## Supplementary Material

### Table S1. Multivariate linear regression models for LOS (log-transformed) on the derivation set.

| Sample | Variables | CCI model | Clavien-Dindo model |
|--------|-----------|-----------|---------------------|
|        |           | Mean change (95% CI) | Mean change (95% CI) |
| Overall sample \( n = 1331 \) | CCI, per 10 unit increase | 0.267 (0.251;0.282) | - |
|       | Clavien-Dindo, per category increase | - | 0.291 (0.273;0.309) |
|       | Surgery major vs minor | -0.012 (-0.065;0.041) | 0.006 (-0.048;0.06) |
|       | Laparoscopy vs open | -0.142 (-0.184;-0.1) | -0.134 (-0.177;-0.091) |
|       | Age, per year | 0.0001 (-0.002;0.003) | -0.0001 (-0.003;0.002) |
|       | ASA score 3-4 vs 1-2 | 0.027 (-0.018;0.071) | 0.037 (-0.008;0.083) |
|       | Child grade B vs A | 0.045 (-0.028;0.118) | 0.054 (-0.022;0.129) |
|       | Duration of surgery >4h vs ≤4h | 0.103 (0.058;0.147) | 0.108 (0.063;0.154) |
|       | Center volume high vs med or low | -0.315 (-0.360;-0.270) | -0.353 (-0.399;-0.308) |
| Subgroup of patients with at least two complications \( n = 177 \) | CCI, per 10 unit increase | 0.219 (0.176;0.262) | - |
|       | Clavien-Dindo, per category increase | - | 0.223 (0.157;0.289) |
|       | Surgery major vs minor | -0.056 (-0.235;0.124) | -0.009 (-0.212;0.193) |
|       | Laparoscopy vs open | -0.168 (-0.319;-0.018) | -0.134 (-0.305;0.036) |
|       | Age, per year | 0.001 (-0.006;0.009) | 0.001 (-0.008;0.001) |
|       | ASA score 3-4 vs 1-2 | 0.141 (-0.006;0.289) | 0.199 (0.034;0.364) |
|       | Child grade B vs A | 0.250 (-0.039;0.539) | 0.336 (-0.002;0.674) |
|       | Duration of surgery >4h vs ≤4h | 0.261 (0.115;0.408) | 0.280 (0.115;0.446) |
|       | Center volume high vs med or low | -0.220 (-0.599;0.159) | -0.241 (-0.669;0.186) |

LOS: Length of stay; CCI: Comprehensive Complication Index; CI: Confidence interval.

### Table S2. Multivariate linear regression models for e-LOS (LOS ≥ 15 days) on the derivation set.

| Sample | Variables | CCI model | Clavien-Dindo model |
|--------|-----------|-----------|---------------------|
|        |           | OR (95% CI) | OR (95% CI) |
| Overall sample \( n = 1331 \) | CCI, per 10 unit increase | 5.507 (4.152;7.304) | - |
|       | Clavien-Dindo, per category increase | - | 5.590 (4.201;7.438) |
|       | Surgery major vs minor | 0.810 (0.400;1.641) | 1.014 (0.521;1.973) |
|       | Laparoscopy vs open | 0.623 (0.346;1.128) | 0.740 (0.413;1.324) |
|       | Age, per year | 0.990 (0.961;1.021) | 0.991 (0.961;1.022) |
|       | ASA score 3-4 vs 1-2 | 1.712 (0.914;3.208) | 1.978 (1.068;3.662) |
|       | Child grade B vs A | 0.892 (0.336;2.372) | 1.336 (0.506;3.528) |
|       | Duration of surgery >4h vs ≤4h | 1.669 (0.912;3.053) | 1.769 (0.989;3.162) |
|       | Center volume high vs med or low | 0.650 (0.341;1.241) | 0.267 (0.133;0.533) |
| Subgroup of patients with at least two complications \( n = 177 \) | CCI, per 10 unit increase | 2.793 (1.896;4.115) | - |
|       | Clavien-Dindo, per category increase | - | 2.439 (1.666;3.57) |
|       | Surgery major vs minor | 0.779 (0.269;2.256) | 1.021 (0.394;2.645) |
|       | Laparoscopy vs open | 0.551 (0.227;1.339) | 0.673 (0.294;1.544) |
|       | Age, per year | 0.976 (0.937;1.016) | 0.98 (0.943;1.018) |
|       | ASA score 3-4 vs 1-2 | 3.093 (1.217;7.861) | 3.336 (1.422;7.822) |
|       | Child grade B vs A | 2.016 (0.459;0.36) | 3.469 (0.822;14.634) |
|       | Duration of surgery >4h vs ≤4h | 3.417 (1.458;8.007) | 3.179 (1.449;6.975) |
|       | Center volume high vs med or low | 0.316 (0.046;2.197) | 0.312 (0.046;2.124) |

LOS: Length of stay; CCI: Comprehensive Complication Index; OR: Odds Ratio; CI: Confidence interval.
Figure S1. ROC curves on subgroups of patients with at least one complication showing the performance of CCI to identify those with e-LOS. The subgroups considered are: (A) minor surgery, (B) major surgery, (C) open surgery, (D) laparoscopy surgery, (E) no cirrhosis, (F) cirrhosis, (G) Child-Pugh grade A, (H) Child-Pugh grade B. The AUC values and the optimal cut-point identified by the Youden Index with the corresponding sensitivity, specificity, positive and negative predictive values are also reported.