**Table 1:** Baseline participant characteristics variables by number of enabling strategies used

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Variable** | **0**  **(n=19,696)** | **1**  **(n=6,031)** | **2**  **(n=1,647)** | **≥3**  **(n=400)** | **p-value** |
| Age (years), ±SD | 64.1±14.9 | 63.9±10.8 | 64.3±10.5 | 65.2±10.4 | 0.240 |
| Female gender, no. (%) | 3,716 (19.9) | 1,129 (18.7) | 285 (17.3) | 68 (17.1) | <0.001 |
| Body mass index, ±SD | 29.5±6.3 | 29.6±5.3 | 29.9±6.9 | 30.0±5.1 | 0.033 |
| Smoking history, no. (%) | 10,604 (64.5) | 3,076 (67.6) | 683 (68.2) | 135 (72.6) | <0.001 |
| Hypertension, no. (%) | 10,674 (60.5) | 3,898 (67.4) | 1,186 (75.5) | 318 (84.8) | <0.001 |
| Diabetes mellitus, no. (%) | 3,856 (21.9) | 1,429 (24.4) | 434 (26.8) | 101 (26.0) | <0.001 |
| Previous MI, no. (%) | 7,094 (41.5) | 2,554 (45.1) | 770 (48.5) | 203 (52.9) | <0.001 |
| Previous stroke, no. (%) | 588 (3.3) | 220 (3.8) | 66 (4.2) | 17 (4.5) | 0.009 |
| Peripheral vascular disease, no. (%) | 996 (5.6) | 360 (6.3) | 115 (7.3) | 39 (10.4) | <0.001 |
| Valvular heart disease, no. (%) | 189 (1.1) | 86 (1.5) | 21 (1.3) | 8 (2.1) | 0.007 |
| Renal disease, no. (%) | 416 (2.3) | 108 (1.9) | 34 (2.1) | 7 (1.8) | 0.093 |
| Previous PCI, no. (%) | 5,451 (30.0) | 2,503 (42.3) | 824 (51.1) | 233 (58.5) | <0.001 |
| Previous CABG, no. (%) | 2,237 (12.4) | 923 (15.6) | 340 (20.9) | 89(22.4) | <0.001 |
| Ejection fraction <30%, no. (%) | 554 (5.0) | 183 (5.0) | 38 (3.5) | 17 (5.6) | 0.229 |
| Anticoagulation therapy, no. (%) | 211 (1.2) | 80 (1.4) | 19 (1.2) | 9 (2.3) | 0.202 |
| CCS class, ±SD | 2.22±0.84 | 2.30±0.86 | 2.35±0.80 | 2.38±0.82 | <0.001 |
| NYHA class, ±SD | 1.89±0.75 | 1.94±0.78 | 1.92±0.79 | 1.93±0.81 | <0.001 |

**Table 2:** Coronary anatomy and procedural variables by number of enabling strategies used

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Variable** | **0**  **(n=19,696)** | **1**  **(n=6,031)** | **2**  **(n=1,647)** | **≥3**  **(n=400)** | **p-value** |
| Off-site surgical cover | 6,378 (36.5) | 1,811 (31.3) | 468 (29.0) | 124 (31.6) | 0.001 |
| Femoral arterial access, no. (%) | 11,019 (61.3) | 4,467 (75.8) | 1,405 (86.4) | 376 (95.0) | <0.001 |
| Trainee first operator, no. (%) | 3,065 (17.0) | 965 (16.6) | 177 (11.3) | 28 (7.4) | <0.001 |
| CTO case volume, , ±SD | 17.1±29.1 | 26.9±33.5 | 31.7±38.5 | 40.5±45.4 | <0.001 |
| No. CTO attempted, ±SD | 1.06±0.29 | 1.06±0.29 | 1.08±0.38 | 1.06±0.28 | 0.122 |
| Vessel attempted, no. (%)  Graft  Left main  Left anterior descending  Circumflex  Right coronary | 543 (3.0)  333 (1.8)  7,163 (38.9)  5,059 (27.5)  9,060 (49.2) | 126 (2.1)  244 (4.1)  2,161 (36.2)  1,047 (17.5)  3,320 (55.6) | 18 (1.1)  120 (7.3)  470 (28.7)  231 (14.1)  1,077 (65.8) | 3 (0.8)  27 (6.8)  102 (25.7)  47 (11.8)  276 (69.5) | <0.001  <0.001  <0.001  <0.001  <0.001 |
| Occlusive restenosis, no. (%) | 1,235 (7.3) | 404 (7.5) | 127 (8.3) | 33 (8.7) | 0.139 |
| Glycoprotein inhibitor, no. (%) | 2,108 (12.0) | 413 (7.2) | 79 (4.9) | 8 (2.1) | <0.001 |
| Number of stents used, ±SD | 1.37±1.36 | 1.69±1.52 | 2.14±1.64 | 2.67±1.50 | <0.001 |
| Largest balloon (mm), ±SD | 3.08±0.65 | 3.25±0.66 | 3.41±0.64 | 3.51±0.59 | <0.001 |
| Stent length (mm), ±SD | 28.8±20.8 | 39.7±27.9 | 49.2±32.2 | 59.7±34.0 | <0.001 |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Variable** | **0**  **(n=19,696)** | **1**  **(n=6,031)** | **2**  **(n=1,647)** | **≥3**  **(n=400)** | **p-value** |
| **Procedural success** | | | | | |
| CTO successful, no. (%) | 8,180 (56.8) | 2,918 (58.7) | 977 (66.7) | 325 (83.8) | <0.001 |
| No. successful lesions ±SD | 1.15±0.98 | 1.11±0.98 | 1.20±0.99 | 1.32±0.94 | <0.001 |
| **Immediate procedural complications** | | | | | |
| Coronary perforation, no. (%) | 228 (1.2) | 117 (2.0) | 44 (2.7) | 16 (4.0) | <0.001 |
| Tamponade, no. (%) | 32 (0.2) | 24 (0.4) | 7 (0.4) | 4 (1.0) | <0.001 |
| Emergency surgery, no. (%) | 13 (0.1) | 7 (0.1) | 2 (0.1) | 0(0) | 0.470 |
| Major side-branch loss, no. (%) | 119 (0.7) | 44 (0.8) | 13 (0.8) | 4 (1.0) | 0.293 |
| Slow flow, no. (%) | 72 (0.4) | 25 (0.4) | 9 (0.6) | 5 (1.3) | 0.074 |
| All coronary complications | 418 (2.4) | 186 (3.2) | 66 (4.1)) | 25 (6.3) | <0.001 |
| Intra-procedural resuscitation | 50 (0.3) | 30 (0.5) | 13 (0.8) | 2 (0.5) | 0.010 |

**Table 3:** Procedural success and immediate coronary complications by number of enabling strategies used

**Table 4:** Significant associations between covariates and procedural success during CTO-PCI

|  |  |  |  |
| --- | --- | --- | --- |
| **Variable** | **Odds ratio** | **[95% CI]** | **p-value** |
| 4 or more enabling strategies | 4.52 | [2.22-9.20] | <0.001 |
| 3 enabling strategies | 1.95 | [1.55-2.45] | <0.001 |
| 2 enabling strategies | 1.43 | [1.24-1.66] | <0.001 |
| 1 enabling strategy | 1.08 | [0.96-1.23] | 0.192 |
| Operator volume/case | 1.004 | [1.003-1.005] | <0.001 |
| Year of PCI/year | 1.092 | [1.027-1.161] | <0.001 |
| Left anterior descending CTO | 1.25 | [1.12-1.39] | <0.001 |
| Left main CTO | 1.48 | [1.13-1.04] | 0.005 |
| Patient age at PCI/year | 0.98 | [0.97-0.99] | <0.001 |
| Previous PCI | 0.84 | [0.75-0.94] | 0.002 |
| Previous MI | 0.75 | [0.67-0.83] | <0.001 |
| Previous CABG | 0.49 | [0.42-0.56] | <0.001 |

**Table 5:** Unadjusted post-procedural in-patient outcomes by number of enabling strategies used

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Variable** | **0**  **(n=19,696)** | **1**  **(n=6,031)** | | **2**  **(n=1,647)** | **≥3**  **(n=400)** | **p-value** |
| **Clinical outcomes** | | | | | | |
| Access site complication, no. (%) | 192 (1.1) | | 101 (1.7) | 41 (2.5) | 8 (2.0) | <0.001 |
| Access site hemorrhage, no. (%) | 61 (0.4) | | 53 (0.9) | 19 (1.2) | 4 (1.0) | <0.001 |
| Retro-peritoneal hematoma, no. (%) | 7 (0.04) | | 24 (0.4) | 1 (0.06) | 2 (0.5) | 0.384 |
| Transfusion, no. (%) | 30 (0.2) | | 22 (0.4) | 9 (0.6) | 3 (0.8) | <0.001 |
| Gastro-intestinal bleed, no. (%) | 9 (0.05) | | 0 (0) | 0 (0) | 4 (1.0) | 0.834 |
| Intra-cerebral bleed, no. (%) | 0 (0) | | 3 (0.05) | 0 (0) | 0 (0) | 1.000 |
| In-hospital major bleed, no. (%) | 111 (0.6) | | 86 (1.5) | 32 (2.0) | 7 (1.8) | <0.001 |
| Acute kidney injury, no. (%) | 0 (0) | | 36 (0.6) | 3 (0.2) | 2 (0.6) | 0.439 |
| Post-procedural MI, no. (%) | 89 (0.5) | | 45 (0.8) | 7 (0.4) | 2 (0.5) | 0.301 |
| Post-procedural CVA, no. (%) | 3 (0.02) | | 3 (0.05) | 3 (0.2) | 4 (1.0) | <0.001 |
| In-hospital mortality, no. (%) | 29 (0.2) | | 17 (0.3) | 4 (0.2) | 4 (1.0) | 0.002 |
| In-hospital MACE, no. (%) | 118 (0.7) | | 63 (1.1) | 14 (0.9) | 8(2.0) | 0.001 |
| 30-day mortality, no. (%) | 75 (0.4) | | 30 (0.5) | 8 (0.7) | 6 (1.6) | <0.001 |

**Table 6:** Adjusted odds of adverse outcomes by number of enabling strategies used. Clinical outcomes adjusted for baseline differences using a propensity score estimation for multiple treatments

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Variable** | **Number of enabling techniques** | **Odds ratio** | **[95% CI]** | **p-value** | **Global p-value** |
| Arterial complication | 1 vs. 0 | 1.56 | [1.19-2.04] | 0.001 | <0.001 |
| 2 vs. 0 | 2.34 | [1.56-3.48] | <0.001 |
| ≥3 vs. 0 | 1.45 | [0.60-3.65] | 0.398 |
| In-hospital major bleeding | 1 vs. 0 | 2.43 | [1.78-3.31] | <0.001 | <0.001 |
| 2 vs. 0 | 3.65 | [2.33-5.72] | <0.001 |
| ≥3 vs. 0 | 1.39 | [0.38-5.18] | 0.619 |
| In-hospital MACCE | 1 vs. 0 | 1.69 | [1.20-2.37] | 0.003 | 0.018 |
| 2 vs. 0 | 0.86 | [0.44-1.67] | 0.646 |
| ≥3 vs. 0 | 1.23 | [0.50-3.0] | 0.654 |
| In-hospital mortality | 1 vs. 0 | 2.09 | [1.06-4.11] | 0.033 | 0.040 |
| 2 vs. 0 | 0.69 | [0.20-2.39] | 0.556 |
| ≥3 vs. 0 | 3.38 | [0.96-11.21] | 0.058 |
| 30-day mortality | 1 vs. 0 | 1.46 | [0.90-2.36] | 0.121 | 0.190 |
| 2 vs. 0 | 0.93 | [0.36-2.40] | 0.878 |
| ≥3 vs. 0 | 2.15 | [0.87-5.32] | 0.097 |