Review

Thieme

Second exam of right colon improves adenoma detection rate: Systematic review and meta-analysis of randomized controlled trials

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ABSTRACT

Background and study aims A second examination of the right colon, either as a second forward view (SFV) or as retroflexion (RF) in the cecum, can increase adenoma detection rate (ADR) in the right colon. In this meta-analysis, we have evaluated the role of a second examination of the right colon in improving ADR.

Methods We reviewed several databases to identify randomized controlled trials that compared right colon SFV with no SFV, and RCTs that compared SFV with RF in the right colon, and reported data on ADR. Our outcomes of interest were ADR and polyp detection rate (PDR) with SFV vs no SFV, right colon and total withdrawal times, and additional ADR and PDR with SFV vs RF. For categorical variables, we calculated pooled risk ratios (RRs) with 95% confidence intervals (CIs); for continuous variables, we calculated standardized mean difference (SMD) with 95% CI. Data were analyzed using random effects model.

Results We included six studies with 3901 patients. Comparing SFV with no SFV, right colon ADR and PDR were significantly higher in the SFV group: ADR (RR [95% CI] 1.39 [1.22,1.58]) and PDR (RR [95% CI] 1.47 [1.30, 1.65]). We found no significant difference in right colon withdrawal time (SMD [95% CI] 1.54 [−0.20,3.28]) or total withdrawal time (SMD (95% CI) 0.37 [−0.39,1.13]) with and without SFV. We found no significant difference in additional ADR between SFV and RF.

Conclusions SFV of the right colon significantly increases right-sided and overall ADR.

Introduction

Colonoscopy is considered the gold standard for colon cancer screening. Colonoscopic detection and resection of polyps reduces colon cancer incidence and mortality [1, 2]. Missing polyps during colonoscopy is a substantial clinical problem that may decrease the efficacy of colonoscopy in the prevention of colon cancer [3, 4]. One meta-analysis including 43 studies and over 15,000 tandem colonoscopies found that the adenoma miss rate (AMR) was 26% [5]. Some studies have found colonoscopy to be less effective in the prevention of proximal than distal colon cancer [2, 6, 7]. This may be partly explained by the morphology of right colon polyps, which are more likely to be flat and more easily missed during colonoscopy [8]. Cancers in the right colon are often diagnosed at an advanced stage and carry a worse prognosis than left-sided cancers, due possibly to different mechanisms of carcinogenesis [9, 10].

The adenoma detection rate (ADR) at colonoscopy is inversely associated with the risk of interval colorectal cancer [11]. A second examination of the right colon either with a second forward view (SFV) or retroflexion (RF) in the cecum increases ADR and the polyp detection rate (PDR) of right-sided polyps [12–14]. A previous meta-analysis [15] that included both observational studies and randomized controlled trials (RCTs) found that SFV and RF of the right colon independently increased ADR. Since then, additional RCTs have compared SFV with no SFV, and SFV with RF, in the right colon and have reported data on right colon ADR [16–19]. In order to examine this further, we have conducted an updated systematic review and meta-analysis confined only to RCTs to evaluate the role of a second examination of the right colon in improving ADR.

Methods

Data sources and search strategy

We followed the guidelines of Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA). The PRISMA checklist is provided in **Supplementary Fig. 1**. An experienced medical librarian (W. L-S.) performed a comprehensive search of MEDLINE (PubMed platform), Embase (Embase.com, Elsevier), Web of Science Core Collection (Clarivate) and the Cochrane Central Register of Controlled Trials (Cochrane Library, Wiley) from inception to January 21, 2021 and subsequently updated the results on August 2, 2021. There was no restriction of publication language in conducting the search. The search included truncation-expanded keywords and database-specific subject terms for SFV of the right colon, right colon RF, and ADR. We have provided full search strategies from all databases in **Supplementary Fig. 2**. Two authors (F.K. and S.S.) independently reviewed the titles and abstracts of the retrieved articles and excluded those that did not provide data on our outcomes of interest. Full texts of remaining articles were reviewed. We also reviewed the bibliographies of these articles to identify any additional relevant studies. The screening results are illustrated in the form of a PRISMA flowchart in **▶Fig. 1**.
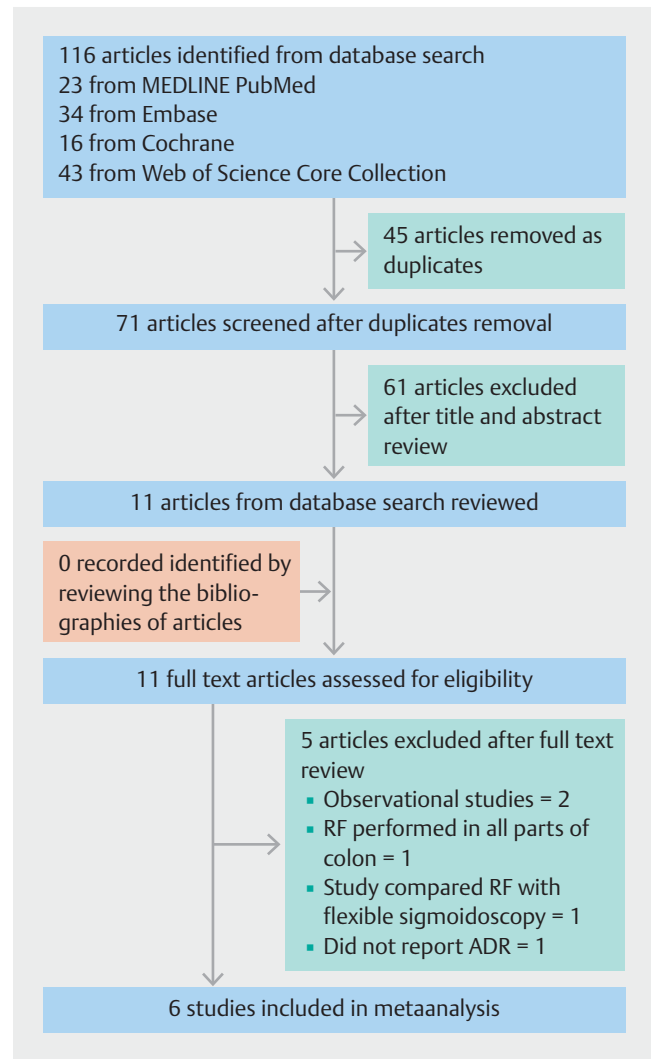
▶ **Fig. 1** PRISMA flowchart.

Inclusion and exclusion criteria

Two authors (F.K. and M.A.K.) independently searched for original studies based on pre-defined inclusion criteria, which are detailed below. We included only RCTs that compared SFV of the right colon or proximal colon with no SFV, and RCTs that compared SFV with RF in the right colon, and reported data on ADR. We excluded observational studies and review articles. We also excluded studies in which RF or SFV was performed in the distal or left colon. All citations were downloaded into Endnote X9 (Clarivate, Philadelphia, Pennsylvania, United States), a bibliographic database manager. Duplicate citations were removed by successive field matching algorithms with manual inspection.

Data extraction

Two authors (F.K. and M.A.K.) independently assessed the eligibility of included studies and collected data using data extraction forms designed for this study. Any disagreement between individual authors was resolved by a repeat review of data and

discussion with a third reviewer (C.W.H.). Extracted data included year of publication, patient demographics, inclusion criteria, exclusion criteria, ADR, PDR, right colon withdrawal time, and total withdrawal time.

Risk of bias assessment

We used the Cochrane tool for assessing risk of bias for RCTs to assess the quality of included studies. The Cochrane tool assesses the presence of selection bias by evaluating the methods of randomization and allocation concealment; performance and detection biases by checking for blinding of personnel and outcome assessment, respectively; and attrition and reporting bias by evaluating for incomplete and selective reporting of data, respectively. Two authors (Z.A. and U.F.) independently performed risk of bias assessment and any disagreement was discussed with a third reviewer (C.W.H.). The risk of bias assessment of RCTs is summarized in **Supplementary Table 1**.

Data synthesis and statistical analysis

Our primary outcome of interest was right colon ADR with SFV vs no SFV. Secondary outcomes of interest were right colon advanced ADR, PDR with SFV vs no SFV, overall ADR with SFV vs no SFV, right colon withdrawal time, total withdrawal time, difference in time spent in SFV vs RF in the right colon, additional ADR on SFV vs RF, and additional PDR on SFV vs RF. In all studies except one [20], the proximal or right colon was defined as being from the cecum to the hepatic flexure. The exception was a study by Guo et al [20], which defined the proximal colon as extending from the cecum to the splenic flexure. We therefore performed a sensitivity analysis by excluding that study. We calculated pooled risk ratios (RR) with 95 % confidence intervals (CI) to compare all outcomes, except withdrawal times, between groups. For the withdrawal times, we calculated standardized mean differences (SMD) with 95 % CI. We used Review Manager (RevMan, version 5.4 for Windows; The Cochrane Collaboration, The Nordic Cochrane Centre, Copenhagen, Denmark, 2014) and comprehensive meta-analysis (CMA) software for statistical analyses. We used a random effects model to analyze the data. We assessed heterogeneity using the I^2 statistic. $P < 0.1$ for Cochran Q test or $I^2 > 50\%$ indicated significant heterogeneity. We did not assess for publication bias as the total number of studies that we included was less than 10.

Assessment of quality of evidence

We used the Grading of Recommendations Assessment, Development and Evaluation (GRADE) framework to assess the quality of evidence. For systematic reviews, the GRADE approach defines the quality of a body of evidence as the extent to which one can be confident that an estimate of effect or association is close to the quantity of specific interest. It classifies the quality of evidence as high, moderate, low or very low. For RCTs, the quality of evidence starts with high confidence; for observational studies, it starts with low confidence. It is further rated based on methodological quality (risk of bias), directness of evidence, inconsistency, precision of effect estimates, and publi-

cation bias. Details of quality of evidence for the outcomes based on GRADE are summarized in **Supplementary Table 2**.

Results

The search strategy produced 116 articles, 45 of which were removed as duplicates (▶**Fig. 1**). From the remaining 71 articles, 60 were removed after title and abstract review. No additional relevant articles were identified from review of bibliographies. Full texts of 11 articles were reviewed. In one study, RF was performed in all parts of the colon rather than the cecum only; it was therefore excluded. Two studies were excluded since they were observational [21, 22]. One RCT reported data on AMR rather than ADR and was excluded [23]. One study that compared RF with flexible sigmoidoscopy was excluded [24]. Six studies [14, 16–20] with 3901 patients were included in the final analysis. Four studies [16–18, 20] with 2403 patients compared SFV with no SFV. Two studies [14, 19] with 1498 patients compared RF with SFV. The characteristics of included studies are summarized in ▶**Table 1**.

Right colon ADR with SFV vs no SFV

Five studies with 3253 patients were included in this analysis. Pooled ADRs in the SFV and no SFV groups were 26 % and 18 %, respectively; RR (95 % CI) 1.39 (1.22, 1.58), $I^2 = 0\%$ (▶**Fig. 2**). On sensitivity analysis with exclusion of the study that defined the proximal colon as extending from the cecum to the splenic flexure [20], the result was consistent; RR (95 % CI) 1.38 (1.20, 1.60), $I^2 = 0\%$. Quality of evidence on GRADE framework was high (**Supplementary Table 2**). Pooled advanced ADRs in the SFV and no SFV groups were 3.7 % and 2.5 %, respectively; RR (95 % CI) 1.45 (0.80, 2.63), $I2 = 0\%$.

Right colon PDR with SFV vs no SFV

Four studies with 2893 patients were included in this analysis. Pooled PDRs in the SFV and no SFV groups were 33 % and 23 %, respectively; RR (95 % CI) 1.47 (1.30, 1.65), $I^2 = 0\%$ (▶**Fig. 3**). Quality of evidence on GRADE framework was high (**Supplementary Table 2**).

Overall ADR with SFV vs no SFV

Four studies with 2403 patients were included in this analysis. Pooled ADRs in SFV and no SFV groups were 51.4 % and 46.7 %, respectively; RR (95 % CI) 1.10 (1.02, 1.19), $I2 = 0\%$ (▶**Fig. 4**). Quality of evidence on GRADE framework was high (**Supplementary Table 2**).

Withdrawal times

We found no significant difference in either right colon withdrawal time (SMD (95 % CI) 1.54 (-0.20, 3.28), $I^2 = 99\%$) (▶**Fig. 5a**) or total withdrawal time (SMD (95 % CI) 0.37 (−0.39, 1.13), $I^2 = 98\%$) (▶**Fig. 5b**) between SFV and no SFV. We also found no significant difference between time spent with SFV or RF in the right colon; SMD (95 % CI) 0.12 (-0.28, 0.52), $I^2 = 93\%$. Quality of evidence on GRADE framework was low (**Supplementary Table 2**).

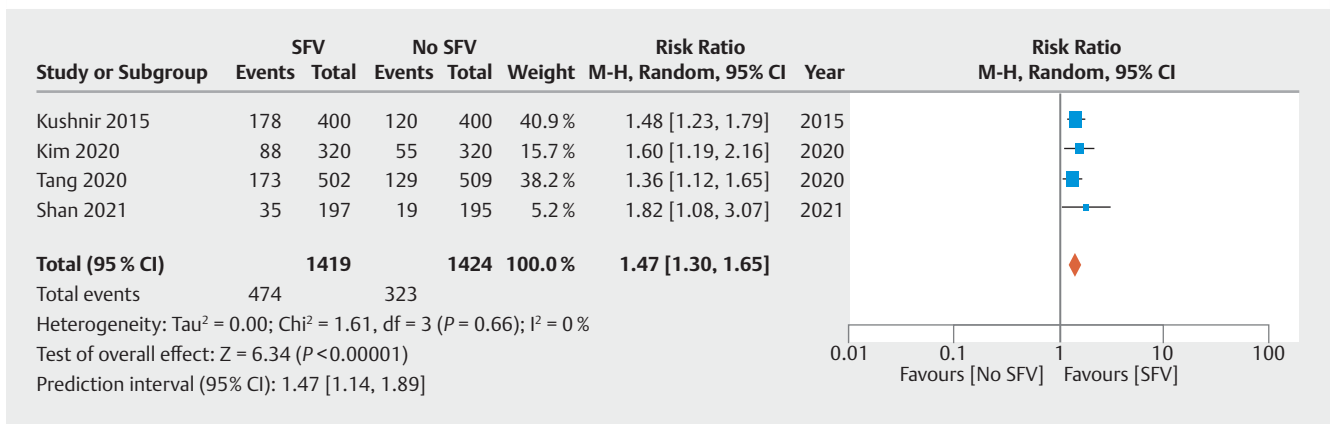▶ **Table 1** Characteristics of included studies.

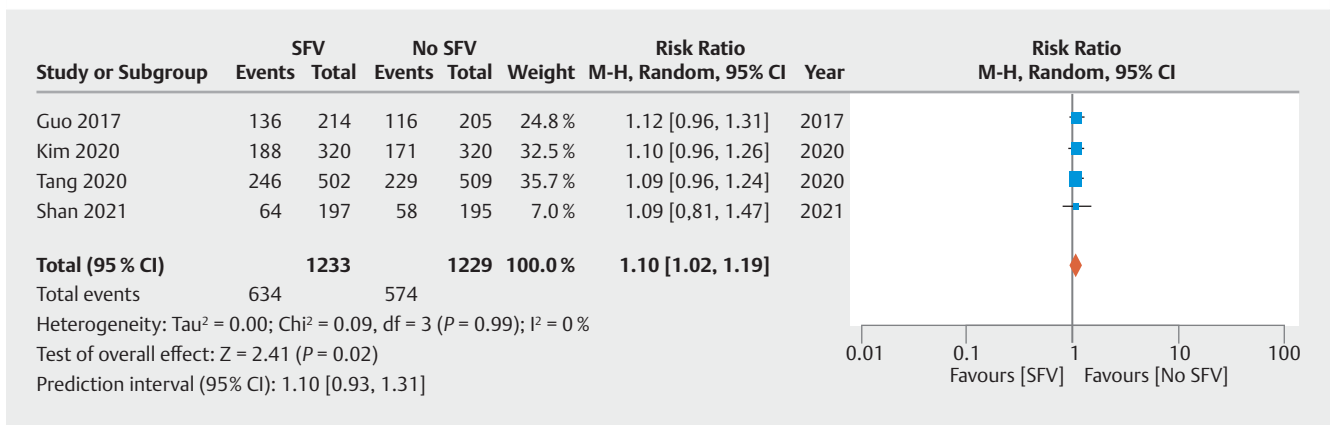| Study, year	No. patients	Comparison groups	Number (%) of males	Mean BMI	Mean age	Definition of right colon or proximal colon	Inclusion criteria	Exclusion criteria
Shan et al, 2021	392	SFV vs no SFV	213 (54%)	SFV: 23.2 ± 3.5 No SFV: 22.9 ± 3.1	SFV: 47.7 ± 12.6 No SFV: 46.1 ± 13.2	Cecum to hepatic flexure	Outpatients, 18 to 75 years old undergoing colonoscopy for screening or surveillance.	History of colon resection, IBD or polyposis syndromes, or poor bowel preparation (BBPS score < 2 in any segment of the colon). Unable to provide informed consent, did not successfully undergo cecal intubation, or were receiving active antithrombotic therapy preventing polypectomy.
Tang et al, 2020	1011	SFV vs no SFV	546 (54%)	SFV: 23.93.6 No SFV: 24 ± 3.8	SFV: 59.9 ± 8.4 No SFV: 59.8 ± 8.5	Cecum to hepatic flexure	Asymptomatic patients, 50 to 75 years of age undergoing colonoscopy for CRC screening or polyp surveillance.	Unable to provide informed consent, contraindications for endoscopy due to comorbidities, history of polyposis syndrome, IBD, prior colonic resection, irreversible coagulopathy and thrombocytopenia, incomplete colonoscopy due to failed cecal intubation, or a BBPS score of 0 in either right colon, transverse colon, or left colon preventing completion of procedure and adequate mucosal examination.
Kim et al, 2020	640	SFV vs no SFV	417 (65%)	SFV: 23.9 ± 3.1 No SFV: 24.5 ± 3.3	SFV: 53.5 ± 9.2 No SFV: 53.7 ± 8.6	Cecum to hepatic flexure	Asymptomatic subjects aged 40 to 70 years who underwent a screening colonoscopy.	Patients who refused to participate, patients with CRC, IBD, colonic polyposis, hereditary colon cancer, prior colonic resection of any part of the colon, or inability to give informed consent.
Nunez Rodriguez et al, 2020	648	SFV vs RF	360 (56%)	SFV: 27 ± 4.67 RF: 27.32 ± 4.63	SFV: 60.64 ± 5.76 RF: 59.74 ± 5.61	Cecum to hepatic flexure	Asymptomatic patients aged 50 to 69 years with a positive FIT (> 20 lg/g) referred by the CRC screening program who signed informed consent.	Patients who rejected giving informed consent, incomplete colonoscopy, inadequate preparation (right side colon BBPS < 2) or pathological findings: colorectal malignant neoplasm, diverticulitis, IBD or colonic stenosis.
Guo et al, 2017	360	SFV vs no SFV	197 (55%)	NA	SFV: 55.0 ± 11.0 No SFV: 54.9 ± 10.3	Cecum to the splenic flexure.	Patients aged ≥ 18 and ≤ 80 undergoing colonoscopy Patients with an intermediate or high risk of colorectal advanced neoplasia were enrolled according to Asia-Pacific CRC screening score (≥ 2).	Patients with advanced colonic cancer, prior resection of the proximal colon, IBD, polyposis syndrome, unable to provide informed consent. quality of bowel preparation was unsatisfactory (BBPS score < 2 in any segment of the colon) or if the cecum could not be intubated during the colonoscopy.
Kushnir et al, 2015	850	SFV vs RF	349 (41%)	SFV: 30.3 ± 7 RF: 29.3 ± 6.5	SFV: 59.0 ± 8.3 RF: 59.9 ± 8.3	Cecum to hepatic flexure	Patients undergoing colonoscopy for colorectal cancer screening or post-polypectomy surveillance.	Unable to provide informed consent, prior resection of the right colon, IBD, or the polyposis syndrome, if the cecum could not be intubated or if the quality of bowel preparation was inadequate (BBPS score < 2 in any segment of the colon).

NA, not available; SFV, second forward view; RF, retroflexion; BBPS, Boston Bowel Preparation Scale; CRC, colorectal cancer; IBD, inflammatory bowel disease.

Study or Subgroup	SFV Events	Total	No SFV Events	Total	Weight	Risk Ratio M-H, Random, 95% CI	Year
Kushnir 2015	136	400	94	400	34.2%	1.45 [1.16, 1.81]	2015
Guo 2017	59	178	43	182	15.3%	1.40 [1.00, 1.96]	2017
Tang 2020	136	502	110	509	35.6%	1.25 [1.01, 1.56]	2020
Kim 2020	56	320	38	320	11.7%	1.47 [1.01, 2.16]	2020
Shan 2021	21	197	10	195	3.2%	2.08 [1.01, 4.30]	2021
Total (95% CI)		1597		1606	100.0%	1.39 [1.22, 1.58]	
Total events	408		295				

Heterogeneity: Tau² = 0.00; Chi² = 2.25, df = 4 (P = 0.69); I² = 0%
Test of overall effect: Z = 4.91 (P<0.00001)
Prediction interval (95% CI): 1.39 [1.13, 1.71]

▶ **Fig. 2** Forest plot comparing right colon ADR between SFV and no SFV groups.

Study or Subgroup	SFV Events	Total	No SFV Events	Total	Weight	Risk Ratio M-H, Random, 95% CI	Year
Kushnir 2015	178	400	120	400	40.9%	1.48 [1.23, 1.79]	2015
Kim 2020	88	320	55	320	15.7%	1.60 [1.19, 2.16]	2020
Tang 2020	173	502	129	509	38.2%	1.36 [1.12, 1.65]	2020
Shan 2021	35	197	19	195	5.2%	1.82 [1.08, 3.07]	2021
Total (95% CI)		1419		1424	100.0%	1.47 [1.30, 1.65]	
Total events	474		323				

Heterogeneity: Tau² = 0.00; Chi² = 1.61, df = 3 (P = 0.66); I² = 0%
Test of overall effect: Z = 6.34 (P<0.00001)
Prediction interval (95% CI): 1.47 [1.14, 1.89]

▶ **Fig. 3** Forest plot comparing right colon PDR between SFV and no SFV groups.

Study or Subgroup	SFV Events	Total	No SFV Events	Total	Weight	Risk Ratio M-H, Random, 95% CI	Year
Guo 2017	136	214	116	205	24.8%	1.12 [0.96, 1.31]	2017
Kim 2020	188	320	171	320	32.5%	1.10 [0.96, 1.26]	2020
Tang 2020	246	502	229	509	35.7%	1.09 [0.96, 1.24]	2020
Shan 2021	64	197	58	195	7.0%	1.09 [0.81, 1.47]	2021
Total (95% CI)		1233		1229	100.0%	1.10 [1.02, 1.19]	
Total events	634		574				

Heterogeneity: Tau² = 0.00; Chi² = 0.09, df = 3 (P = 0.99); I² = 0%
Test of overall effect: Z = 2.41 (P = 0.02)
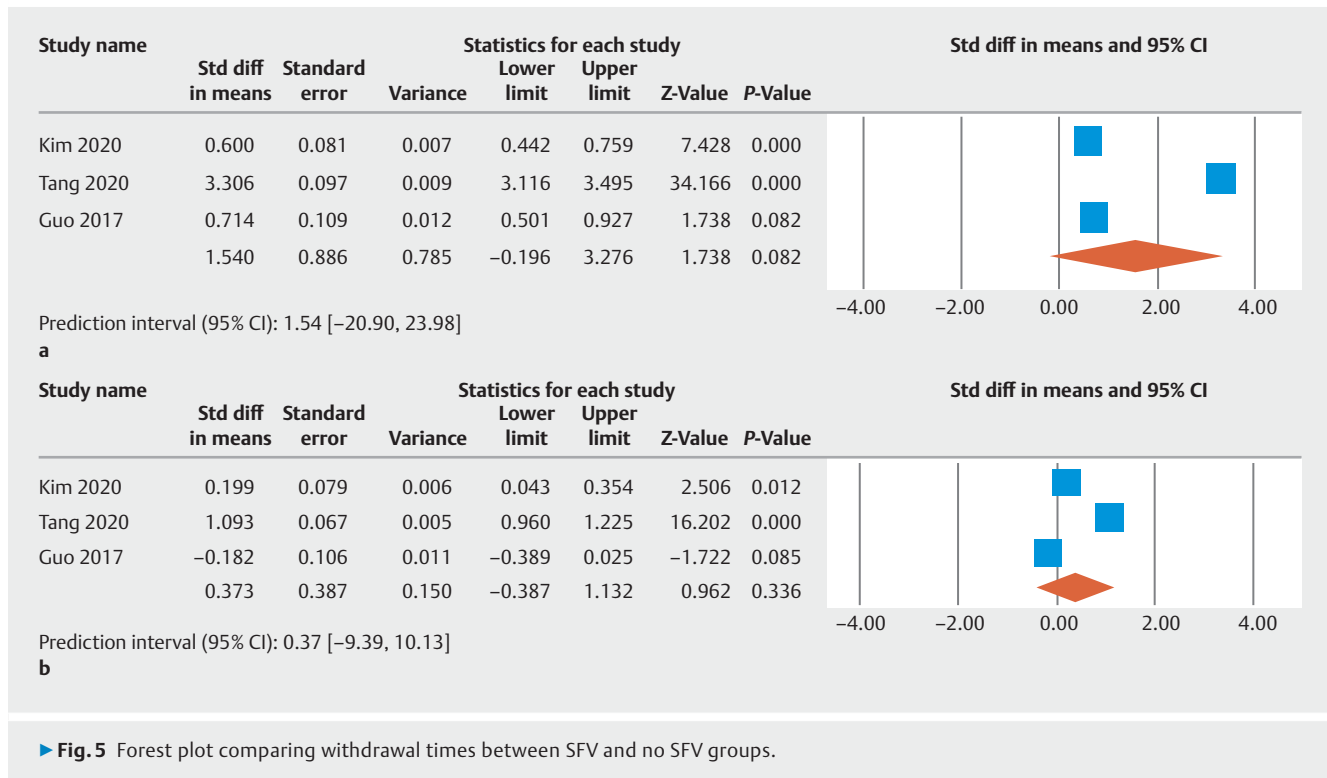Prediction interval (95% CI): 1.10 [0.93, 1.31]

▶ **Fig. 4** Forest plot comparing overall ADR between SFV and no SFV groups.

Additional ADR and PDR with RF vs SFV

Pooled additional ADRs with RF or SFV were 8% and 11%, respectively; RR (95% CI) 0.74 (0.54, 1.01), I² = 0% (**Supplementary Fig. 3**). Pooled additional PDRs with RF or SFV were 13% and 18%, respectively; RR (95% CI) 0.76 (0.59, 0.97), I² = 0% (**Supplementary Fig. 4**). Quality of evidence on GRADE framework was moderate to high (**Supplementary Table 2**).

Study name				Statistics for each study				Std diff in means and 95% CI
	Std diff in means	Standard error	Variance	Lower limit	Upper limit	Z-Value	P-Value	
Kim 2020	0.600	0.081	0.007	0.442	0.759	7.428	0.000	
Tang 2020	3.306	0.097	0.009	3.116	3.495	34.166	0.000	
Guo 2017	0.714	0.109	0.012	0.501	0.927	1.738	0.082	
	1.540	0.886	0.785	−0.196	3.276	1.738	0.082	

Prediction interval (95% CI): 1.54 [−20.90, 23.98]

a

Study name				Statistics for each study				Std diff in means and 95% CI
	Std diff in means	Standard error	Variance	Lower limit	Upper limit	Z-Value	P-Value	
Kim 2020	0.199	0.079	0.006	0.043	0.354	2.506	0.012	
Tang 2020	1.093	0.067	0.005	0.960	1.225	16.202	0.000	
Guo 2017	−0.182	0.106	0.011	−0.389	0.025	−1.722	0.085	
	0.373	0.387	0.150	−0.387	1.132	0.962	0.336	

Prediction interval (95% CI): 0.37 [−9.39, 10.13]

b

▶ **Fig. 5** Forest plot comparing withdrawal times between SFV and no SFV groups.

Discussion

SFV of the right colon during colonoscopy significantly increases the ADR in the right colon and overall. However, there was no significant difference in additional ADR between performing either SFV or RF in the right colon. The clinical relevance of these findings is that polyps in the right colon present a clinical challenge as they are often more difficult to detect during colonoscopy, which is less effective for the prevention of right-sided than left-sided cancer [6]. Therefore, a second inspection of the right colon with either SFV or RF affords an opportunity to increase ADR in the right colon and, by extension, to improve the ability to prevent right-sided colon cancer. Several modalities may also increase ADR such as cap-assisted colonoscopy [25], second-generation distal attachment cuff device [26], and third eye retroscopes [27]. However, these are inevitably associated with increased costs of the procedure. In contrast, SFV or RF in the right colon increase ADR at no additional cost.

We found that SFV of the right colon was associated with an 8 % increase in right-sided ADR, which was statistically significant (pooled OR [95 % CI] 0.67 [0.54,0.82]). Several studies have shown that RF in the right colon also increases ADR. One advantage of SFV over RF is that it can be performed safely in all patients and does not require additional skills. In contrast, RF requires additional skills and supervised training, and may not be achievable in all patients including those with tortuosity of the colon. One meta-analysis found that the rate of successful RF in the cecum was 92 % [28]. Although RF in the proximal colon is generally considered safe, it may be associated with a slightly increased risk of perforation [28, 29]. Furthermore, we found no significant difference in additional ADR between SFV

and RF. These findings support the use of SFV as the preferred modality of making a second examination of the right colon. It is also important to note that the increase in ADR with SFV exam of right colon is probably limited to small adenomas. We found no significant difference in advanced ADR between SFV and no SFV groups, RR (95 % CI) 1.45 (0.80,2.63).

We found no significant differences in withdrawal times for the right colon or the entire colon when comparing SFV with no SFV. Second examination of the right colon could potentially increase procedure time and, in this regard, our results were unexpected. Although the absolute withdrawal times were slightly higher in the SFV group than the no SFV group, this difference did not reach statistical significance. However, lack of statistical significance is not an indication of equivalence. Also, the analyses of withdrawal times were limited by considerable heterogeneity, and the quality of evidence was low. Because of these limitations, firm conclusions cannot be made about withdrawal times.

One previous meta-analysis [30] that included both observational studies and RCTs found that SFV was associated with a higher additional right-sided ADR compared to RF, which is in contrast with our findings. However, those authors included the study by Rath et al [31] in which RF was performed in all parts of the colon rather than just the proximal colon. As previously noted, we excluded that study from our analysis for the reason stated. We did not perform an analysis of AMR as it was performed in a previous meta-analysis [30]; consequently, we excluded the RCT by Harrison et al [23] because it reported AMR rather than ADR. Lv et al [30] found no significant difference in AMR between RF and SFV.

The major strength of our meta-analysis is that it was restricted to RCTs only. RCTs represent the highest level of evidence. There was low heterogeneity in most of our analyses, except for those of withdrawal times. Our findings remained robust in a pre-determined sensitivity analysis. Our meta-analysis also has several limitations. In all studies except one [20], the SFV examination was performed from the hepatic flexure to the cecum. The exception was the study by Guo et al [20], in which the SFV examination was performed from the splenic flexure to the cecum. To address this, we performed a sensitivity analysis that excluded that study, and found consistent results. The analysis of additional ADR when comparing right colon SFV with RF was necessarily limited as there were only two studies. There was some clinical heterogeneity among studies. Nunez Rodriguez et al [19] only included patients with a positive fecal immunochemical test. In the study by Shan et al [18], all patients underwent colonoscopy without sedation. Most studies included patients who underwent either screening or surveillance colonoscopy. However, Kim et al [16] only included patients having screening colonoscopy. Serrated PDR is also a predictor of post-colonoscopy colorectal cancer [32]. Only one of the included studies in our meta-analysis reported data on the detection rate of serrated lesions. Therefore, we could not perform an analysis of this potential outcome.

Conclusions

In conclusion, SFV of the right colon increases right-sided and overall ADR. RF in the right colon does not offer additional benefit in increasing ADR than SFV. Although a second exam of the right colon may increase procedure time, its benefits in improving ADR should still outweigh this. Because SFV of the right colon requires no additional skills and is easier to perform than RF, it can be considered in clinical practice.

Competing interests

The authors declare that they have no conflict of interest.

References

[1] Winawer SJ, Zauber AG, Ho MN et al. Prevention of colorectal cancer by colonoscopic polypectomy. The National Polyp Study Workgroup. N Engl J Med 1993; 329: 1977–1981

[2] Guo F, Chen C, Holleczek B et al. Strong reduction of colorectal cancer incidence and mortality after screening colonoscopy: prospective cohort study from Germany. Am J Gastroenterol 2021; 116: 967–975

[3] Heresbach D, Barrioz T, Lapalus MG et al. Miss rate for colorectal neoplastic polyps: a prospective multicenter study of back-to-back video colonoscopies. Endoscopy 2008; 40: 284–290

[4] Pohl H, Robertson DJ. Colorectal cancers detected after colonoscopy frequently result from missed lesions. Clin Gastroenterol Hepatol 2010; 8: 858–864

[5] Zhao S, Wang S, Pan P et al. Magnitude, risk factors, and factors associated with adenoma miss rate of tandem colonoscopy: a systematic review and meta-analysis. Gastroenterology 2019; 156: 1661–74 e11

[6] Singh H, Nugent Z, Demers AA et al. The reduction in colorectal cancer mortality after colonoscopy varies by site of the cancer. Gastroenterology 2010; 139: 1128–1137

[7] Brenner H, Chang-Claude J, Seiler CM et al. Protection from colorectal cancer after colonoscopy: a population-based, case-control study. Ann Intern Med 2011; 154: 22–30

[8] Soetikno RM, Kaltenbach T, Rouse RV et al. Prevalence of nonpolypoid (flat and depressed) colorectal neoplasms in asymptomatic and symptomatic adults. JAMA 2008; 299: 1027–1035

[9] Benedix F, Kube R, Meyer F et al. Comparison of 17,641 patients with right- and left-sided colon cancer: differences in epidemiology, perioperative course, histology, and survival. Dis Colon Rectum 2010; 53: 57–64

[10] Nawa T, Kato J, Kawamoto H et al. Differences between right- and left-sided colon cancer in patient characteristics, cancer morphology and histology. J Gastroenterol Hepatol 2008; 23: 418–423

[11] Corley DA, Jensen CD, Marks AR et al. Adenoma detection rate and risk of colorectal cancer and death. N Engl J Med 2014; 370: 1298–1306

[12] Clark BT, Parikh ND, Laine L. Yield of repeat forward-view examination of the right side of the colon in screening and surveillance colonoscopy. Gastrointest Endosc 2016; 84: 126–132

[13] Chandran S, Parker F, Vaughan R et al. Right-sided adenoma detection with retroflexion versus forward-view colonoscopy. Gastrointest Endosc 2015; 81: 608–613

[14] Kushnir VM, Oh YS, Hollander T et al. Impact of retroflexion vs. second forward view examination of the right colon on adenoma detection: a comparison study. Am J Gastroenterol 2015; 110: 415–422

[15] Desai M, Bilal M, Hamade N et al. Increasing adenoma detection rates in the right side of the colon comparing retroflexion with a second forward view: a systematic review. Gastrointest Endosc 2019; 89: 453–9 e3

[16] Kim SY, Lee SJ, Chung JW et al. Efficacy of repeat forward-view examination of the right-sided colon during colonoscopy: A prospective randomized controlled trial. J Gastroenterol Hepatol 2020; 35: 1746–1752

[17] Tang RSY, Lee JWJ, Chang LC et al. Two vs one forward view examination of right colon on adenoma detection: an international multicenter randomized trial. Clin Gastroenterol Hepatol 2022; 20: 372–380. e2

[18] Shan K, Lu H, Zhang Z et al. Impact of second forward-view examination on adenoma detection rate during unsedated colonoscopy: a randomized controlled trial. BMC Gastroenterol 2021; 21: 213

[19] Nunez Rodriguez MH, Diez Redondo P et al. Proximal retroflexion versus second forward view of the right colon during screening colonoscopy: A multicentre randomized controlled trial. United European Gastroenterol J 2020; 8: 725–735

[20] Guo CG, Zhang F, Ji R et al. Efficacy of segmental re-examination of proximal colon for adenoma detection during colonoscopy: a randomized controlled trial. Endoscopy 2017; 49: 243–250

[21] Nogales O, de la Maza J, Martos E et al. Success, safety, and usefulness of right colon retroflexion for the detection of additional colonic lesions not visualized with standard frontal view. Surg Endosc 2021; 35: 620–625

[22] Triantafyllou K, Tziatzios G, Sioulas AD et al. Diagnostic yield of scope retroflexion in the right colon: A prospective cohort study. Digestive and Liver Disease 2016; 48: 176–181

[23] Harrison M, Singh N, Rex DK. Impact of proximal colon retroflexion on adenoma miss rates. Am J Gastroenterol 2004; 99: 519–522

[24] Papanikolaou IS, Apostolopoulos P, Tziatzios G et al. Lower adenoma miss rate with FUSE vs. conventional colonoscopy with proximal retroflexion: a randomized back-to-back trial. Endoscopy 2017; 49: 468–475

[25] Desai M, Sanchez-Yague A, Choudhary A et al. Impact of cap-assisted colonoscopy on detection of proximal colon adenomas: systematic review and meta-analysis. Gastrointest Endosc 2017; 86: 274–81e3

[26] Patel HK, Chandrasekar VT, Srinivasan S et al. Second-generation distal attachment cuff improves adenoma detection rate: meta-analysis of randomized controlled trials. Gastrointest Endosc 2021; 93: 544–53 e7

[27] Siersema PD, Rastogi A, Leufkens AM et al. Retrograde-viewing device improves adenoma detection rate in colonoscopies for surveillance and diagnostic workup. World J Gastroenterol 2012; 18: 3400–3408

[28] Cohen J, Grunwald D, Grossberg LB et al. The effect of right colon retroflexion on adenoma detection: a systematic review and meta-analysis. J Clin Gastroenterol 2017; 51: 818–824

[29] Geng Z, Agrawal D, Singal AG et al. Contained colonic perforation due to cecal retroflexion. World J Gastroenterol 2016; 22: 3285–3288

[30] Lv XH, Lu Q, Sun YN et al. Retroflexed view for reexamination of the right colon after forward view examination: Systematic review and meta-analysis. Dig Endosc 2021; 34: 33–42

[31] Rath T, Pfeifer L, Neufert C et al. Retrograde inspection vs standard forward view for the detection of colorectal adenomas during colonoscopy: A back-to-back randomized clinical trial. World J Gastroenterol 2020; 26: 1962–1970

[32] Anderson JC, Hisey W, Mackenzie TA et al. Clinically significant serrated polyp detection rates and risk for post colonoscopy colorectal cancer: data from the New Hampshire Colonoscopy Registry. Gastrointest Endosc 2022: doi:10.1016/j.gie.2022.03.001