Reduced Adenoma and Advanced Adenoma Miss Rates with 9-Minute vs. 6-Minute Average Withdrawal Time for Screening Colonoscopy: A Multicenter Randomized Tandem Trial

**Supplementary Materials**

**Supplementary Methods**

**Definitions**

Adenomas located proximal to the splenic flexure were defined as proximal adenomas, whereas those located more distally were defined as distal adenomas. Advanced adenomas (AAs) were defined with one of the following features: diameter ≥10 mm or (tubulo)villous adenomas or with high-grade dysplasia. Sessile serrated lesions (SSLs) were defined as lesions with at least one crypt showing a characteristic sessile serrated lesion-type appearance. Clinically relevant serrated polyps (CRSPs) were defined as ≥10 mm serrated polyps (SPs, including hyperplastic polyps, SSLs, and traditional serrated adenomas) and >5 mm SPs in the proximal colon1. High-risk adenomas (HRAs) were defined as lesions needing 3-year or shorter surveillance after resection2. The detection rate of lesions, including polyps, adenomas, AAs, SSLs, clinically relevant serrated polyps, and HRAs, was defined as the number of participants with at least 1 corresponding lesion divided by the total number of participants. The number of lesions per colonoscopy was defined as the number of corresponding lesions divided by the total number of colonoscopies or participants. Adenomas per positive colonoscopy (APPC) was defined as the number of adenomas divided by the total number of colonoscopies with ≥1 adenoma. The miss rate for lesions was defined as the number of corresponding lesions detected only during the second-pass colonoscopy divided by the total number of corresponding lesions detected during the tandem colonoscopy. The participant-level miss rate for lesions was defined as the number of participants with corresponding lesions detected only (or accumulatively detected only for HRAs and multiple adenomas) during the second-pass colonoscopy divided by the total number of participants with corresponding lesions detected during the tandem colonoscopy. The false-negative rate (FNR) for corresponding lesions was defined as the number of participants with corresponding lesions detected only at the second colonoscopy divided by the number of participants without lesions in the first-pass colonoscopy. Adequate bowel preparation quality (BPQ) was defined as a ≥6 Boston bowel preparation score3 (BBPS) with ≥2 BBPS in each segmental colon, which was further divided into fair (BBPS 6-7) and good (BBPS 8-9). Number of significant polyps per 6 minutes (SP6) was defined as the number of adenomas and SSLs detected divided by the WT (minutes, excluding the time for biopsy and polypectomy) and multiplied by 64. The Asia-Pacific Colorectal Screening score5 (APCS) was used to evaluate the CRC risk. The colonoscopy-relevant discomfort included nausea and vomiting, abdominal pain, bloating, dizziness, hypoglycemia, palpitations, and hunger. Adverse events included aspiration pneumonia, perforation, bleeding, splenic injury/rupture, death, or others requiring hospitalization within 30 days after the colonoscopy.

**Bowel preparation and relevant details**

Participants received at least 3 L of a split-dose polyethylene glycol (PEG) electrolyte solution (Wanhe Pharmaceutical Co. Ltd. for the majority of participating centers; Staidson Co. Ltd. et al for the resting centers) diluted in 2000 mL water for bowel preparation. The inadequate Boston bowel preparation score (BBPS) during withdrawal was included in the intention-to-treat analysis but excluded from per-protocol analysis. High-definition colonoscopes (Evis-Exera 290 and 260 video system; Olympus Optical, Tokyo, Japan) were used by colonoscopists with ≥1000 diagnostic experience without trainees involved. The application of simethicone (for bowel preparation), antispasmodics, sedation, air or CO2 inflation, and position change and abdominal pressure (during insertion) was at the discretion of colonoscopists. Mechanical or optical auxiliary techniques, water-based colonoscopy, image-guided devices, position change during withdrawal, or retroversion were not used or performed. Ileal intubation was not performed or not included for withdrawal time. Pilot trials with ≥5 tandem colonoscopies were performed to ensure that colonoscopists and timer operators were familiar with the withdrawal techniques and standard operating procedures; the trial was carried out until they were evaluated to be qualified by the NCRCDD investigators6. The adopted withdrawal techniques in both groups kept similar and included clearing residual stool, providing adequate bowel distention, looking behind folds, and utilizing repeated examination with “to and fro” movement.



**Supplementary figure 1** The 6-minute and 9-minute protocol of segmental tandem withdrawal.

**Supplementary tables**

**Supplementary table 1.** Clinical characteristics of colonoscopy and details of cumulative detection of twice colonoscopy.

|  |  |  |  |
| --- | --- | --- | --- |
|  | **9MF**  **(n=366)** | **6MF**  **(n=367)** | **P value** |
| **Split-dose PEG, n (%) #** |  |  | 0.86 |
| 3-L PEG | 235 (64.7) | 234 (64.1) |  |
| 4-L PEG | 128 (35.3) | 131 (35.9) |  |
| **Use of simethicone, n (%)** | 312 (85.2) | 311 (84.7) | 0.85 |
| **Use of** **antispasmodics, n (%)** | 5 (1.4) | 9 (2.5) | 0.28 |
| **Colonoscopists experience, n (%)** |  |  | 0.97 |
| > 5000 | 225 (61.5) | 227 (61.9) |  |
| 3000-5000 | 42 (11.5) | 40 (10.9) |  |
| 1000-3000 | 99 (27.0) | 100 (27.2) |  |
| **Baseline ADR of colonoscopists in routine colonoscopy** |  |  | 0.85 |
| Unqualified (<25%) | 179 (48.9) | 182 (49.6) |  |
| Qualified (≥25%) | 187 (51.1) | 185 (50.4) |  |
| **Colonoscope type#** |  |  | 0.48 |
| CF290 | 174 (47.7) | 184 (50.3) |  |
| CF260 | 191 (52.3) | 182 (49.7) |  |
| **Use of sedation, n (%)** |  |  | 0.64 |
| No | 132 (36.1) | 124 (33.8) |  |
| Conscious sedation | 39 (10.7) | 35 (9.5) |  |
| Monitored anesthesia | 195 (53.3) | 208 (56.7) |  |
| **Insufflation, n (%)** |  |  | 0.88 |
| Air | 280 (76.5) | 279 (76.0) |  |
| CO2 | 86 (23.5) | 88 (24.0) |  |
| **Colonoscopy insertion, n (%)** |  |  |  |
| Position change | 110 (30.1) | 100 (27.2) | 0.40 |
| Abdominal pressure | 151 (41.3) | 144 (39.2) | 0.58 |
| **CIT (minutes, mean ± SD)** | 5.68**±**4.04 | 5.76**±**4.70 | 0.79 |
| **Bubble score (mean ± SD)** | 8.41±1.01 | 8.46±0.98 | 0.51 |
| ≥6 bubble score, n (%) | 361 (98.6) | 364 (99.2) | 0.72 |
| **Cumulative adenoma detection rate** |  |  |  |
| **Location** |  |  |  |
| Proximal | 126 (34.4) | 111 (30.2) | 0.23 |
| Distal | 90 (24.6) | 89 (24.3) | 0.92 |
| **Size** |  |  |  |
| 1-5 mm | 138 (37.7) | 141 (38.4) | 0.84 |
| 6-9 mm | 46 (12.6) | 43 (11.7) | 0.72 |
| ≥10 mm | 16 (4.4) | 16 (4.4) | 0.99 |
| **Morphology** |  |  |  |
| Pedunculated | 6 (1.6) | 3 (0.8) | 0.5 |
| Semi-pedunculated | 18 (4.9) | 18 (4.9) | 0.99 |
| Flat or sessile | 161 (44.0) | 158 (43.1) | 0.80 |
| **Pathology** |  |  |  |
| Tubular | 170 (46.4) | 162 (44.1) | 0.53 |
| (Tubulo)villous | 7 (1.9) | 7 (1.9) | 0.56 |
| HGD | 0 (0.0) | 3 (0.8) | 0.25 |
| **CRC detection rate** | 2 (0.5) | 1 (0.3) | 1 |
| **Multiple adenomas\* detection rate** | 29 (7.9) | 23 (6.3) | 0.38 |
| **Cumulative detected number of lesions, mean ± SD** |  |  |  |
| Polyp | 1.49±1.50 | 1.44±1.52 | 0.65 |
| Adenoma | 0.79±1.11 | 0.73±1.08 | 0.46 |
| AA | 0.05±0.23 | 0.09±0.46 | 0.19 |
| SSL | 0.02±0.13 | 0.02±0.19 | 0.67 |
| CRSP | 0.08±0.37 | 0.08±0.38 | 0.92 |
| **Number of adenomas, mean ± SD** |  |  |  |
| **Location** |  |  |  |
| Proximal | 0.49±0.81 | 0.43±0.77 | 0.34 |
| Distal | 0.30±0.60 | 0.30±0.60 | 0.94 |
| **Size** |  |  |  |
| 1-5 mm | 0.57±0.91 | 0.53±0.84 | 0.57 |
| 6-9 mm | 0.17±0.56 | 0.14±0.42 | 0.33 |
| ≥10 mm | 0.04±0.20 | 0.06±0.34 | 0.51 |
| **Morphology** |  |  |  |
| Pedunculated | 0.02±0.13 | 0.01±0.13 | 0.56 |
| Semi-pedunculated | 0.05±0.22 | 0.06±0.34 | 0.53 |
| Flat or sessile | 0.72±1.07 | 0.66±0.96 | 0.37 |
| **Pathology** |  |  |  |
| Tubular | 0.77±1.09 | 0.70±1.02 | 0.33 |
| (Tubulo)villous | 0.02±0.14 | 0.04±0.28 | 0.32 |
| HGD | 0.0±0.0 | 0.01±0.17 | 0.13 |
| **Discomfort after colonoscopy, n (%)** | 14 (3.8) | 18 (4.9) | 0.48 |

# Records of laxative and colonoscope information for 5 and 2 participants were missed; \* Referring to detecting ≥3 adenomas; 9MF, 9-minute first group; 6MF, 6-minute first group; PEG, polyethylene glycol electrolyte; ADR, adenoma detection rate; CIT, cecal intubation time; SD, standard deviation; HGD, high-grade dysplasia; CRC, colorectal cancer.

**Supplementary table 2.** Subgroup analyses of lesion-level AMR

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **9MF**  **(n=289)** | **6MF**  **(n=268)** | **RR**  **(95% CI)** | **P value** | **P for interaction** |
| **AMR, n (%)** | 42 (14.5) | 98 (36.6) | 0.40 (0.29-0.55) | <0.001 |  |
| **Baseline ADR in routine practice** |  |  |  |  | 0.85 |
| Unqualified (<25%) | 18 (12.6) | 45 (36.3) | 0.35 (0.21-0.57) | <0.001 |  |
| Qualified (≥25%) | 24 (16.4) | 53 (36.8) | 0.45 (0.29-0.68) | <0.001 |  |
| **ADR of 6MF\*** |  |  |  |  | 0.13 |
| Low (<33.5%) | 21 (12.3) | 50 (39.1) | 0.31 (0.20-0.50) | 0.001 |  |
| High (≥33.5%) | 21 (17.8) | 48 (34.3) | 0.52 (0.33-0.81) | 0.003 |  |
| **Location** |  |  |  |  |  |
| Proximal | 29 (15.3) | 56 (35.4) | 0.46 (0.31-0.68) | <0.001 | 0.23 |
| Distal | 13 (11.7) | 42 (38.2) | 0.31 (0.18-0.54) | <0.001 |  |
| **Size** |  |  |  |  | 0.36 |
| 1-5 mm | 34 (16.3) | 76 (38.8) | 0.42 (0.29-0.60) | <0.001 |  |
| 6-9 mm | 7 (10.9) | 14 (27.5) | 0.40 (0.17-0.91) | 0.02 |  |
| ≥10 mm | 1 (6.3) | 8 (38.1) | 0.16 (0.02-1.18) | 0.06 |  |
| **Morphology** |  |  |  |  | 0.81 |
| Pedunculated | 0 (0.0) | 1 (25.0) | - | 0.40 |  |
| Semi-pedunculated | 3 (16.7) | 8 (34.8) | 0.48 (0.15-1.55) | 0.35 |  |
| Flat or sessile | 39 (14.7) | 89 (36.9) | 0.40 (0.29-0.56) | <0.001 |  |
| **Pathology** |  |  |  |  | 0.99 |
| Tubular | 42 (14.9) | 91 (35.5) | 0.42 (0.30-0.58) | <0.001 |  |
| (Tubulo)villous | 0 (0.0) | 7 (58.3) |  | 0.01 |  |
| HGD | 0 (0.0) | 2 (33.3) | - | - | - |
| **Sex** |  |  |  |  | 0.98 |
| Male | 27 (14.4) | 62 (36.5) | 0.40 (0.27-0.59) | <0.001 |  |
| Female | 15 (14.7) | 36 (36.7) | 0.40 (0.24-0.68) | <0.001 |  |
| **Age** |  |  |  |  | 0.21 |
| 40-49 | 11 (19.6) | 20 (32.3) | 0.61 (0.32-1.16) | 0.12 |  |
| 50-59 | 12 (9.7) | 37 (35.7) | 0.27 (0.15-0.19) | <0.001 |  |
| 60-75 | 19 (17.4) | 41 (39.8) | 0.44 (0.27-0.70) | <0.001 |  |
| **BMI** |  |  |  |  | 0.21 |
| <24 | 17 (14.8) | 36 (32.1) | 0.46 (0.28-0.77) | 0.002 |  |
| ≥24 | 25 (14.4) | 62 (39.7) | 0.36 (0.24-0.55) | <0.001 |  |
| **APCS** |  |  |  |  | 0.50 |
| Average risk | 5 (16.7) | 15 (36.6) | 0.46 (0.19-1.12) | 0.07 |  |
| Intermediate risk | 24 (13.3) | 64 (38.3) | 0.35 (0.23-0.53) | <0.001 |  |
| High risk | 13 (16.7) | 19 (31.7) | 0.53 (0.28-0.98) | 0.04 |  |
| **Colonoscopists experience** |  |  |  |  | 0.96 |
| > 5000 | 27 (14.5) | 58 (36.5) | 0.40 (0.27-0.60) | <0.001 |  |
| 3000-5000 | 5 (20.0) | 17 (48.6) | 0.41 (0.18-0.97) | 0.02 |  |
| 1000-3000 | 10 (12.8) | 23 (31.1) | 0.41 (0.21-0.81) | 0.01 |  |
| **Split-dose PEG** |  |  |  |  | 0.18 |
| 3-L PEG | 27 (13.6) | 74 (38.5) | 0.35 (0.24-0.52) | <0.001 |  |
| 4-L PEG | 15 (16.5) | 22 (29.7) | 0.55 (0.31-0.99) | 0.04 |  |
| **Bowel preparation quality** |  |  |  |  | 0.45 |
| Inadequate | 2 (50.0) | 3 (75.0) | 0.67 (0.22-2.07) | 1 |  |
| fair | 13 (15.9) | 24 (33.8) | 0.47 (0.26-0.85) | 0.01 |  |
| Good | 27 (13.3) | 71 (36.8) | 0.36 (0.24-0.54) | <0.001 |  |
| **Colonoscope type** |  |  |  |  | 0.70 |
| CF290 | 20 (12.8) | 51 (34.9) | 0.37 (0.23-0.58) | <0.001 |  |
| CF260 | 22 (16.5) | 46 (38.0) | 0.44 (0.28-0.68) | <0.001 |  |
| **Use of antispasmodics** |  |  |  |  | 0.16 |
| Yes | 3 (60.0) | 12 (54.5) | 1.10 (0.49-2.48) | 1.00 |  |
| No | 39 (13.7) | 86 (35.0) | 0.39 (0.28-0.55) | <0.001 |  |
| **Use of sedation** |  |  |  |  | 0.06 |
| No | 19 (20.0) | 33 (33.7) | 0.59 (0.36-0.97) | 0.03 |  |
| Conscious sedation | 6 (25.0) | 14 (50.0) | 0.50 (0.23-1.10) | 0.07 |  |
| Monitored anesthesia | 17 (10.0) | 51 (35.9) | 0.28 (0.17-0.46) | <0.001 |  |

\* Colonoscopists were classified into high and low group according to average ADR of the first withdrawal in 6MF; 9MF, 9-minute first group; 6MF, 6-minute first group; RR, relative risk; CI, confidence interval; AMR, adenoma miss rate; ADR, adenoma detection rate; HGD, high-grade dysplasia; BMI, body mass index; APCS, Asia-Pacific Colorectal Screening score; PEG, polyethylene glycol electrolyte.

**Supplementary table 3.** Subgroup analyses of lesion-level AAMR

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **9MF**  **(n=19)** | **6MF**  **(n=32)** | **RR**  **(95% CI)** | **P value** | **P for interaction** |
| **AAMR, n (%)** | 1 (5.3) | 15 (46.9) | 0.11 (0.02-0.78) | 0.002 |  |
| **Baseline ADR in routine practice** |  |  |  |  | 0.63 |
| Unqualified (<25%) | 0 (0.0) | 11 (50.0) | - | 0.01 |  |
| Qualified (≥25%) | 1 (9.1) | 4 (40.0) | 0.23 (0.30-1.71) | 0.15 |  |
| **ADR of 6MF\*** |  |  |  |  | 0.99 |
| Low (<33.5%) | 1 (10.0) | 5 (38.5) | 0.26 (0.04-1.89) | 0.18 |  |
| High (≥33.5%) | 0 (0.0) | 10 (52.6) | - | 0.01 |  |
| **Location** |  |  |  |  | 0.99 |
| Proximal | 0 (0.0) | 8 (66.7) | - | 0.01 |  |
| Distal | 1 (7.7) | 7 (35.0) | 0.22 (0.03-1.59) | 0.11 |  |
| **Size** |  |  |  |  | 0.85 |
| 1-5 mm | 0 (-) | 3 (100.0) | - | - |  |
| 6-9 mm | 0 (0.0) | 4 (50.0) | - | 0.24 |  |
| ≥10 mm | 1 (6.3) | 8 (38.1) | 0.16 (0.02-1.18) | 0.05 |  |
| **Morphology** |  |  |  |  | 0.99 |
| Pedunculated | 0 (0.0) | 5 (35.7) | - | 0.05 |  |
| Semi-pedunculated | 0 (0.0) | 9 (64.3) | - | 0.03 |  |
| Flat or sessile | 1 (25.0) | 1 (25.0) | 1.00 (0.09-11.03) | 1 |  |
| **Pathology** |  |  |  |  | 0.99 |
| Tubular | 1 (8.3) | 7 (36.8) | 0.23 (0.03-1.62) | 0.11 |  |
| (Tubulo)villous | 0 (0.0) | 8 (61.5) | - | 0.02 |  |
| **HGD** |  |  | - | - | 0.47 |
| Yes | 0 (-) | 2 (33.3) | - | - |  |
| No | 1 (5.3) | 13 (50.0) | 0.11 (0.02-0.74) | 0.001 |  |
| **Sex** |  |  |  |  | 0.99 |
| Male | 1 (7.1) | 11 (45.8) | 0.16 (0.02-1.08) | 0.03 |  |
| Female | 0 (0.0) | 4 (50.0) | - | 0.11 |  |
| **Age** |  |  |  |  | 1.00 |
| 40-49 | 0 (0.0) | 2 (50.0) | - | 0.17 |  |
| 50-59 | 0 (0.0) | 3 (33.3) | - | 0.21 |  |
| 60-75 | 1 (14.3) | 10 (52.6) | 0.27 (0.04-1.75) | 0.18 |  |
| **BMI** |  |  |  |  | 0.99 |
| <24 | 0 (0.0) | 2 (25.0) | - | 0.47 |  |
| ≥24 | 1 (7.7) | 13 (54.2) | 0.14 (0.02-0.96) | 0.01 |  |
| **APCS** |  |  |  |  | 1.00 |
| Average risk | 0 (0.0) | 1 (50.0) | - | 1 |  |
| Intermediate risk | 0 (0.0) | 13 (52.0) | - | 0.003 |  |
| High risk | 1 (14.3) | 1 (20.0) | 0.71 (0.06-8.91) | 1 |  |
| **Colonoscopists experience** |  |  |  |  | 1.00 |
| > 5000 | 1 (10.0) | 6 (42.9) | 0.23 (0.03-1.65) | 0.17 |  |
| 3000-5000 | 0 (0.0) | 0 (0.0) | - | - |  |
| 1000-3000 | 0 (0.0) | 9 (56.3) | - | <0.05 |  |
| **Split-dose PEG** |  |  |  |  | 1.00 |
| 3-L PEG | 1 (5.9) | 13 (50.0) | 0.12 (0.02-0.82) | 0.003 |  |
| 4-L PEG | 0 (0.0) | 1 (20.0) | - | 1 |  |
| **Bowel preparation quality** |  |  |  |  | 0.70 |
| Inadequate | 0 (-) | 1 (100.0) | - | - |  |
| fair | 1 (10.0) | 4 (66.7) | 0.15 (0.02-1.05) | 0.04 |  |
| Good | 0 (0.0) | 10 (40.0) | - | 0.03 |  |
| **Colonoscope type** |  |  |  |  | 0.99 |
| CF290 | 1 (12.5) | 7 (41.2) | 0.30 (0.05-2.07) | 0.21 |  |
| CF260 | 0 (0.0) | 8 (53.3) | - | 0.01 |  |
| **Use of sedation** |  |  |  |  | 1.00 |
| No | 1 (14.3) | 3 (50.0) | 0.29 (0.04-2.08) | 0.27 |  |
| Conscious sedation | 0 (0.0) | 1 (50.0) | - | 1 |  |
| Monitored anesthesia | 0 (0.0) | 11 (45.8) | - | 0.01 |  |

\* Colonoscopists were classified into high and low group according to average ADR of the first withdrawal in 6MF; 9MF, 9-minute first group; 6MF, 6-minute first group; RR, relative risk; CI, confidence interval; AAMR, advanced adenoma miss rate; ADR, adenoma detection rate; HGD, high-grade dysplasia; BMI, body mass index; APCS, Asia-Pacific Colorectal Screening score; PEG, polyethylene glycol electrolyte.

**Supplementary table 4.** Comparisons of lesion-level colonoscopy detection and miss for lesion from per-protocol analysis.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **9MF**  **(n=353)** | **6MF**  **(n=352)** | **RR**  **(95% CI)** | **P value** |
| **Number of lesions in the first withdrawal, mean ± SD** |  |  |  |  |
| Polyp | 1.28±1.41 | 0.91±1.14 | - | <0.001 |
| Adenoma | 0.69±1.04 | 0.47±0.78 | - | <0.001 |
| AA | 0.05±0.23 | 0.05±0.25 | - | 0.76 |
| SSL | 0.02±0.13 | 0.02±0.15 | - | 1.00 |
| CRSP | 0.07±0.27 | 0.05±0.29 | - | 0.51 |
| CRC | 0.006±0.08 | 0.003±0.05 | - | 0.57 |
| SP6 | 0.45±0.68 | 0.45±0.76 | - | 0.92 |
| **Number of lesions in the second withdrawal, mean ± SD** |  |  |  |  |
| Polyp | 0.21±0.51 | 0.50±0.79 | - | <0.001 |
| Adenoma | 0.11±0.35 | 0.24±0.55 | - | <0.001 |
| AA | 0.003±0.05 | 0.03±0.26 | - | 0.03 |
| SSL | 0.00±0.00 | 0.006±0.08 | - | 0.16 |
| CRSP | 0.008±0.16 | 0.02±0.17 | - | 0.25 |
| CRC | 0.00±0.00 | 0.00±0.00 | - | - |
| SP6 | 0.10±0.34 | 0.16±0.36 | - | 0.04 |
| **Lesion-level miss rate at lesion level, n (%)** |  |  |  |  |
| Polyp | 73/526 (13.9) | 177/496 (35.7) | 0.39 (0.31-0.50) | <0.001 |
| Adenoma | 38/280 (13.6) | 86/250 (34.4) | 0.40 (0.28-0.56) | <0.001 |
| AA | 1/19 (5.3) | 12/28 (42.9) | 0.12 (0.02-0.87) | 0.01 |
| SSL | 0/6 (0.0) | 2 (25.0) | - | 0.47 |
| CRSP | 3/27 (11.1) | 8/27 (29.6) | 0.38 (0.11-1.26) | 0.09 |
| CRC | 0/2 (0.0) | 0/1 (0.0) | - | - |

9MF, 9-minute first group; 6MF, 6-minute first group; RR, relative risk; CI, confidence interval; SD, standard deviation; AA, advanced adenoma; SSL, sessile serrated lesion; CRSP, clinically relevant serrated polyp; CRC, colorectal cancer; SP6, significant polyps per 6 minutes.

**Supplementary table 5.** The first-withdrawal ADRs in different location, size, morphology and pathology.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **9MF**  **(n=366)** | **6MF**  **(n=367)** | **RR**  **(95% CI)** | **P value** |
| **ADR, n (%)** | 155 (42.3) | 123 (33.5) | 1.26 (1.05-1.52) | 0.02 |
| **Location** |  |  |  |  |
| Proximal | 110 (30.1) | 81 (22.1) | 1.36 (1.06-1.75) | 0.01 |
| Distal | 80 (21.9) | 60 (16.3) | 1.34 (0.99-1.81) | 0.06 |
| **Size** |  |  |  |  |
| 1-5 mm | 121 (33.1) | 91 (24.8) | 1.33 (1.06-1.68) | 0.01 |
| 6-9 mm | 43 (11.7) | 32 (8.7) | 1.35 (0.87-2.08) | 0.18 |
| ≥10 mm | 15 (4.1) | 12 (3.3) | 1.25 (0.56-2.64) | 0.55 |
| **Morphology** |  |  |  |  |
| Pedunculated | 6 (1.6) | 3 (0.8) | 2.01 (0.51-7.96) | 0.34 |
| Semi-pedunculated | 15 (4.1) | 13 (3.5) | 1.15 (0.56-2.40) | 0.69 |
| Flat or sessile | 144 (39.3) | 111 (30.3) | 1.30 (1.06-1.59) | 0.01 |
| **Pathology** |  |  |  |  |
| Tubular | 151 (41.3) | 120 (32.7) | 1.26 (1.04-1.53) | 0.02 |
| (Tubulo)villous | 7 (1.9) | 5 (1.4) | 1.40 (0.45-4.38) | 0.56 |
| HGD | 0 (0.0) | 3 (0.8) | - | 0.25 |

9MF, 9-minute first group; 6MF, 6-minute first group; RR, relative risk; CI, confidence interval; ADR, adenoma detection rate; HGD, high-grade dysplasia.

**Supplementary table 6.** Subgroup analyses of the first-withdrawal ADR.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **9MF**  **(n=366)** | **6MF**  **(n=367)** | **RR**  **(95% CI)** | **P value** | **P for interaction** |
| **ADR, n (%)** | 155 (42.3) | 123 (33.5) | 1.26 (1.05-1.52) | 0.02 |  |
| **Baseline ADR in routine practice** |  |  |  |  |  |
| Unqualified (<25%) | 73 (44.0) | 54 (32.0) | 1.38 (1.04-1.82) | 0.02 | 0.62 |
| Qualified (≥25%) | 82 (41.0) | 69 (34.8) | 1.17(0.91-1.52) | 0.21 |  |
| **ADR of 6MF\*** |  |  |  |  | **0.02** |
| Low (<33.5%) | 92 (45.1) | 58 (28.0) | 1.61 (1.23-2.10) | <0.001 |  |
| High (≥33.5%) | 63 (38.9) | 65 (40.6) | 0.96 (0.73-1.25) | 0.75 |  |
| **Sex** |  |  |  |  | 0.93 |
| Male | 94 (51.6) | 74 (42.8) | 1.21 (0.97-1.51) | 0.09 |  |
| Female | 61 (33.2) | 49 (25.3) | 1.31 (0.96-1.80) | 0.09 |  |
| **Age** |  |  |  |  | 0.51 |
| 40-49 | 39 (30.7) | 35 (27.8) | 1.11 (0.75-1.62) | 0.61 |  |
| 50-59 | 63 (44.7) | 49 (31.4) | 1.42 (1.06-1.91) | 0.02 |  |
| 60-75 | 53 (54.1) | 39 (45.9) | 1.18 (0.88-1.58) | 0.27 |  |
| **BMI** |  |  |  |  | 0.64 |
| <24 | 64 (36.6) | 56 (30.1) | 1.22 (0.91-1.63) | 0.19 |  |
| ≥24 | 91 (47.6) | 67 (37.0) | 1.29 (1.01-1.64) | 0.04 |  |
| **APCS** |  |  |  |  | 0.55 |
| Average risk | 24 (27.0) | 23 (24.0) | 1.13 (0.69-1.84) | 0.64 |  |
| Intermediate risk | 95 (45.0) | 73 (34.9) | 1.29 (1.02-1.64) | 0.04 |  |
| High risk | 36 (54.5) | 27 (43.5) | 1.25 (0.88-1.79) | 0.21 |  |
| **Colonoscopists experience** |  |  |  |  | 0.73 |
| > 5000 | 40 (40.4) | 33 (33.0) | 1.22 (0.85-1.77) |  |  |
| 3000-5000 | 17 (40.5) | 14 (35.0) | 1.16 (0.66-2.02) |  |  |
| 1000-3000 | 98 (43.6) | 76 (33.5) | 1.30 (1.03-1.65) |  |  |
| **Split-dose PEG** |  |  |  |  | 0.90 |
| 3-L PEG | 104 (44.3) | 83 (35.5) | 1.25 (1.00-1.56) | 0.05 |  |
| 4-L PEG | 51 (39.8) | 40 (30.5) | 1.30 (0.93-1.82) | 0.12 |  |
| **Bowel preparation quality** |  |  |  |  | 0.06 |
| Inadequate | 2 (25.0) | 2 (33.3) | 0.75 (0.14-3.90) | 1.00 |  |
| fair | 42 (43.3) | 35 (46.1) | 0.94 (0.67-1.31) | 0.72 |  |
| Good | 111 (42.5) | 86 (30.2) | 1.41 (1.12-1.77) | 0.003 |  |
| **Colonoscope type** |  |  |  |  | 0.25 |
| CF260 | 72 (37.7) | 60 (33.0) | 1.14 (0.87-1.51) | 0.34 |  |
| CF290 | 83 (47.7) | 63 (34.2) | 1.39 (1.08-1.79) | 0.01 |  |
| **Use of antispasmodics** |  |  |  |  | 0.19 |
| Yes | 2 (40.0) | 6 (66.7) | 0.60 (0.19-1.93) | 0.58 |  |
| No | 153 (42.4) | 117 (32.7) | 1.30 (1.07-1.57) | 0.01 |  |
| **Use of sedation** |  |  |  |  | 0.32 |
| No | 48 (36.4) | 41 (33.1) | 1.10 (0.79-1.54) | 0.58 |  |
| Conscious sedation | 15 (38.5) | 13 (37.1) | 1.04 (0.58-1.86) | 0.91 |  |
| Monitored anesthesia | 92 (47.2) | 69 (33.2) | 1.42 (1.12-1.81) | 0.004 |  |

\* Colonoscopists were classified into high and low group according to average ADR of the first withdrawal in 6MF; 9MF, 9-minute first group; 6MF, 6-minute first group; RR, relative risk; CI, confidence interval; ADR, adenoma detection rate; BMI, body mass index; APCS, Asia-Pacific Colorectal Screening score; PEG, polyethylene glycol electrolyte.

**Supplementary table 7.** Comparisons of participant-level colonoscopy detection and miss for lesion from per-protocol analysis.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **9MF**  **(n=353)** | **6MF**  **(n=352)** | **RR**  **(95% CI)** | **P value** |
| **Detection rate in the first withdrawal, n (%)** |  |  |  |  |
| Polyp | 237 (67.1) | 185 (52.6) | 1.28 (1.13-1.45) | <0.001 |
| Adenoma | 151 (42.8) | 118 (33.5) | 1.28 (1.06-1.54) | 0.01 |
| Proximal adenoma | 108 (30.6) | 77 (21.9) | 1.40 (1.09-1.80) | 0.01 |
| Distal adenoma | 77 (21.8) | 58 (16.5) | 1.32 (0.97-1.80) | 0.07 |
| AA | 17 (4.8) | 14 (4.0) | 1.21 (0.61-2.42) | 0.59 |
| SSL | 6 (1.7) | 5 (1.4) | 1.20 (0.37-3.89) | 1 |
| CRSP | 22 (6.2) | 14 (4.0) | 1.57 (0.82-3.01) | 0.17 |
| Multiple adenomas\* | 23 (6.5) | 10 (2.8) | 2.29 (1.11-4.75) | 0.02 |
| HRA | 41 (11.6) | 25 (7.1) | 1.64 (1.02-2.63) | 0.04 |
| CRC | 2 (0.6) | 1 (0.3) | 1.99 (0.18-21.89) | 1 |
| **Detection rate in the second withdrawal, n (%)** |  |  |  |  |
| Polyp | 59 (16.7) | 126 (35.8) | 0.47 (0.36-0.61) | <0.001 |
| Adenoma | 33 (9.3) | 70 (19.9) | 0.47 (0.32-0.69) | <0.001 |
| Proximal adenoma | 25 (7.1) | 43 (12.2) | 0.58 (0.36-.93) | 0.02 |
| Distal adenoma | 10 (2.8) | 33 (9.4) | 0.30 (0.15-0.60) | <0.001 |
| AA | 1 (0.3) | 8 (2.3) | 0.13 (0.02-0.99) | 0.02 |
| SSL | 0 (0.0) | 2 (0.6) | - | 0.25 |
| CRSP | 1 (0.3) | 7 (2.0) | 0.14 (0.02-1.15) | 0.04 |
| Multiple adenomas\* | 4 (1.1) | 11 (3.1) | 0.36 (0.12-1.13) | 0.07 |
| HRA | 4 (1.1) | 13 (3.7) | 0.31 (0.10-0.93) | 0.03 |
| CRC | 0 (0.0) | 0 (0.0) | - | - |
| **Participant-level miss rate, n (%)** |  |  |  |  |
| Polyp | 14/251 (5.6) | 41/226 (18.1) | 0.31 (0.17-0.55) | <0.001 |
| Adenoma | 18/169 (10.7) | 37/155 (23.9) | 0.45 (0.27-0.75) | 0.002 |
| Proximal adenoma | 16/124 (12.9) | 28/105 (26.7) | 0.48 (0.28-0.84) | 0.01 |
| Distal adenoma | 8/85 (9.4) | 24/82 (29.3) | 0.32 (0.15-0.67) | 0.01 |
| AA | 1/18 (5.6) | 4/18 (22.2) | 0.25 (0.03-2.03) | 0.34 |
| SSL | 0/6 (0.0) | 0/5 (0.0) | - | - |
| CRSP | 0/22 (0.0) | 3/17 (17.6) | - | 0.07 |
| Multiple adenomas\* | 4/27 (14.8) | 11/21 (52.4) | 0.28 (0.11-0.76) | 0.01 |
| HRA | 4/45 (8.9) | 13/38 (34.8) | 0.26 (0.09-0.73) | 0.004 |
| CRC | 0/2 (0.0) | 0/1 (0.0) | - | - |
| **False-negative rate, n (%)** |  |  |  |  |
| Adenoma | 18 (8.9) | 37 (15.8) | 0.56 (0.33-0.96) | 0.03 |
| AA | 1 (0.3) | 4 (1.2) | 0.25 (0.03-2.24) | 0.37 |
| Multiple adenomas\* | 4 (1.2) | 11 (3.2) | 0.38 (0.12-1.17) | 0.08 |
| HRA | 4 (1.3) | 13 (4.0) | 0.32 (0.11-0.98) | 0.03 |
| **Rate of shortening surveillance interval by the 2nd colonoscopy findings, n (%)** | | |  |  |
| USMSTF guideline | 24 (6.8) | 51 (14.5) | 0.47 (0.30-0.75) | 0.001 |
| UK guideline | 1 (0.3) | 11 (3.1) | 0.09 (0.01-0.70) | 0.004 |
| European guideline | 3 (0.8) | 6 (1.7) | 0.50 (0.13-1.98) | 0.34 |

\* Referring to detecting ≥3 adenomas; 9MF, 9-minute-first group; 6MF, 6-minute-first group; RR, relative risk; CI, confidence interval; AA, advanced adenoma; SSL, sessile serrated lesion; CRSP, clinically relevant serrated polyp; HRA, high-risk adenoma; CRC, colorectal cancer; USMSTF, US Multi-Society Task Force.

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **No.** | **AMR, n (%)** | **P value** | **AAMR, n (%)** | **P value** | **First-ADR, n (%)** | **P value** | **Cumulative ADR, n (%)** | **P value** |
| **Overall, minutes** |  |  | **<0.001** |  | **0.001** |  | **0.003** |  | 0.06 |
| A: 5-6 | 48 | 13 (39.4) | 0.93  (A vs. B) | 0 (-) |  | 13 (27.1) | 0.90  (A vs. B) | 15 (31.3) |  |
| B: 6-9 | 375 | 93 (35.1) | 0.003  (B vs. C) | 16 (45.7) | **0.001**  (B vs. C) | 126 (33.6) | 0.01  (B vs. C) | 172 (45.9) |  |
| C: 9-10 | 310 | 34 (13.1) | 0.002  (C vs. A) | 0 (0) |  | 139 (44.8) | 0.06  (C vs. A) | 153 (49.4) |  |
| Mean WT | 733 | 140 (25.1) |  | 16 (31.4) |  | 278 (37.9) |  | 340 (46.4) |  |
| **Proximal** |  |  | **<0.001** |  | **0.04** |  | **0.002** |  | 0.07 |
| A: 3-4 | 63 | 9 (37.5) | 0.96  (A vs. B) | 0 (-) |  | 11 (17.5) | 0.88  (A vs. B) | 14 (22.2) |  |
| B: 4-6 | 372 | 54 (35.1) | 0.003  (B vs. C) | 8 (61.5) | 0.04  (B vs. C) | 82 (22.0) | 0.01  (B vs. C) | 115 (30.9) |  |
| C: 6-7 | 298 | 22 (13.9) | 0.01  (C vs. A) | 0 (0.0) |  | 98 (32.9) | 0.045  (C vs. A) | 108 (36.2) |  |
| Mean WT | 733 | 85 (25.3) |  | 8 (44.4) |  | 191 (26.1) |  | 237 (32.3) |  |
| **Distal** |  |  | **<0.001** |  | **0.03** |  | 0.14 |  | 0.90 |
| A: 1-2 | 24 | 1 (20.0) | 0.90  (A vs. B) | 0 (-) |  | 4 (16.7) |  | 5 (20.8) |  |
| B: 2-3 | 387 | 43 (37.1) | 0.002  (B vs. C) | 8 (36.4) | 0.03  (B vs. C) | 64 (16.5) |  | 94 (24.3) |  |
| C: 3-4 | 322 | 11 (11.0) | 0.99  (C vs. A) | 0 (0.0) |  | 72 (22.4) |  | 80 (24.8) |  |
| Mean WT | 733 | 55 (24.9) |  | 8 (24.2) |  | 140 (19.1) |  | 179 (24.4) |  |

**Supplementary table 8.** AMR, AAMR and ADR from the analysis of actual-WT grouping.

AMR, adenoma miss rate; AAMR, advanced adenoma miss rate; ADR, adenoma detection rate; WT, withdrawal time.

**Supplementary table 9**. Quality indicators of colonoscopy for each colonoscopist.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Center**  **/COL** | **Groups** | **N** | **m-WT, mean (SD)** | **AMR, n (%)** | **AAMR, n (%)** | **p-AMR, n (%)** | **p-AAMR, n (%)** |
| **Overall** | 9MF | 366 | 9.14 (0.19) | 42 (14.5) | 1 (5.3) | 19 (10.9) | 1 (5.6) |
| 6MF | 367 | 6.18 (0.22) | 98 (36.6) | 15 (46.9) | 43 (25.9) | 6 (28.6) |
| **Baseline ADR <25%** | | |  |  |  |  |  |
| **B/** COL 2 | 9MF | 30 | 9.02 (0.08) | 4 (23.5) | 0 (0.0) | 3 (23.1) | 0 (0.0) |
| 6MF | 31 | 6.01 (0.06) | 2 (16.7) | 0 (-) | 1 (12.5) | 0 (-) |
| **D/** COL 6 | 9MF | 12 | 9.16 (0.12) | 5 (35.7) | 0 (0.0) | 2 (25.0) | 0 (0.0) |
| 6MF | 13 | 6.22 (0.17) | 7 (63.6) | 2 (66.7) | 4 (50.0) | 1 (50.0) |
| **F/** COL 10 | 9MF | 26 | 9.18 (0.20) | 2 (5.7) | 0 (0.0) | 1 (6.7) | 0 (0.0) |
| 6MF | 25 | 6.14 (0.12) | 8 (27.6) | 1 (100.0) | 5 (31.3) | 1 (100.0) |
| **J/** COL 14 | 9MF | 55 | 9.19 (0.06) | 2 (4.3) | 0 (0.0) | 1 (3.6) | 0 (0.0) |
| 6MF | 56 | 6.21 (0.08) | 11 (34.4) | 0 (0.0) | 6 (26.1) | 0 (0.0) |
| **Baseline ADR ≥25%** | | |  |  |  |  |  |
| **A**/ COL 1 | 9MF | 11 | 9.25 (0.25) | 2 (50.0) | 1 (50.0) | 1 (33.3) | 1 (50.0) |
| 6MF | 12 | 6.54 (0.24) | 9 (75.0) | 2 (66.7) | 4 (66.7) | 1 (50.0) |
| **B/** COL 2 | 9MF | 30 | 9.02 (0.08) | 4 (23.5) | 0 (0.0) | 3 (23.1) | 0 (0.0) |
| 6MF | 31 | 6.01 (0.06) | 2 (16.7) | 0 (-) | 1 (12.5) | 0 (-) |
| **B/** COL 3 | 9MF | 37 | 9.06 (0.09) | 8 (38.1) | 0 (-) | 2 (14.3) | 0 (-) |
| 6MF | 36 | 6.09 (0.10) | 5 (21.7) | 0 (-) | 2 (12.5) | 0 (-) |
| **C/** COL 4 | 9MF | 11 | 9.18 (0.08) | 2 (11.8) | 0 (0.0) | 0 (0.0) | 0 (0.0) |
| 6MF | 11 | 6.25 (0.06) | 5 (50.0) | 0 (-) | 3 (50.0) | 0 (-) |
| **D/** COL 5 | 9MF | 20 | 9.02 (0.07) | 2 (18.2) | 0 (-) | 0 (0.0) | 0 (-) |
| 6MF | 19 | 6.03 (0.08) | 5 (45.5) | 0 (-) | 4 (40.0) | 0 (-) |
| **D/** COL 6 | 9MF | 12 | 9.16 (0.12) | 5 (35.7) | 0 (0.0) | 2 (25.0) | 0 (0.0) |
| 6MF | 13 | 6.22 (0.17) | 7 (63.6) | 2 (66.7) | 4 (50.0) | 1 (50.0) |
| **E/** COL 7 | 9MF | 16 | 9.03 (0.19) | 2 (28.6) | 0 (0.0) | 2 (40.0) | 0 (0.0) |
| 6MF | 16 | 6.10 (0.12) | 7 (43.8) | 0 (-) | 1 (14.3) | 0 (-) |
| **E/** COL 8 | 9MF | 13 | 9.00 (0.08) | 1 (20.0) | 0 (-) | 1 (20.0) | 0 (-) |
| 6MF | 13 | 6.01 (0.11) | 4 (57.1) | 0 (-) | 3 (50.0) | 0 (-) |
| **F/** COL 9 | 9MF | 11 | 9.08 (0.11) | 2 (20.0) | 0 (0.0) | 2 (28.6) | 0 (0.0) |
| 6MF | 10 | 6.24 (0.19) | 6 (46.2) | 0 (0.0) | 3 (42.9) | 0 (0.0) |
| **F/** COL 10 | 9MF | 26 | 9.18 (0.20) | 2 (5.7) | 0 (0.0) | 1 (6.7) | 0 (0.0) |
| 6MF | 25 | 6.14 (0.12) | 8 (27.6) | 1 (100.0) | 5 (31.3) | 1 (100.0) |
| **G/** COL 11 | 9MF | 11 | 9.14 (0.12) | 1 (11.1) | 0 (-) | 1 (16.7) | 0 (-) |
| 6MF | 12 | 6.25 (0.25) | 2 (18.2) | 1 (100.0) | 0 (0.0) | 1 (100.0) |
| **H/** COL 12 | 9MF | 43 | 9.05 (0.07) | 4 (15.4) | 0 (0.0) | 0 (0.0) | 0 (0.0) |
| 6MF | 44 | 6.06 (0.05) | 13 (39.4) | 8 (53.3) | 1 (6.6) | 1 (16.7) |
| **I/** COL 13 | 9MF | 18 | 9.22 (0.19) | 2 (20.0) | 0 (0.0) | 1 (11.1) | 0 (0.0) |
| 6MF | 17 | 6.34 (0.41) | 7 (46.7) | 0 (0.0) | 3 (30.0) | 0 (0.0) |
| **J/** COL 14 | 9MF | 55 | 9.19 (0.06) | 2 (4.3) | 0 (0.0) | 1 (3.6) | 0 (0.0) |
| 6MF | 56 | 6.21 (0.08) | 11 (34.4) | 0 (0.0) | 6 (26.1) | 0 (0.0) |
| **K/** COL 15 | 9MF | 52 | 9.41 (0.15) | 3 (5.3) | 0 (0.0) | 2 (6.5) | 0 (0.0) |
| 6MF | 52 | 6.45 (0.20) | 7 (21.2) | 1 (25.0) | 3 (15.8) | 1 (25.0) |

COL, colonoscopist; m-WT, mean withdrawal time; ADR, adenoma detection rate; AADR, advanced adenoma detection rate; APC, adenomas per colonoscopy; APPC, adenomas per positive colonoscopy; ADR-plus, detection rate of ≥2 adenomas; SP6, significant polyps per 6 minutes; AMR, adenoma miss rate; AAMR, advanced adenoma miss rate; p-AMR, participant-level adenoma miss rate; p-AAMR, participant-level advanced adenoma miss rate; 9MF, 9-minute first group; 6MF, 6-minute first group.

**Supplementary table 10.** Sensitivity analyses of ADR, AMR and AAMR for each colonoscopist.

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Center**  **/COL** | **Groups** | **ADR, n (%)** | **AMR, n (%)** | **AAMR, n (%)** | **Sensitivity analyses\*** | | | | | |
| **ADR-S, n (%)** | **P value** | **AMR-S, n (%)** | **P value** | **AAMR-S, n (%)** | **P value** |
| **Overall** | 9MF | 155 (42.3) | 42 (14.5) | 1 (5.3) | - | | | | | |
| 6MF | 123 (33.5) | 98 (36.6) | 15 (46.9) |
| **A**/ COL 1 | 9MF | 2 (18.2) | 2 (50.0) | 1 (50.0) | 153 (43.1) | 0.01 | 40 (14.0) | <0.001 | 0 (0.0) | 0.001 |
| 6MF | 2 (16.7) | 9 (75.0) | 2 (66.7) | 121 (34.1) | 89 (34.8) | 13 (44.8) |
| **B/** COL 2 | 9MF | 10 (33.3) | 4 (23.5) | 0 (0.0) | 145 (43.2) | 0.02 | 38 (14.0) | <0.001 | 1 (5.6) | 0.003 |
| 6MF | 7 (22.6) | 2 (16.7) | 0 (-) | 116 (34.5) | 96 (37.5) | 15 (46.9) |
| **B/** COL 3 | 9MF | 12 (32.4) | 8 (38.1) | 0 (-) | 143 (43.5) | 0.01 | 34 (12.7) | <0.001 | 1 (5.3) | 0.002 |
| 6MF | 14 (38.9) | 5 (21.7) | 0 (-) | 109 (32.9) | 93 (38.0) | 15 (46.9) |
| **C/** COL 4 | 9MF | 8 (72.7) | 2 (11.8) | 0 (0.0) | 147 (41.4) | 0.03 | 40 (14.7) | <0.001 | 1 (6.3) | 0.005 |
| 6MF | 3 (27.3) | 5 (50.0) | 0 (-) | 120 (33.7) | 93 (36.0) | 15 (46.9) |
| **D/** COL 5 | 9MF | 6 (30.0) | 2 (18.2) | 0 (-) | 149 (43.1) | 0.01 | 40 (14.4) | <0.001 | 1 (5.3) | 0.002 |
| 6MF | 6 (31.6) | 5 (45.5) | 0 (-) | 117 (33.6) | 93 (36.2) | 15 (46.9) |
| **D/** COL 6 | 9MF | 6 (50.0) | 5 (35.7) | 0 (0.0) | 149 (42.1) | 0.02 | 37 (13.5) | <0.001 | 1 (5.6) | 0.004 |
| 6MF | 4 (30.8) | 7 (63.6) | 2 (66.7) | 119 (33.6) | 91 (35.4) | 13 (44.8) |
| **E/** COL 7 | 9MF | 3 (18.8) | 2 (28.6) | 0 (0.0) | 152 (43.4) | 0.01 | 40 (14.2) | <0.001 | 1 (5.6) | 0.003 |
| 6MF | 6 (37.5) | 7 (43.8) | 0 (-) | 117 (33.3) | 91 (36.1) | 15 (46.9) |
| **E/** COL 8 | 9MF | 4 (30.8) | 1 (20.0) | 0 (-) | 151 (42.8) | 0.02 | 41 (14.4) | <0.001 | 1 (5.3) | 0.002 |
| 6MF | 3 (23.1) | 4 (57.1) | 0 (-) | 120 (33.9) | 94 (36.0) | 15 (46.9) |
| **F/** COL 9 | 9MF | 5 (45.5) | 2 (20.0) | 0 (0.0) | 150 (42.3) | 0.01 | 40 (14.3) | <0.001 | 1 (5.6) | 0.002 |
| 6MF | 4 (40.0) | 6 (46.2) | 0 (0.0) | 119 (33.3) | 92 (36.1) | 15 (48.4) |
| **F/** COL 10 | 9MF | 14 (53.8) | 2 (5.7) | 0 (0.0) | 141 (41.5) | 0.02 | 40 (15.7) | <0.001 | 1 (5.9) | 0.005 |
| 6MF | 11 (44.0) | 8 (27.6) | 1 (100.0) | 112 (32.7) | 90 (37.7) | 14 (45.2) |
| **G/** COL 11 | 9MF | 5 (45.5) | 1 (11.1) | 0 (-) | 150 (42.3) | 0.01 | 41 (14.6) | <0.001 | 1 (5.3) | 0.003 |
| 6MF | 8 (66.7) | 2 (18.2) | 1 (100.0) | 115 (32.4) | 96 (37.4) | 14 (45.2) |
| **H/** COL 12 | 9MF | 16 (37.1) | 4 (15.4) | 0 (0.0) | 139 (43.0) | 0.01 | 38 (14.4) | <0.001 | 1 (6.3) | 0.04 |
| 6MF | 15 (34.1) | 13 (39.4) | 8 (53.3) | 108 (33.4) | 85 (36.2) | 7 (41.2) |
| **I/** COL 13 | 9MF | 8 (44.4) | 2 (20.0) | 0 (0.0) | 147 (42.2) | 0.01 | 40 (14.3) | <0.001 | 1 (5.9) | 0.003 |
| 6MF | 7 (41.2) | 7 (46.7) | 0 (0.0) | 116 (33.1) | 91 (36.0) | 15 (48.4) |
| **J/** COL 14 | 9MF | 27 (49.1) | 2 (4.3) | 0 (0.0) | 128 (41.2) | 0.07 | 40 (16.5) | <0.001 | 1 (5.6) | 0.001 |
| 6MF | 17 (30.4) | 11 (34.4) | 0 (0.0) | 106 (34.1) | 87 (36.9) | 15 (51.7) |
| **K/** COL 15 | 9MF | 29 (55.8) | 3 (5.3) | 0 (0.0) | 126 (40.1) | 0.11 | 39 (16.8) | <0.001 | 1 (5.9) | 0.002 |
| 6MF | 16 (30.8) | 7 (21.2) | 1 (25.0) | 107 (34.0) | 91 (38.7) | 14 (50.0) |

\* The sensitivity analyses were conducted for calculation of the ADR-S, AMR-S and AAMR-S by excluding one colonoscopist in turn; COL, colonoscopist; ADR, adenoma detection rate; AMR, adenoma miss rate; AAMR, advanced adenoma miss rate; 9MF, 9-minute first group; 6MF, 6-minute first group.

**Supplementary table 11.** Correlations between quality indicators and ADR or AMR for individual colonoscopists.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **ADR** | | **AADR** | | **AMR** | | **AAMR** | |
|  | **SCC (****ρ)** | **P value** | **SCC (ρ)** | **P value** | **SCC (ρ)** | **P value** | **SCC (ρ)** | **P value** |
| **m-WT** | 0.40 | 0.03 | 0.41 | 0.03 | -0.50 | 0.01 | -0.50 | 0.03 |
| **ADR** | - | - | 0.17 | 0.37 | -0.58 | 0.001 | -0.27 | 0.25 |
| **APC** | 0.89 | <0.001 | 0.09 | 0.65 | -0.62 | <0.001 | -0.24 | 0.32 |
| **APPC** | 0.36 | 0.05 | 0.16 | 0.41 | -0.40 | 0.03 | -0.24 | 0.32 |
| **ADR-plus** | 0.54 | 0.002 | 0.10 | 0.58 | -0.51 | 0.004 | -0.16 | 0.51 |
| **SP6** | 0.80 | <0.001 | 0.06 | 0.74 | -0.44 | 0.02 | -0.06 | 0.78 |

ADR, adenoma detection rate; AADR, advanced adenoma detection rate; AMR, adenoma miss rate; AAMR, advanced adenoma miss rate; SCC, Spearman correlation coefficient; m-WT, mean withdrawal time; APC, adenomas per colonoscopy; APPC, adenomas per positive colonoscopy; ADR-plus, detection rate of ≥2 adenomas; SP6, significant polyps per 6 minutes.

**Supplementary table 12.** Simple and multiple linear regressions for potential predictors of AMR.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Simple linear regression** | | **Multiple linear regression** | |
|  | **Coefficients (95% CI)** | **P value** | **Coefficients (95% CI)** | **P value** |
| **m-WT** | -6.66 (-10.58 to -2.74) | 0.002 | -5.08 (-8.58 to -1.58) | 0.01 |
| **ADR** | -0.79 (-1.22 to -0.37) | 0.001 | -0.64 (-1.03 to -0.25) | 0.002 |
| **APC** | -37.58 (-56.77 to -18.39) | <0.001 | - | - |
| **APPC** | -22.99 (-41.67 to -4.30) | 0.02 | - | - |
| **ADR-Plus** | -1.05 (-1.69 to -0.40) | 0.002 | - | - |
| **SP6** | -39.27 (-70.71 to -7.84) | 0.02 | - | - |

AMR, adenoma miss rate; CI, confidence interval; m-WT, mean withdrawal time; ADR, adenoma detection rate; APC, adenomas per colonoscopy; APPC, adenomas per positive colonoscopy; ADR-plus, detection rate of ≥2 adenomas; SP6, significant polyps per 6 minutes.

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