.3 ± 0.3 | 1.3 ± 0.3 | 0.040 |
| Log AST (U/L), missing data=23 | 1.9 ± 0.4 | 1.9 ± 0.4 | 1.8 ± 0.4 | 0.206 |
| Child-Pugh class, missing data =95 |         |                         |                           | 0.499   |
| A                      | 508 (88.0%)       | 452 (87.3%)             | 279 (85.3%)               |         |
| B                      | 69 (12.0%)        | 66 (12.7%)              | 48 (14.7%)                |         |
| AFP (ng/ml), missing data=85 |         |                         |                           | 0.575   |
| <200                   | 265 (46.5%)       | 235 (45.5%)             | 170 (49.1%)               |         |
| ≥200                   | 305 (53.5%)       | 281 (54.5%)             | 176 (50.9%)               |         |
| Diameter of main tumor(cm) | 7.3 ± 3.7        | 7.0 ± 3.4               | 7.1 ± 3.5                 | 0.286   |
| Location of Lesions    |                   |                         |                           | <0.001  |
| left lobe              | 14 (2.3%)         | 39 (6.9%)               | 19 (6.1%)                 |         |
| right lobe             | 204 (34.2%)       | 212 (37.7%)             | 121 (38.9%)               |         |
| both lobe              | 379 (63.5%)       | 311 (55.3%)             | 171 (55.0%)               |         |
| No. of intrahepatic lesions |                   |                         |                           | 0.004   |
| 2                      | 148 (24.8%)       | 182 (32.4%)             | 128 (35.8%)               |         |
| 3                      | 47 (7.9%)         | 44 (7.8%)               | 21 (5.9%)                 |         |
| >3                     | 402 (67.3%)       | 336 (59.8%)             | 209 (58.4%)               |         |

Numbers that do not add up to 597 or 562 or 358 are attributable to missing data.
Table S2. Fit statistics for latent class models from two to five classes.

| Number of classes | BIC   | N1       | N2       | N3       | N4       | N5       | P-value   |
|-------------------|-------|----------|----------|----------|----------|----------|-----------|
| Derivation cohort |       |          |          |          |          |          |           |
| 2                 | 3658.95 | 506 (84.8%) | 91 (15.2%) |          |          |          | <0.000001 |
| 3                 | 3034.69 | 83 (13.9%)  | 355 (59.5%) | 159 (26.6%) |          |          | <0.000001 |
| 4                 | 3051.18 | 83 (13.9%)  | 14 (2.3%)  | 355 (59.5%) | 145 (24.3%) |          | <0.000001 |
| 5                 | 3426.82 | 104 (17.4%) | 9 (1.5%)  | 150 (25.1%) | 251 (42%)  | 83 (13.9%) | <0.000001 |
| Validation cohort |       |          |          |          |          |          |           |
| 2                 | 9353.91 | 562 (61.1%) | 358 (38.9%) |          |          |          | <0.000001 |
| 3                 | 9296.62 | 130 (14.1%) | 432 (47%)  | 358 (38.9%) |          |          | <0.000001 |
| 4                 | 8777.69 | 130 (14.1%) | 26 (2.8%)  | 432 (47%)  | 332 (36.1%) |          | <0.000001 |
| 5                 | 8881.47 | 432 (47%)  | 26 (2.8%)  | 332 (36.1%) | 93 (10.1%) | 37 (4%)  | <0.000001 |

#By Vuong-Lo-Mendell-Rubin likelihood ratio test, testing whether the number of classes provides an improved model fit compared to a model using one fewer class.
Between January 2007 and May 2012, 5005 consecutive patients with newly diagnosed HCC at Sun Yat-sen University Cancer Center (SYSUCC) were retrospectively reviewed to develop the derivation cohort. Between June 2012 and December 2015, a consecutive independent series of 3843 HCC patients treated at SYSUCC were examined to establish the internal testing cohort. Besides, between January 2010 and December 2016, 843 patients from Fifth Affiliated Hospital of Sun Yat-sen University, 415 patients from the Third Affiliated Hospital of Sun Yat-sen University, and 437 patients from the Second Hospital of Guangzhou Medical University were reviewed to develop the multicenter testing cohort. After meeting the inclusion criteria, a total of 979, 627, and 414 patients were included in the derivation cohort, internal testing cohort, and multicenter testing cohort, respectively. According to the exclusion criteria, 597 and 920 patients were included in the derivation cohort and validation cohort, respectively.

**Figure S1. Flowchart for the patients with HCC after first TACE treatment.** Between January 2007 and May 2012, 5005 consecutive patients with newly diagnosed HCC at Sun Yat-sen University Cancer Center (SYSUCC) were retrospectively reviewed to develop the derivation cohort. Between June 2012 and December 2015, a consecutive independent series of 3843 HCC patients treated at SYSUCC were examined to establish the internal testing cohort. Besides, between January 2010 and December 2016, 843 patients from Fifth Affiliated Hospital of Sun Yat-sen University, 415 patients from the Third Affiliated Hospital of Sun Yat-sen University, and 437 patients from the Second Hospital of Guangzhou Medical University were reviewed to develop the multicenter testing cohort. After meeting the inclusion criteria, a total of 979, 627, and 414 patients were included in the derivation cohort, internal testing cohort, and multicenter testing cohort, respectively. According to the exclusion criteria, 597 and 920 patients were included in the derivation cohort and validation cohort, respectively.