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Systematic Review

Perioperative Continuation Versus Discontinuation of Antiplatelet Therapy in Colorectal Surgery: A Systematic Review and Meta-Analysis of Bleeding and Thrombotic Events

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Abstract

Background: Perioperative management of antiplatelet therapy in colorectal surgery requires balancing the risk of surgical bleeding against cardiovascular and cerebrovascular complications after treatment withdrawal. This meta-analysis assessed the safety of continuing antiplatelet therapy compared with preoperative discontinuation. **Methods:** PubMed and Embase were searched through 30 May 2026 for comparative studies of adults undergoing colorectal surgery. Random-effects models were used to pool odds ratios (ORs) for dichotomous outcomes and mean differences (MDs) for continuous outcomes. The clinically relevant analysis was restricted to patients already receiving antiplatelet therapy with separately reported continuation and discontinuation groups. Risk of bias was assessed with ROBINS-I and certainty of evidence with GRADE. **Results:** Seven observational studies were included in the systematic review, of which four (505 patients; 209 continuation and 296 discontinuation) contributed to the primary analysis. Continuation was not associated with statistically significant differences in postoperative bleeding (OR 2.65, 95% CI 0.78–8.99), thrombotic events (OR 0.29, 95% CI 0.06–1.32), transfusion (OR 1.39, 95% CI 0.35–5.51), overall morbidity (OR 2.08, 95% CI 0.97–4.48), intraoperative blood loss (MD −2.74 mL, 95% CI −13.07 to 7.59), or operative time (MD 0.72 min, 95% CI −11.83 to 13.27). Hospital stay was longer with continuation (MD 0.65 days, 95% CI 0.40–0.91). In the broader secondary analysis, continuation was associated with increased postoperative bleeding (OR 3.30, 95% CI 1.40–7.78). GRADE certainty was very low for all outcomes. **Conclusions:** Among established antiplatelet users undergoing colorectal surgery, continuation was not associated with statistically significant differences in bleeding or thrombotic outcomes compared with discontinuation. However, sparse events, imprecise estimates, and very low certainty of evidence preclude definitive safety conclusions. Perioperative management should be individualized according to thrombotic risk, anticipated bleeding risk, and surgical complexity.

Keywords: antiplatelet therapy; aspirin; colorectal surgery; colorectal cancer

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1. Introduction

Antiplatelet therapy, particularly low-dose aspirin, is widely prescribed for the primary and secondary prevention of cardiovascular and cerebrovascular events. With the ageing of the surgical population and the increasing prevalence of coronary artery disease, previous percutaneous coronary intervention, and cerebrovascular disease, colorectal surgeons frequently encounter patients receiving long-term antiplatelet therapy. The perioperative management of these patients remains challenging because continuation of aspirin may increase surgical bleeding, whereas temporary discontinuation may expose patients to myocardial infarction, ischaemic stroke or other thrombotic complications [1–4]. Current guidelines for non-cardiac surgery recommend balancing the individual risk of perioperative bleeding against the risk of thrombotic events associated with antiplatelet withdrawal. Aspirin continuation is generally recommended in patients with previous percutaneous coronary intervention when the bleeding risk is acceptable, while discontinuation may be considered when the anticipated bleeding risk outweighs the cardiovascular benefit. However, these recommendations are largely based on evidence from heterogeneous non-cardiac surgical populations and may not be directly applicable to colorectal surgery [1–4].

In routine clinical practice, colorectal surgeons commonly extrapolate decisions regarding perioperative aspirin interruption from European recommendations for non-cardiac surgery. However, the evidence informing these recommendations is derived from heterogeneous surgical cohorts, including vascular, orthopaedic, abdominal and other non-cardiac procedures, with substantial variation in baseline bleeding risk and limited colorectal-specific data [4]. At the same time, colorectal surgery in experienced centres is increasingly regarded as a procedure that can often be performed with minimal blood loss, encouraging a tendency to continue low-dose aspirin in patients at relevant thrombotic risk. Nevertheless, solid evidence supporting this practice in colorectal surgery remains scarce and conflicting when it comes to the balance between bleeding and thrombotic outcomes. Propensity-score-matched analyses have similarly reported comparable perioperative bleeding outcomes between patients continuing aspirin and those not receiving continuous perioperative therapy [5,6]. Conversely, Harino et al. [7] observed a significantly higher incidence of postoperative bleeding complications among patients who continued aspirin. The same study [7] reported more frequent and more severe thrombotic complications among patients in whom aspirin was discontinued, highlighting the competing clinical consequences of the two strategies.

Thus, it is not clear whether aspirin can be safely continued throughout the perioperative period in patients undergoing colorectal surgery and whether its continuation provides protection against thrombotic events without producing a clinically significant increase in bleeding. This meta-analysis aimed to analyse the perioperative continuation of antiplatelet therapy in patients undergoing colorectal surgery, with particular emphasis on postoperative bleeding and thromboembolic complications.

2. Materials and Methods

2.1. Literature Search and Study Selection

The study was registered with PROSPERO (International Prospective Register of Systematic Reviews) [8]. The study ID is CRD420261454772. A systematic search of PubMed and EMBASE databases was performed for all comparative studies examining continuation of antiplatelet therapy perioperatively in colorectal surgery. In addition, reference lists of eligible articles and relevant reviews were manually searched to identify further studies. The following search algorithm was used: (“colorectal surgery” OR “colorectal resection” OR colectomy OR “colon surgery” OR “rectal surgery” OR proctectomy OR

"anterior resection") AND (antiplatelet OR aspirin OR "acetylsalicylic acid" OR clopidogrel OR ticagrelor OR prasugrel OR cilostazol) AND (perioperative OR preoperative OR continuation OR discontinuation OR interruption OR withdrawal). This systematic review and meta-analysis was reported in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 guidelines [9] (Figure 1). Inclusion criteria were used according to the Problem, Intervention, Comparison and Outcome (PICO) formula. The latest search was performed on 30 May 2026. Two authors (SM and BCM) assessed the titles and abstracts of studies found in the search and the full texts of potentially eligible trials were reviewed. Disagreements were resolved by consensus-based discussion. The ROBINS-I tool [10] (Figure 2) and GRADE assessment [11] were used to quantify quality of eligible studies as previously done [12,13]. The references of full texts reviewed were further screened for additional eligible studies. The corresponding author was contacted to clarify data extraction if additional information was necessary.

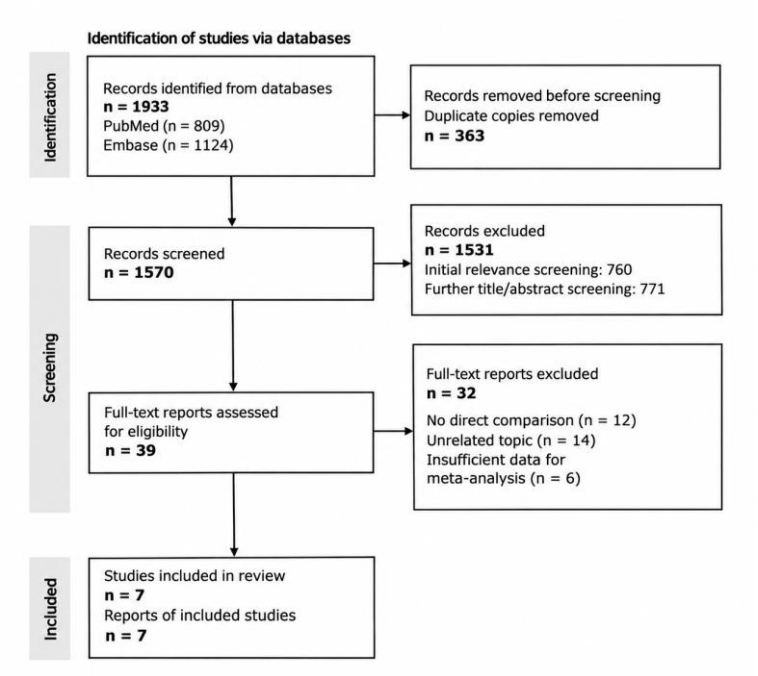


Figure 1. PRISMA flowchart.

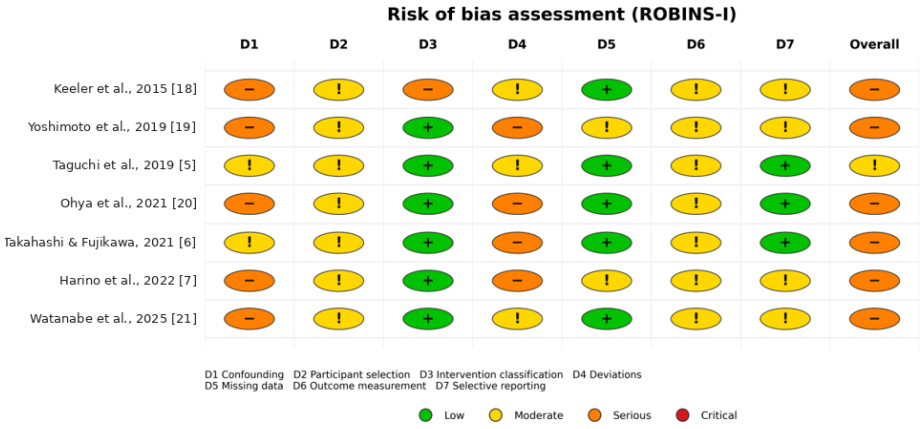


Figure 2. ROBINS-I risk of bias assessment.

2.2. Eligibility Criteria

Studies were eligible if they included adults aged 18 years or older undergoing colorectal resection who were receiving antiplatelet therapy before surgery (study group). Open, laparoscopic and robot-assisted procedures were considered.

The intervention of interest was perioperative continuation of at least one antiplatelet agent, including aspirin monotherapy or continuation of aspirin following conversion from another antiplatelet regimen. Continuation was defined according to the criteria applied in each individual study, including uninterrupted perioperative aspirin therapy, short preoperative interruptions of varying duration, or conversion from dual antiplatelet therapy or another antiplatelet agent to continued aspirin monotherapy. The exact antiplatelet agent, dose, timing of the last preoperative dose and postoperative resumption strategy were recorded. The comparator consisted of patients whose pre-existing antiplatelet therapy was discontinued or interrupted before surgery. Mixed or antiplatelet-naïve comparators were classified as secondary evidence and not included in the primary analysis. Eligible studies were required to report at least one relevant perioperative outcome, including postoperative bleeding, thromboembolic events, transfusion, intraoperative blood loss, postoperative morbidity, reoperation, mortality, operative duration or length of hospital stay. Perioperative heparin bridging was considered a concomitant intervention rather than an exclusion criterion for the meta-analysis. Patients receiving heparin bridging were retained within their respective study-defined antiplatelet continuation or discontinuation groups, where included in the original study data. The potential confounding effect of heparin bridging was considered when interpreting the pooled results.

Randomized controlled trials and prospective or retrospective comparative studies were eligible, including cohort, case–control, propensity-score-matched and propensity-adjusted studies. Studies containing mixed surgical populations were included only when data relating to colorectal surgery could be extracted separately. Case reports, uncontrolled case series, narrative or systematic reviews, editorials, letters without original extractable data and conference abstracts lacking sufficient outcome information were excluded. Studies that did not report a relevant comparative group or did not provide sufficient data to calculate an effect estimate were also excluded.

2.3. Data Extraction and Outcomes

The extracted study characteristics included the first author, year of publication, country, participating institution, recruitment period, study design, number of centres and sample size. Patient-level characteristics comprised age, sex, body mass index, American Society of Anaesthesiologists (ASA) classification, relevant cardiovascular and cerebrovascular comorbidities, indication for antiplatelet therapy and history of coronary or cerebrovascular intervention. Information concerning perioperative antithrombotic management included the antiplatelet agent and dose, use of single or dual antiplatelet therapy, definitions of continuation and discontinuation, duration of preoperative interruption, aspirin substitution, concomitant anticoagulant therapy, heparin bridging and timing of postoperative treatment resumption.

Surgical variables included the underlying diagnosis, anatomical site, operative procedure, surgical approach, emergency status, combined organ resection, operative duration and conversion to open surgery. For each outcome, its definition and ascertainment period were recorded together with the number of events and participants in each group (Supplementary Table S1). Data on intraoperative blood loss, transfusion, postoperative bleeding, thromboembolic events, morbidity and length of hospital stay were extracted where available. When reported, adjusted effect estimates, corresponding confidence intervals and the variables included in the adjustment model were also collected.

Information relevant to missing data, selective outcome reporting, population overlap and risk-of-bias assessment was documented.

2.4. Statistical Analysis

For dichotomous outcomes, pooled odds ratios (ORs) with 95% confidence intervals (CIs) were calculated. Continuous outcomes were synthesised as mean differences with 95% CIs, using standard methods for imputation of missing standard deviations where necessary. Random-effects models as described by DerSimonian–Laird [14] were specified a priori as the primary analytic approach for all outcomes, given the expected clinical and methodological heterogeneity across studies. Statistical heterogeneity was assessed using Cochran's Q test and quantified with the I^2 statistic. We considered I^2 values of 25%, 50% and 75% to correspond to low, moderate and high heterogeneity, respectively. For each outcome, forest plots display individual study estimates (squares proportional to study weight) and pooled estimates (diamonds). Baseline characteristics were summarized descriptively using the available data from studies included in the primary analysis. For dichotomous characteristics, unadjusted risk ratios (RRs), 95% confidence intervals (CIs) and two-sided *p*-values were calculated from aggregated group-level counts. These comparisons were descriptive and were not adjusted for between-study differences or potential confounding. For continuous outcomes, mean differences (MDs) with 95% confidence intervals were calculated. When means and standard deviations were directly reported, these values were extracted without modification. For studies reporting medians with interquartile ranges or ranges, means and standard deviations were estimated using established methods described by Wan et al. [15]. All analyses were performed using RevMan v5.4 [16] and MedCalc v23.2.0 [17]. The meta-analyses were based on unadjusted aggregate study-level data, as adjusted effect estimates were not consistently available across the included studies. The handling of zero-event studies followed the settings applied in RevMan, including the continuity correction for single-zero studies and exclusion of double-zero studies from odds-ratio estimation, where applicable.

3. Results

3.1. Eligible Studies

Seven studies [5–7,18–21] containing comparative data between continued and discontinued antiplatelet therapy were included (Table 1). The initial search found 1933 records. After excluding duplicates and unrelated studies based on abstract triage, 39 full texts were assessed for eligibility, out of which 7 matched the inclusion criteria and were systematically reviewed (Figure 1). The seven included studies were published between 2015 and 2025. Studies which include aspirin naïve patients were excluded from the primary analysis, thus four direct comparisons [5,7,19,20] were included consisting of 209 patients classified as continuing treatment (study group, SG) and 296 classified as discontinuing treatment (control group, CG) for a total of 505. Six studies were conducted in Japan and one in the United Kingdom. Six were single-centre studies, whereas Ohya et al. [20] included patients from two institutions. Six studies used retrospective observational designs, while Keeler et al. conducted a prospective observational study [18]. Two studies [5,6] employed propensity-score matching to reduce differences in measured baseline characteristics. No randomized controlled trials were identified.

Table 1. Characteristics of included studies.

Study	Design and Setting	Study Period	SG No	CG No	Perioperative Antiplatelet Management	Main Outcomes
Keeler et al., 2015 [18]	Prospective	2011–2014	20	87	Median duration of aspirin discontinuation was 4.5 days (IQR 0–7). Platelet function was measured before discontinuation and on the day of surgery.	Overall and haemorrhagic complications, major haemorrhage, transfusion, perioperative haemoglobin change, MACE and thrombotic events
Yoshimoto et al., 2019 [19]	Retrospective	2005–2015	54	114	At least one antiplatelet agent, usually aspirin 100 mg, was continued until the day before surgery in high-risk patients. APT was discontinued 7 days before surgery in low-risk patients and generally resumed on POD 1–2.	Bleeding and thrombotic events, postoperative morbidity and 30-day mortality
Taguchi et al., 2019 [5]	Retrospective PSM	2013–2018	36	10	High-thromboembolic-risk patients continued aspirin. Low-risk patients generally discontinued APT 7 days before surgery. Heparin-bridged patients were excluded from the aspirin safety analysis.	Intraoperative blood loss, transfusion, conversion, bleeding and thrombotic events, overall morbidity and mortality
Ohya et al., 2021 [20]	Retrospective	2011–2020	89	125	Aspirin was continued until the morning of surgery and resumed on POD 1. Other agents or DAPT were generally converted to aspirin. In the discontinuation group, the interruption period depended on the agent; 46 patients received heparin bridging.	Perioperative blood loss, transfusion, conversion, postoperative complications, three-point MACE, reoperation and in-hospital mortality
Takahashi et al., 2021 [6]	Retrospective PSM	2005–2019	140	649	Aspirin 100 mg/day was continued with no more than 2 days of interruption. P2Y12 inhibitor monotherapy or DAPT was converted to aspirin. Aspirin was generally resumed within 2 postoperative days.	Perioperative blood loss, transfusion, overall morbidity, hospital stay and 30-day mortality
Harino et al., 2022 [7]	Retrospective	2015–2019	30	47	Continuation included aspirin withdrawal for <7 days. The discontinuation group stopped aspirin for 7 days; 37/47 received heparin bridging. Aspirin was restarted at a median of POD 2 and POD 3, respectively.	Operative time, perioperative blood loss, transfusion, thrombotic events, overall morbidity and postoperative hospital stay
Watanabe et al., 2025 [21]	Retrospective	2020–2023	27	65	All patients in the APT group received aspirin monotherapy until the day before surgery. Other agents or DAPT were converted to aspirin. APT was resumed at a median of POD 2.	Perioperative blood loss, transfusion, thrombotic events, overall morbidity and postoperative hospital stay

Key: DAPT, dual antiplatelet therapy; APT, antiplatelet therapy; PSM, propensity score matching; IQR, interquartile range; MACE, major adverse cardiovascular events.

Baseline characteristics of patients included in the primary analysis are summarized in Table 2. The four studies comprised 209 patients in the continuation group (SG) and 296 in the discontinuation group (CG). Patients in the SG were more frequently male (70.3% versus 62.2%; RR 1.13, 95% CI 1.00–1.28; $p = 0.053$), although the difference did not reach statistical significance. Similarly, no significant differences were observed in ASA physical status ≥3 (43.5% versus 38.5%; $p = 0.255$), diabetes mellitus (36.3% versus 28.1%; $p = 0.071$), history of stroke (23.1% versus 20.9%; $p = 0.620$), or chronic heart failure (14.0% versus 13.4%; $p = 0.869$). Coronary/ischaemic heart disease was more prevalent in the SG (66.4% versus 52.3%; RR 1.27, 95% CI 1.05–1.54; $p = 0.015$), as was previous percutaneous coronary intervention (74.1% versus 40.4%; RR 1.84, 95% CI 1.40–2.41; $p < 0.001$). Conversely, concomitant anticoagulant therapy (7.7% versus 17.2%; $p = 0.013$) and perioperative heparin bridging (5.3% versus 36.1%; $p < 0.001$) were more frequent in the CG. The proportion of patients undergoing rectal surgery was comparable between groups (26.0% versus 23.8%; $p = 0.589$). All patients included in the primary analysis underwent planned laparoscopic surgery for colorectal cancer. Denominators varied according to the availability of individual baseline characteristics, and the comparisons were descriptive and unadjusted.

3.2. Primary Analysis

Four of the seven included studies [5,7,19,20] provided separately extractable outcomes for study-defined continuation (SG) and discontinuation groups (CG) among patients receiving antiplatelet therapy before surgery. These studies comprised 505 patients, including 209 in the continuation group and 296 in the discontinuation group. The remaining three studies were excluded from this primary comparison because they did not provide a clearly separable continuation-versus-discontinuation comparison among established antiplatelet users. Takahashi et al. [6] used a comparator comprising both patients who discontinued treatment and antiplatelet-naïve patients, whereas Watanabe et al. [21] used exclusively antiplatelet-naïve controls. In Keeler et al. [18], the aspirin-user group included patients with differing treatment interruption periods, and outcomes were not reported separately according to continuation or discontinuation. This restriction aligned the primary analysis with the clinical question of whether established antiplatelet therapy should be continued or interrupted before colorectal surgery. Table 3 summarizes results, for each outcome, of the primary analysis (where antiplatelet naïve patients were excluded) in comparison with a broad analysis of all studies.

3.3. Operative Time

Four studies involving 505 patients (209 in the SG and 296 in the CG) reported operative time. There was no statistically significant difference in operative time between the two groups (mean difference [MD]: 0.72 min, 95% CI: −11.83 to 13.27; $p = 0.91$). Moderate interstudy heterogeneity was observed ($\chi^2 = 6.68$, $I^2 = 55\%$) (Figure 3).

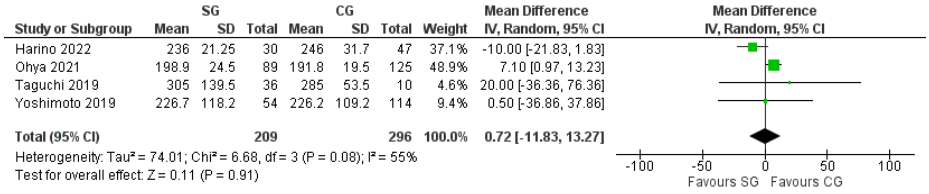


Figure 3. Forest plot comparing operative time between the SG and CG. Individual study estimates are presented as mean differences (MDs) with corresponding 95% confidence intervals (CIs), while the pooled estimate is represented by a diamond. A random-effects inverse-variance model was applied.

Table 2. Baseline characteristics.

Characteristic	SG	CG	Effect (95% CI)	*p* Value	Studies
Number of patients	209	296	—	—	4
Male sex	147/209 (70.3%)	184/296 (62.2%)	RR 1.13 (1.00–1.28)	0.053	4
ASA physical status ≥ 3	91/209 (43.5%)	114/296 (38.5%)	RR 1.13 (0.92–1.40)	0.255	4
Diabetes mellitus	65/179 (36.3%)	70/249 (28.1%)	RR 1.29 (0.98–1.71)	0.071	3
Coronary/ischaemic heart disease	79/119 (66.4%)	90/172 (52.3%)	RR 1.27 (1.05–1.54)	0.015	2
Cerebral infarction or history of stroke	33/143 (23.1%)	50/239 (20.9%)	RR 1.10 (0.75–1.63)	0.620	2
Chronic heart failure	20/143 (14.0%)	32/239 (13.4%)	RR 1.04 (0.62–1.75)	0.869	2
Previous PCI	40/54 (74.1%)	46/114 (40.4%)	RR 1.84 (1.40–2.41)	<0.001	1
Concomitant anticoagulant therapy	11/143 (7.7%)	41/239 (17.2%)	RR 0.45 (0.24–0.84)	0.013	2
Perioperative heparin bridging	11/209 (5.3%)	107/296 (36.1%)	RR 0.15 (0.08–0.26)	<0.001	4
Rectal surgery	45/173 (26.0%)	68/286 (23.8%)	RR 1.09 (0.79–1.52)	0.589	3
Laparoscopic surgery (planned approach)	209/209 (100%)	296/296 (100%)	—	—	4
Colorectal cancer diagnosis	209/209 (100%)	296/296 (100%)	—	—	4

Key: SD, standard deviation; RR, relative risk.

Table 3. Comparison of primary and broader analyses of perioperative antiplatelet continuation versus discontinuation in colorectal surgery.

Outcome	Primary Analysis: Continuation vs. Discontinuation	I^2	Broader Analysis (Including Antiplatelet Naïve Patients)	I^2	Comparison
Operative time	4 studies, 505 patients; MD 0.72 min (95% CI −11.83 to 13.27), $p = 0.91$	55%	6 studies, 807 patients; MD −2.54 min (95% CI −15.54 to 10.45), $p = 0.70$	52%	Neither analysis demonstrated a significant or clinically important difference.
Intraoperative blood loss	4 studies, 505 patients; MD −2.74 mL (95% CI −13.07 to 7.59), $p = 0.60$	82%	6 studies, 807 patients; MD −2.58 mL (95% CI −11.93 to 6.78), $p = 0.59$	69%	Results were concordant, with no meaningful difference but substantial heterogeneity.
Blood transfusion	4 studies, 505 patients; OR 1.39 (95% CI 0.35–5.51), $p = 0.64$	0%	6 studies, 807 patients; OR 0.85 (95% CI 0.34–2.08), $p = 0.72$	0%	Neither analysis demonstrated a difference; estimates were imprecise because events were sparse.
Bleeding events	4 studies, 505 patients; OR 2.65 (95% CI 0.78–8.99), $p = 0.12$	0%	7 studies, 914 patients; OR 3.30 (95% CI 1.40–7.78), $p = 0.007$	0%	The direction was consistent, but statistical significance was present only in the broader analysis.
Thrombotic events	4 studies, 505 patients; OR 0.29 (95% CI 0.06–1.32), $p = 0.11$	0%	7 studies, 914 patients; OR 0.36 (95% CI 0.09–1.39), $p = 0.14$	0%	Both analyses suggested fewer thrombotic events with continuation, but neither was statistically significant.
Overall morbidity	3 studies, 459 patients; OR 2.08 (95% CI 0.97–4.48), $p = 0.06$	53%	6 studies, 868 patients; OR 1.72 (95% CI 0.95–3.10), $p = 0.07$	58%	Both analyses showed a similar non-significant trend towards greater morbidity with continuation.
Length of stay	3 studies, 459 patients; MD 0.65 days (95% CI 0.40–0.91), $p < 0.001$	0%	6 studies, 868 patients; MD 0.59 days (95% CI 0.31–0.87), $p < 0.001$	4%	Continuation was associated with a statistically significant but small increase in hospital stay in both analyses.

Key: MD, mean difference; CI, confidence interval. The primary analysis includes studies with separately extractable continuation and discontinuation groups among established antiplatelet users. The broader analysis also includes studies with mixed or antiplatelet-naïve comparator populations. Patients receiving perioperative heparin bridging were not systematically excluded from either analysis.

3.4. Intraoperative Blood Loss

Four studies including 505 patients (209 in the SG and 296 in the CG) reported intraoperative blood loss. No statistically significant difference was observed between the groups (MD: −2.74 mL, 95% CI: −13.07 to 7.59; $p = 0.60$). Substantial interstudy heterogeneity was identified ($\chi^2 = 16.36$, $I^2 = 82\%$) (Figure 4).

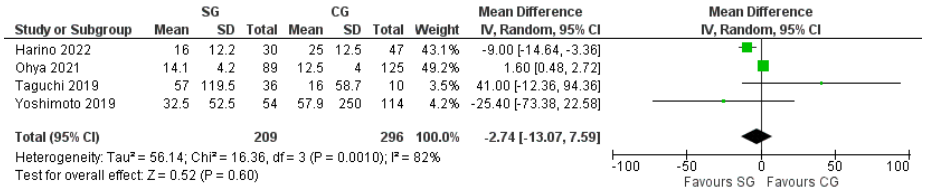


Figure 4. Meta-analysis of intraoperative blood loss between SG and CG. Each study is shown by the point estimate of the mean difference and 95% confidence interval (CI); the combined mean difference and 95% CIs by random effects calculations are shown by diamonds.

3.5. Blood Transfusions

Four studies involving 505 patients (209 in the SG and 296 in the CG) reported perioperative blood transfusions. There was no statistically significant difference in transfusion requirements between the two groups (odds ratio [OR]: 1.39, 95% CI: 0.35–5.51; $p = 0.64$). No interstudy heterogeneity was observed ($\chi^2 = 0.70$, $I^2 = 0\%$) (Figure 5).

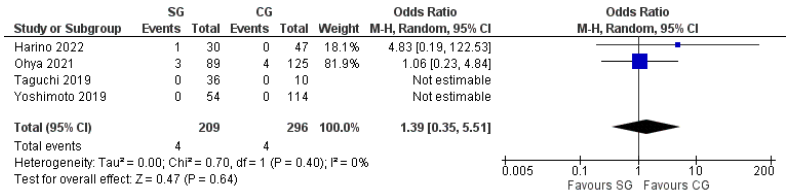


Figure 5. Meta-analysis of blood transfusions. Each study is shown by the point estimate of the odds ratio (OR; square proportional to the weight of each study) and 95% confidence interval (CI) for the OR (extending lines); the combined ORs and 95% CIs by random effects calculations are shown by diamonds.

3.6. Bleeding Events

Four studies involving 505 patients (209 in the SG and 296 in the CG) reported postoperative bleeding events. Although bleeding events were numerically more frequent in the SG (8/209, 3.8%) than in the CG (4/296, 1.4%), the pooled analysis did not demonstrate a statistically significant difference between the groups (OR: 2.65, 95% CI: 0.78–8.99; $p = 0.12$). No interstudy heterogeneity was observed ($\chi^2 = 1.22$, $I^2 = 0\%$) (Figure 6).

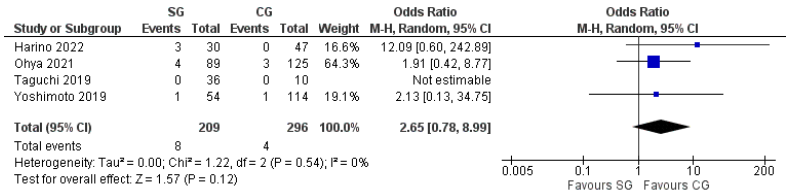


Figure 6. Meta-analysis of bleeding events between SG and CG. Each study is shown by the point estimate of the odds ratio (OR; square proportional to the weight of each study) and 95% confidence interval (CI) for the OR (extending lines); the combined ORs and 95% CIs by random effects calculations are shown by diamonds.

3.7. Thrombotic Events

Four studies including 505 patients (209 in the SG and 296 in the CG) reported postoperative thrombotic events. Thrombotic events occurred in one patient in the SG (0.5%) and ten patients in the CG (3.4%). Although the pooled estimate suggested a lower risk of thrombotic events with antiplatelet therapy continuation, the difference did not reach statistical significance (OR: 0.29, 95% CI: 0.06–1.32; $p = 0.11$). No interstudy heterogeneity was observed ($\chi^2 = 0.88$, $I^2 = 0\%$) (Figure 7).

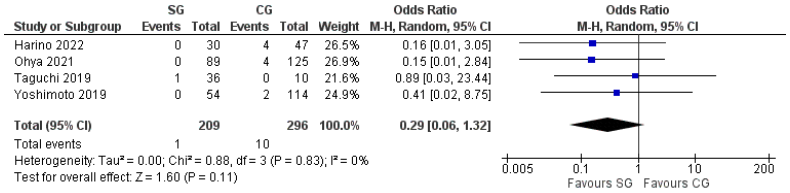


Figure 7. Meta-analysis of thrombotic events. Each study is shown by the point estimate of the odds ratio (OR; square proportional to the weight of each study) and 95% confidence interval (CI) for the OR (extending lines); the combined ORs and 95% CIs by random effects calculations are shown by diamonds.

3.8. Morbidity

Three studies involving 459 patients (173 in the SG and 286 in the CG) reported overall postoperative morbidity. The pooled analysis suggested a higher risk of postoperative complications in the SG, although the difference did not reach statistical significance (OR: 2.08, 95% CI: 0.97–4.48; $p = 0.06$). Moderate interstudy heterogeneity was observed ($\chi^2 = 4.29$, $I^2 = 53\%$). Taguchi et al. [5] was not included in the pooled analysis of overall postoperative morbidity because the study did not report an extractable overall morbidity event count (Figure 8).

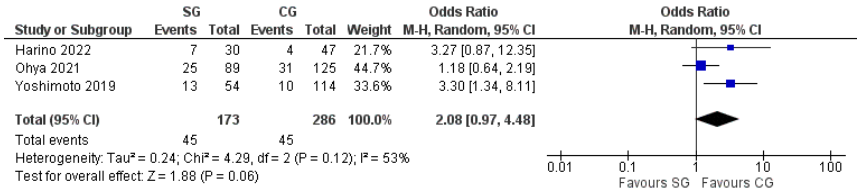


Figure 8. Meta-analysis of overall morbidity. Each study is shown by the point estimate of the odds ratio (OR; square proportional to the weight of each study) and 95% confidence interval (CI) for the OR (extending lines); the combined ORs and 95% CIs by random effects calculations are shown by diamonds.

3.9. Length of Stay

Three studies involving 459 patients (173 in the SG and 286 in the CG) reported postoperative length of hospital stay. Patients in the SG had a statistically significantly longer hospital stay compared with those in the CG (MD: 0.65 days, 95% CI: 0.40–0.91; $p < 0.00001$). No interstudy heterogeneity was observed ($\chi^2 = 1.37$, $I^2 = 0\%$) (Figure 9).

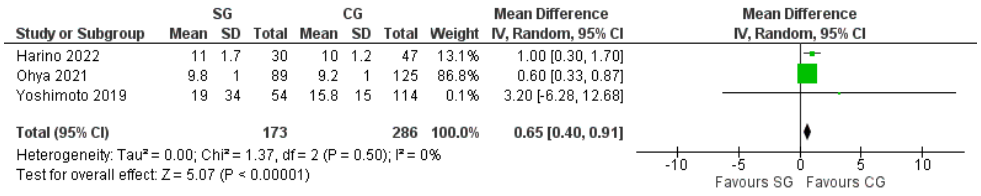


Figure 9. Meta-analysis of length of stay. Each study is shown by the point estimate of the mean difference and 95% confidence interval (CI); the combined mean difference and 95% CIs by random effects calculations are shown by diamonds.

Overall, the certainty of evidence was rated as very low for all evaluated outcomes based on the GRADE assessment [11] (Table 4). The GRADE assessment was restricted to outcomes from the primary analysis involving direct comparisons between antiplatelet continuation and discontinuation among established users. Accordingly, four studies contributed to most outcomes, while three studies contributed to overall morbidity and postoperative length of stay. This assessment reflected the observational and predominantly retrospective design of the included studies, serious risk of confounding by indication, heterogeneous definitions of antiplatelet continuation and discontinuation, and differences in perioperative co-interventions such as anticoagulant therapy and heparin bridging. Certainty was further limited by sparse bleeding, thrombotic and transfusion events, wide confidence intervals and moderate-to-substantial heterogeneity for selected outcomes.

Table 4. GRADE assessment.

Outcome	No of Patients	Relative or Mean Effect (95% CI)	Absolute Effect	Certainty
Postoperative bleeding	505 (4)	OR 2.65 (0.78–8.99)	14 per 1000 with discontinuation versus 35 per 1000 with continuation (11–110)	Very low
Thrombotic events	505 (4)	OR 0.29 (0.06–1.32)	34 per 1000 with discontinuation versus 10 per 1000 with continuation (2–44)	Very low
Red-cell transfusion	505 (4)	OR 1.39 (0.35–5.51)	14 per 1000 with discontinuation versus 19 per 1000 with continuation (5–70)	Very low
Overall postoperative morbidity	459 (3)	OR 2.08 (0.97–4.48)	157 per 1000 with discontinuation versus 280 per 1000 with continuation (153–455)	Very low
Intraoperative blood loss	505 (4)	MD 2.74 mL lower (13.07 lower to 7.59 higher)	No clinically important difference demonstrated	Very low
Operative duration	505 (4)	MD 0.72 min longer (11.83 shorter to 13.27 longer)	No clinically important difference demonstrated	Very low
Postoperative hospital stay	459 (3)	MD 0.65 days longer (0.40–0.91 longer)	Approximately 0.7 additional hospital days with continuation	Very low

Key: MD, mean difference; OR, odds ratio. The GRADE assessment was restricted to outcomes from the primary analysis comparing perioperative antiplatelet continuation versus discontinuation among established antiplatelet users. Four studies comprising 505 patients contributed to operative time, intraoperative blood loss, blood transfusion, postoperative bleeding, and thrombotic events. Three studies comprising 459 patients contributed to overall postoperative morbidity and length of hospital stay. The certainty of evidence was assessed separately for each outcome.

4. Discussion

This systematic review addresses a common practical dilemma in colorectal surgery: whether antiplatelet treatment, particularly aspirin, should be continued around the time of surgery. In the primary analysis restricted to four studies directly comparing continuation with discontinuation, treatment continuation was not associated with a statistically significant increase in postoperative bleeding, transfusion, intraoperative blood loss or operative time. Thrombotic events were also uncommon, although they occurred numerically less often among patients who continued treatment. A small but statistically significant increase in hospital length of stay was observed with continuation. These findings remain inconclusive given the limited number of events, imprecise effect estimates and very low certainty of evidence, and do not support a uniform approach to perioperative antiplatelet management. Importantly, the wide confidence intervals for postoperative bleeding and overall morbidity indicate that clinically relevant increases in these complications cannot be excluded despite the absence of statistical significance. Importantly, the absence of statistically significant differences should not be interpreted as evidence of equivalence between perioperative antiplatelet continuation and discontinuation. Similarly, although the point estimate for thrombotic events numerically favoured continuation, the small number of events, wide confidence interval, and potential confounding from concomitant antithrombotic interventions preclude any conclusion regarding a protective effect.

Bleeding is usually the main concern for the operating surgeon. In the direct comparison between continuation and discontinuation, postoperative bleeding was numerically more frequent in patients who continued antiplatelet therapy (3.8% versus 1.4%; OR 2.65, 95% CI 0.78–8.99), although the difference did not reach statistical significance. The wide confidence interval, however, does not exclude a clinically relevant increase in bleeding risk. The clinical details are important. In Harino et al. [7], the additional bleeding events were Clavien–Dindo grade II rather than life-threatening haemorrhage. Takahashi and Fujikawa [6] also reported that several bleeding episodes occurred after other antithrombotic drugs had been restarted. Therefore, postoperative bleeding may depend not only on aspirin itself, but also on when anticoagulants or additional antiplatelet agents are resumed. This balance is consistent with evidence from non-cardiac surgery, where aspirin continuation may increase bleeding, although the effect varies considerably according to the procedure and comparator [3,22].

The broader analysis showed significantly more postoperative bleeding with continuation (OR 3.30, 95% CI 1.40–7.78), whereas this finding was not maintained when only direct continuation-versus-discontinuation comparisons were considered. This does not mean that the two analyses are contradictory. Patients who had never received antiplatelet therapy would be expected to have a different baseline risk from patients taking aspirin for established cardiovascular or cerebrovascular disease. Including such patients as controls may therefore make continuation appear less favourable. The direct comparison is more relevant to the clinical decision faced when a patient already receiving aspirin is scheduled for colorectal resection.

No statistically significant difference was demonstrated in thrombotic events, although these were numerically fewer when antiplatelet therapy was continued (0.5% versus 3.4%; OR 0.29, 95% CI 0.06–1.32). This is clinically plausible, particularly in patients with coronary stents, previous myocardial infarction or cerebrovascular disease, because interruption of aspirin used for secondary prevention has been associated with an increased risk of cardiovascular events [4,23]. At the same time, baseline characteristics differed between the groups, with coronary/ischaemic heart disease and previous percutaneous coronary intervention being more frequent among patients continuing antiplatelet

therapy. These imbalances suggest that patients at higher cardiovascular risk were preferentially selected for continuation, introducing potential confounding by indication. The small number of thrombotic events further limits the precision of the estimate.

Heparin bridging further complicates this decision. In the primary analysis, perioperative heparin bridging was substantially more frequent in the discontinuation group than in the continuation group (36.1% versus 5.3%; $p < 0.001$). In Harino et al. [7], most patients who stopped aspirin received perioperative heparin, and bridging was also common in the discontinuation group reported by Ohya et al. [20]. Heparin is not a substitute for aspirin in preventing arterial platelet-driven events and may itself increase bleeding, a concern also reflected in perioperative antithrombotic reviews and guidance [22,24,25]. This imbalance represents an important potential confounder, as the observed outcomes may reflect not only antiplatelet continuation or discontinuation but also differences in concomitant antithrombotic management.

Continuation did not appear to make the operation technically more difficult. No statistically significant differences were observed in intraoperative blood loss, transfusion requirements or operative duration, although substantial heterogeneity was present for intraoperative blood loss. Overall morbidity was numerically higher among patients continuing treatment (OR 2.08, 95% CI 0.97–4.48), but the difference did not reach statistical significance. The continuation group had a higher prevalence of coronary/ischaemic heart disease and previous percutaneous coronary intervention, while concomitant anticoagulant therapy and perioperative heparin bridging were more frequent in the discontinuation group. These baseline differences may have influenced postoperative outcomes independently of antiplatelet continuation. Hospital stay was significantly longer in the continuation group, although the mean difference was only 0.65 days. Such a small increase is unlikely to alter clinical practice substantially and may reflect closer observation or delayed discharge among patients with greater cardiovascular risk. Nevertheless, this finding should be interpreted cautiously given the limited number of studies, the influence of individual study estimates and the potential for residual confounding.

In clinical practice, these results argue against an automatic policy of stopping aspirin before every colorectal operation. Continuation of low-dose aspirin appears reasonable in patients with a strong secondary-prevention indication, particularly those with previous coronary intervention or substantial cardiovascular or cerebrovascular risk, when elective surgery is planned. Conversely, temporary interruption may still be appropriate when the indication for aspirin is weak, the expected bleeding risk is high or the planned procedure is extensive. The final decision should be shared between the surgeon, anaesthetist and, when appropriate, cardiologist, with a clear plan for postoperative resumption, in keeping with current multidisciplinary guidance [1,2,24,25].

This review has several strengths. It focuses specifically on colorectal surgery and separates direct continuation-versus-discontinuation comparisons from studies using mixed or antiplatelet-naïve controls. This makes the primary analysis more closely aligned with the clinical question faced by surgeons. Nevertheless, information regarding perioperative heparin bridging, conversion from other antiplatelet agents and postoperative treatment resumption was used descriptively and could not be incorporated into the quantitative analyses because of heterogeneous management strategies and insufficient patient-level data.

Previous systematic reviews have investigated perioperative antiplatelet management in gastrointestinal surgery. Fang et al. [26] included 22 studies involving various gastrointestinal procedures and found that most studies did not demonstrate a significant increase in bleeding complications with continued antiplatelet therapy. A subsequent systematic review [27] focusing on laparoscopic colorectal cancer surgery also suggested that perioperative aspirin continuation was not associated with increased surgical blood loss

or postoperative bleeding complications, however it lacked quantitative meta-analysis. More recently, a meta-analysis [28] of antithrombotic therapy in gastrointestinal surgery evaluated bleeding and thrombotic outcomes across heterogeneous surgical procedures and antithrombotic regimens. However, these reviews did not specifically provide a pooled comparison restricted to continuation versus discontinuation among established antiplatelet users undergoing colorectal surgery. The present meta-analysis addresses this distinction, although its findings remain limited by the small number of eligible studies and very low certainty of evidence.

The main limitation is the quality of the available evidence. All included studies were observational, most were retrospective and most were performed in Japanese centres. Only four studies were eligible for the primary direct comparison, resulting in a relatively small sample size and limited statistical power, particularly for uncommon bleeding and thrombotic events. The decision to continue or discontinue antiplatelet therapy was based on clinical judgement, resulting in differences in baseline cardiovascular risk and perioperative antithrombotic management. In particular, the continuation group had a higher prevalence of coronary disease, whereas heparin bridging and concomitant anticoagulant therapy were more common in the discontinuation group. These imbalances introduce potential confounding by indication and limit causal interpretation of the pooled results. Definitions of continuation, discontinuation and bleeding varied, and clinically important events were uncommon. Most patients underwent elective minimally invasive cancer surgery, limiting the relevance of the findings to open, emergency and benign colorectal procedures. Possible overlap between the Yoshimoto and Takahashi cohorts in the broader analysis and the need to estimate some continuous data from medians and ranges introduce further uncertainty.

Accordingly, the GRADE certainty of evidence was very low for all outcomes. Larger prospective multicentre studies are needed, with clear definitions of uninterrupted aspirin use, clinically relevant bleeding and thrombotic events. They should report aspirin monotherapy separately from dual antiplatelet therapy, document heparin bridging and anticoagulant use, and describe exactly when each drug is restarted after surgery.

Taken together, the available evidence suggests that continuation of low-dose aspirin during elective minimally invasive colorectal surgery may be feasible without a clearly demonstrated increase in major perioperative bleeding complications. However, the confidence intervals remain wide, and a clinically important increase in bleeding risk cannot be excluded. The evidence remains too limited for a universal rule, and treatment should continue to be tailored to the patient and the planned operation.

5. Conclusions

Perioperative continuation of antiplatelet therapy in colorectal surgery was not associated with statistically significant differences in postoperative bleeding, transfusion requirements, intraoperative blood loss, thrombotic events, operative time or overall morbidity when compared directly with discontinuation. However, bleeding events were numerically more frequent and thrombotic events less frequent among patients continuing treatment, while a small but statistically significant increase in hospital length of stay was observed. Given the limited number of studies, imprecise estimates and very low certainty of evidence, clinically relevant differences cannot be excluded. Therefore, perioperative antiplatelet management should be individualized according to the patient's thrombotic risk, anticipated bleeding risk and surgical complexity. Further prospective studies are needed to establish the safety of antiplatelet continuation in colorectal surgery.

Supplementary Materials: The following supporting information can be downloaded at: https://www.mdpi.com/article/10.3390/medsci14070747/s1, Table S1. Study-level data for primary and broader meta-analyses; File S1 PRISMA 2020 checklist; File S2 PRISMA 2020 flowchart.

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Abbreviations

The following abbreviations are used in this manuscript:

APT	Antiplatelet therapy
ASA	American Society of Anaesthesiologists
CG	Control group
CI	Confidence interval
DAPT	Dual antiplatelet therapy
GRADE	Grading of Recommendations Assessment, Development and Evaluation
IQR	Interquartile range
MACE	Major adverse cardiovascular events
MD	Mean difference
OR	Odds ratio
PICO	Population, Intervention, Comparison, and Outcome
POD	Postoperative day
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-Analyses
PROSPERO	International Prospective Register of Systematic Reviews
PSM	Propensity score matching
ROBINS-I	Risk Of Bias In Non-randomized Studies—of Interventions
RR	Relative risk
SD	Standard deviation
SG	Study group

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