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Management of Antiplatelet and Anticoagulant Agents before and after Polypectomy

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BACKGROUND

Several antithrombotic medications are available with different mechanisms of action, half-lives, and times to effect (Table 1). These are broadly divided into agents that affect platelet function and those that affect coagulation factors. Antiplatelet and anticoagulant agents are indicated to prevent thromboembolism in at-risk patients, as summarized later in discussion.

Antiplatelet agents

- Acute coronary syndrome
- Postcoronary stent
- Postperipheral artery stent
- Stroke/transient ischemic attack

Anticoagulant agents

- Atrial fibrillation
- Mechanical heart valve
- Venous thromboembolic disease
- Thrombophilia

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DISCLOSURE

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It is now commonplace for a gastroenterologist to be asked for recommendations regarding antithrombotic management before and following colonoscopy. The risk of postpolypectomy bleeding without antithrombotic interruption is weighed against the risk of sustained thromboembolic complication due to antithrombotic interruption. Often, the patient's hematologist, cardiologist, or neurologist is involved in the periprocedural antithrombotic management, particularly in the context of a patient at high risk of thromboembolism or a more advanced polyp resection.

There are very few randomized trials comparing different management strategies in patients on antithrombotic agents undergoing colonoscopy and polypectomy. Our best sources of evidence are derived from large, multicenter studies that include all surgeries and invasive procedures but do not report specific outcomes in the colonoscopy subgroup. Often, these trials exclude those patients at the highest risk of thromboembolism. Published cohort studies specific to colonoscopy are difficult to interpret due to confounding as patient and physician factors may influence peri-procedural antithrombotic management and decisions regarding the polypectomy approach. Also, there is an observed inconsistency between studies in outcomes definition and ascertainment, follow-up time, and polypectomy technique, including prophylactic measures to prevent postpolypectomy bleeding. Several guidelines address the management of antithrombotic medications before and following colonoscopy; however, these are based on low-quality evidence. As physicians incorporate these guidelines into their clinical practice, it is important to recognize that, in the absence of high-quality studies to inform decisions, patient preferences are essential to decisions regarding the interruption of antithrombotic drugs.

DISCUSSION

Patient Preferences and Shared Decision-Making

Perceptions and values regarding antithrombotic therapy vary among patients and between patients and their physicians.[1] Generally, patients will accept a higher gastrointestinal (GI) bleeding risk to prevent a stroke or an acute coronary event,[2-4] but these preferences are influenced by a patient's personal experience with bleeding or thromboembolism.[3]

Physicians may respond more strongly to the risk of postpolypectomy bleeding as it is an outcome they experience immediately and may treat following resumption of the antithrombotic agent.[1,5] Whereas a stroke may occur later, perhaps without the knowledge of the physician performing the colonoscopy. Physicians should be mindful of the potential for unconscious biases and ensure they identify the management strategy most in keeping with the patient's preferences.

A patient may elect to continue the antithrombotic agent for their procedure after a risk-benefit discussion with their gastroenterologist, cardiologist, hematologist, and/or neurologist. During consent, gastroenterologists can specify that removing subcentimeter polyps by cold snare polypectomy is possible without the temporary interruption of antiplatelet or anticoagulant drugs; however, a repeat colonoscopy with medication discontinuation may be required to excise a larger polyp safely. Alternatively, an approach of universal temporary interruption can be adopted in the anticipation of performing small and

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large polypectomy at index colonoscopy after appropriate discussion with the patient. The latter approach may be favorable in the setting of open-access endoscopy.

Clinical Practice Guidelines Addressing Antithrombotics and Polypectomy

Several clinical practice guidelines address the management of antithrombotic medications in patients undergoing endoscopic procedures.[6-9] These recommendations distinguish between endoscopic procedures at low or high risk of postprocedure bleeding and categorize patients based on their risk of thromboembolism (Table 2).[10,11] All guidelines endorse the safety of colonoscopic biopsy without temporary interruption of antithrombotic drugs. In contrast, polypectomy has traditionally been considered a high-risk bleeding intervention for which antiplatelet agents, except for acetylsalicylic acid (ASA), and anticoagulants are temporarily interrupted. In addition to low and high-risk bleeding procedures, the Asian guidelines classified endoscopic submucosal dissection and endoscopic mucosal resection (EMR) of lesions greater than 2 cm as ultra-high-risk procedures and suggested withholding ASA.[8]

However, with increasing uptake of nonthermal polypectomy techniques, there is a growing acceptance to classify cold snare polypectomy of polyps (up to 1 cm) as a low-risk bleeding risk procedure. Such a low-risk procedure might be performed safely without temporary interruption of antiplatelet or anticoagulant drugs, which are appealing as most polyps discovered at colonoscopy will be less than 1 cm in size.[7,9] However, endorsement of this strategy is based on very limited data, as discussed later in this review.

Colonic polyps greater than 1 cm pose a greater risk of immediate and delayed postpolypectomy bleeding,[12-16] and most require a short period of temporary interruption of the anticoagulant or non-ASA antiplatelet drug as outlined later in discussion.

Patients prescribed a non-ASA thienopyridine antiplatelet drug (clopidogrel, prasugrel) should be instructed to hold their antiplatelet agent for 7 days before the colonoscopy. Patients prescribed ticagrelor can discontinue their drugs for a shorter period of 4 days, as this nonthienopyridine is the only reversible platelet $P2Y_{12}$ receptor antagonist. Resumption is recommended once immediate hemostasis is achieved, ideally within 24 hours. However, as described later in discussion, gastroenterologists should avoid temporary interruption of these specific agents during periods when the patient is at the highest risk of thrombotic events and consider deferring the colonoscopy until the antiplatelet can be safely held.

For patients anticoagulated with warfarin, the accepted standard is to discontinue warfarin 5 days before the colonoscopy and polypectomy and resume the day of the procedure, provided endoscopic hemostasis was attained. Bridging during warfarin interruption is not required unless the patient has a high-risk thromboembolic condition (see Table 2), such as certain mechanical heart valves, atrial fibrillation plus mitral stenosis, or a high $CHADS_2$/CHA_2DS_2VASc score, or recent venous thromboembolism or cerebrovascular event. In this situation, bridge therapy, typically with low molecular weight heparin, is begun 3 days before the colonoscopy and polypectomy, held the day of the procedure, and then continued for 3 to 5 days following, until the patient's INR reaches the target range. Direct oral anticoagulants (DOAC) are discontinued 1 to 2 days before colonoscopy and polypectomy

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with resumption the day after the procedure if endoscopic hemostasis is achieved. Bridge anticoagulation is not required, as these agents achieve therapeutic levels within hours of resumption.[17]

Could Colonoscopy Be Deferred?

Among the patient group at the highest risk of thromboembolic events, there are several clinical scenarios in which antithrombotic medication should not be interrupted for a specified period.

Patients who have been diagnosed with one of the following in the previous 3 months:

- Transient ischemic attack,
- Stroke,
- Lower extremity deep vein thrombosis
- Pulmonary embolus, or
- Acute coronary syndrome event

Patients who have undergone coronary stent placement:

- Drug-eluting stent placement within the previous 6 months,
- Bare metal stent placement within the previous month,
- Acute coronary syndrome event *plus* drug-eluting stent placement within the previous 6 months, or
- Acute coronary syndrome event *plus* bare metal stent within the previous 2 months.

Whether colonoscopy can be safely deferred depends on the indication and the patient's risk of a thrombotic event (as highlighted above and in Table 2). Colonoscopy undertaken for average-risk screening, previous neoplastic polyps or colorectal cancer surveillance, or a family history of colorectal cancer could reasonably be deferred until the minimum period of antithrombotic therapy is complete. For patients with a positive fecal immunochemical test (FIT), a recent systematic review of 8 studies concluded that colonoscopy performed beyond 9 months of a positive FIT was associated with a higher incidence of colorectal cancer and advanced-stage colorectal cancer.[18] While most colon screening programs use 1 or 2 months as the benchmark time to complete colonoscopy following a positive FIT,[19,20] these data indicate it is reasonable to wait if aligned with the patient's wishes. Similarly, the urgency by which a luminal cause of iron deficiency anemia or abdominal symptoms is sought can be dictated by the patient's presentation, the risk for advanced luminal lesions, and their underlying thrombotic risk, which determines the safety of temporary interruption of the antithrombotic agent.

Through informed discussion, a shared decision is reached to either:

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1. Defer colonoscopy in patients at higher risk of thromboembolism until the minimum period of necessary continuous antithrombotic therapy is complete, or
2. Undergo colonoscopy with the understanding that a repeat procedure may be necessary to remove larger polyps at higher risk of postpolypectomy bleeding.

Antithrombotic Agents and Polypectomy: What We Know to Date

Polypectomy and acetylsalicylic acid—ASA monotherapy is used for secondary cardioprevention in doses from 81 mg to 325 mg per day. In general, ASA does not need to be interrupted before colonoscopy and polypectomy. ASA interruption is associated with an increase in thromboembolic events, and the risk of postpolypectomy bleeding seems to be very low.[21,22] However, removal of large colonic polyps (≥1 cm) will carry a higher bleeding risk, and this needs to be balanced against the patient's cardiovascular risk and their preferences regarding bleeding complications versus thromboembolic complications.

Polypectomy and $P2Y_{12}$ receptor inhibitors—$P2Y_{12}$ inhibitors, including the thienopyridine agents clopidogrel, prasugrel, and ticlopidine, and the nonthienopyridine agent ticagrelor, are used in the treatment of patients with coronary or peripheral artery stent placement, recent acute coronary syndrome event, and transient ischemic attack (TIA) or stroke.[23,24] The newer $P2Y_{12}$ agents have largely replaced ticlopidine due to a less favorable side effect profile. Dual antiplatelet therapy (DAPT) combines a $P2Y_{12}$ inhibitor with ASA and is recommended, often temporarily, for patients who have acute coronary syndrome with or without percutaneous coronary intervention.[25]

Whether $P2Y_{12}$ inhibitors should be interrupted before colonoscopy and polypectomy has been addressed in 2 randomized trials comparing continued clopidogrel to placebo, with or without ASA, in patients undergoing colonoscopy and polypectomy.[26,27] Chan and colleagues included various polypectomy techniques (42.8% cold biopsy or cold snare) and did not allow prophylaxis against postpolypectomy bleeding with clipping. There was no significant difference in the rate of immediate postpolypectomy bleeding, delayed postpolypectomy bleeding, or thromboembolic events between the clopidogrel and placebo groups. The delayed postpolypectomy bleeding rate was 3.8% and 3.6% in the clopidogrel and placebo arms, respectively. Won and colleagues included patients undergoing cold snare polypectomy of polyps ≤ 1 cm and reported similar delayed postpolypectomy bleeding rates between those randomized to continue DAPT (1/42%, 2.4%) versus ASA alone (0/45).[27] However, both trials had low numbers of postpolypectomy bleeding events and wide confidence intervals, raising concerns about whether the sample size was large enough to detect a true difference.[7]

Adding to our understanding of bleeding risk with uninterrupted thienopyridines is the prospective cohort study by Feagins and colleagues,[22] which reported 7.3% of patients on continuous $P2Y_{12}$ inhibitors experienced postpolypectomy bleeding (69.2% cold biopsy or cold snare). Immediate postpolypectomy bleeding was more common following cold forceps removal, while delayed bleeding was exclusively seen in patients who underwent hot snare polypectomy. A subsequent systematic review and meta-analysis including the Chan

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and Feagins studies reported a significant increase in the rate of delayed postpolypectomy bleeding in patients continued on clopidogrel.[28] This meta-analysis has methodologic concerns as it mislabels a cohort study as a randomized trial and pools randomized trials with observational studies.

Overall, these data suggest that hot-snare polypectomy without temporary interruption may be associated with an increased risk of delayed bleeding. An emerging body of literature suggests cold polypectomy techniques may be associated with less delayed postpolypectomy bleeding in patients who continue their $P2Y_{12}$ inhibitor, acknowledging the potential for increased intraprocedural bleeding.

Polypectomy and warfarin—Vitamin K antagonists (VKA), such as warfarin, were the only oral anticoagulants available until 2011, when the DOACs were approved to prevent stroke in patients with nonvalvular atrial fibrillation.[29] While most consensus guidelines recommend discontinuing warfarin before colonoscopic polypectomy, with heparin bridging depending on the underlying thromboembolic risk of the patient, the data to support this recommendation are lacking.[6-8]

Whether uninterrupted warfarin increases the risk of postpolypectomy bleeding, particularly in the context of nonthermal polypectomy techniques, has been addressed in a small trial randomizing patients with polyps up to 1 cm in size to continuous warfarin and cold snare polypectomy, versus interrupted warfarin with heparin bridging and hot snare polypectomy.[30] The former strategy was noninferior with no patients in the uninterrupted warfarin/cold snare group (0/30) and 12.0% (3/25) of patients in the interrupted warfarin/hot snare group sustaining major bleeding with a risk difference of 12.0% (95% CI: −0.7–24.7). This study failed to control for the polypectomy technique, evaluating 2 interventions simultaneously. Additional methodological issues include patient recruitment, which was not consecutive, that patients and physicians were not blinded to the patient's allocation, and the small sample size with few bleeding events. While this study is challenging to interpret, the results seem to support the evolving paradigm of cold snare excision of small polyps on uninterrupted warfarin.

Larger polyps, however, may require temporary interruption of warfarin with or without heparin bridging. The BRIDGE trial assessed the indication for heparin bridging. Patients with atrial fibrillation, who were not at high risk of embolism (see Table 2), undergoing an invasive procedure, including colonoscopy and polypectomy, were randomized to low molecular weight heparin bridging or placebo.[31] The control group was noninferior to the bridged group in the risk of arterial thromboembolism; however, the risk of postprocedural bleeding was lower in patients that were not bridged (Relative Risk 0.41, 95% CI: 0.02–0.78).

In summary, patients on warfarin may elect to continue anticoagulation with the removal of polyps up to 1 cm in size with cold snare polypectomy with the understanding that repeats colonoscopy with warfarin interruption may be indicated if a larger polyp is detected.

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Polypectomy and direct oral anticoagulants—DOACs including, apixaban, dabigatran, edoxaban, and rivaroxaban, are used for secondary thromboembolic prevention, treatment of venous thromboembolism, and stroke prevention in patients with nonvalvular atrial fibrillation.[29] There is evolving data that GI bleeding risk varies among the DOACs, with apixaban associated with a more favorable GI bleeding and postpolypectomy bleeding profile.[32,33]

Direct oral anticoagulant agents offer several advantages over warfarin:

- Fixed dose,
- Rapid anticoagulation within 3 hours of the first dose,
- No monitoring, and
- No interaction with medications or foods

A limited number of studies are published assessing the approach to polypectomy in patients taking DOACs whereby there are 4 specific considerations: is temporary interruption beneficial, when should DOACs be resumed if a temporary interruption occurs, is bridge anticoagulation required, and the role of cold snare polypectomy in preventing postpolypectomy bleeding.

The PAUSE trial is the landmark study informing our understanding of patient outcomes associated with a standardized approach to peri-procedural interruption of DOACs. The PAUSE trial is a prospective cohort trial enrolling patients with nonvalvular atrial fibrillation on DOAC agents undergoing elective procedures, including colonoscopy and polypectomy.[17] A standardized protocol for DOAC interruption and resumption without heparin bridging was assessed. The DOAC was held the day before a low-risk bleeding procedure (the category that includes all GI procedures) and 2 days before a high-risk bleeding procedure. The DOAC was resumed 24 hours after low-risk bleeding procedures and 48 to 72 hours after high-risk bleeding procedures once hemostasis was attained. This standardized approach to DOAC interruption was shown to be safe. Of the 3007 patients enrolled, the rate of major bleeding at 30 days ranged from 0.90% to 1.85% and the rate of arterial thromboembolism ranged from 0.16% to 0.60%, depending on the DOAC used.

Our ability to apply the results of the PAUSE study to colonoscopy and polypectomy is supported by a retrospective analysis including 1590 patients on DOAC medications who underwent colonoscopy and polypectomy, including EMR, following a brief period of DOAC interruption.[34] Peri-procedural DOAC management was concordant with the ASGE guidelines[6]: held 1 to 3 days before the procedure and resumed within 48 hours. A small proportion, 1.6%, did receive heparin bridging. After adjusting for bridge anticoagulation, patient comorbidities, and procedure type, patients with DOAC did not have an increased risk of GI bleeding (0.63%, 95% CI: 0.3%–1.2%), stroke, myocardial infarction, or hospital admission following drug resumption compared with patients not on DOACs.

The recommendation to avoid heparin bridging in patients with nonvalvular atrial fibrillation who require a short peri-procedural interruption of their DOACs is aligned with the PAUSE trial, which did not use bridging anticoagulation in their population of patients with lower

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CHADS-VASC scores.[17] This no-bridge strategy is also supported by the results of the RE-LY trial, whereby an increased risk of procedural bleeding without a decrease in thromboembolic events was associated with heparin bridging.[35] Altogether, a short period of DOAC interruption without bridge anticoagulation seems to be safe as these agents achieve therapeutic levels within hours of resumption. If DOACs are continued for colonoscopy, cold snare polypectomy of subcentimeter polyps may be preferable.

Strategies to Decrease Postpolypectomy Bleeding Risk

The risk of delayed postpolypectomy bleeding has been associated with larger polyp size,[12-16] proximal,[12,13,16,33] especially cecal,[36] location, and the use of antithrombotic medications.[12,15,34,37] In addition, a large, retrospective cohort of patients on oral anticoagulants reported the use of thermal techniques for polypectomy was independently associated with postpolypectomy bleeding.[33] Postpolypectomy bleeding definitions vary among studies but are often subgrouped into immediate (intraprocedural) bleeding or delayed bleeding (typically reported at 14- or 30-days following colonoscopy). In patients on antithrombotic agents, the risk of postpolypectomy bleeding is challenging to assess as this population of patients is often under-represented in clinical studies. Furthermore, patients prescribed antithrombotic agents tend to be at higher risk of bleeding due to increased age, comorbid medical conditions, and multiple medications, all contributing to altered metabolism and excretion of the antithrombotic drugs.[38]

The following summarizes 2 strategies that may decrease the risk of postpolypectomy bleeding: cold snare polypectomy and prophylactic clip placement at the polypectomy site.

Cold snare polypectomy—The American and European endoscopy societies recommend cold snare polypectomy for nonpedunculated polyps up to 1 cm in size.[39,40] Concerning postpolypectomy bleeding, a recent meta-analysis included 3 randomized controlled trials comparing cold snare polypectomy to hot snare polypectomy to remove polyps 4 to 10 mm in size.[41] The rate of delayed postpolypectomy bleeding was similar between the 2 groups, but the pooled sample size was unlikely to detect any difference. The meta-analysis did show an increase in adverse events in the cold snare polypectomy arm due to immediate bleeding. However, the previously mentioned studies excluded patients on antithrombotic medications, thus limiting our ability to extrapolate findings to this specific population.

In patients who are not on an antithrombotic agent, self-limited intraprocedural bleeding is common after cold-snare polypectomy.[42] Less is known about the severity of immediate bleeding following cold polypectomy techniques in patients who require prompt resumption of an antiplatelet or anticoagulant agent. Published studies vary in their definition of immediate bleeding. While some have described bleeding beyond 30 seconds as a significant adverse event, other studies have a less standardized protocol in which bleeding is considered a true complication when the endoscopist, at their discretion, applies hemostatic therapy. This behavior is subject to bias as an unblinded endoscopist may have a lower threshold for hemostatic therapy in a patient they know to be on an antithrombotic drug.

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Takeuchi and colleagues clarified intraprocedural bleeding as poorly controlled bleeding at the time of colonoscopy requiring blood transfusion, surgery, or interventional radiology.[30] Recently, a greater effort has been made to define intraprocedural bleeding in a fashion that can be easily standardized and is consistent with expert consensus that suggested: "Immediate bleeding is not considered an adverse event unless it results in hospitalization, transfusion, or surgery."[43] This general statement did not apply specifically to patients on antithrombotics; and, the definition and importance of immediate postpolypectomy bleeding is an evolving area of controversy.

Two randomized trials have compared cold and hot snare polypectomy in patients on anticoagulant medications. Horiuchi and colleagues randomized 70 patients on continuous warfarin therapy with polyps less than 1 cm to cold or hot snare polypectomy.[44] Immediate bleeding, managed by clip placement, was observed in 5.7% of the cold snare group and 23% of the hot snare group. At 14-day follow-up, no patients in the cold snare arm experienced delayed bleeding versus 14% in the hot snare arm. This trial was at risk of bias due to a lack of blinding of the physician performing the colonoscopy and the outcome assessors. Furthermore, the lower risk of immediate postpolypectomy bleeding in the cold snare arm is incongruent with studies evaluating cold snare polypectomy in patients who are not on antithrombotics.[41] As discussed above, Takeuchi and colleagues demonstrated that cold snare polypectomy on continuous warfarin or DOAC was noninferior to hot snare polypectomy in patients with the anticoagulant interrupted and receiving heparin bridging.[30] However, in addition to the design flaws previously noted, the bridging strategy used in patients prescribed DOACs is not endorsed by national cardiology or hematology organizations in the United States.

Prophylactic clipping—Prophylactic clipping is attractive to many endoscopists following polypectomy of larger lesions in patients requiring antiplatelet or anticoagulant agents. Several prospective trials have studied the association between clipping and postpolypectomy bleeding.[12-14]

Feagin and colleagues did stratify randomization by antithrombotic use and presented different outcomes for different antithrombotic strategies.[12] Of the 1050 patients with polyps ≥ 1 cm, 5.7% were on $P2Y_{12}$ inhibitors (4% interrupted, 1.7% uninterrupted), 1.6% on uninterrupted DOACs, and 6.8% on interrupted warfarin therapy (2.6% bridged, 4.2% not bridged). Given the small numbers in each subgroup, it is not unexpected that a difference in postpolypectomy bleeding rate was not observed; however, the authors did find that bridging therapy and $P2Y_{12}$ inhibitor use—without discriminating between continuous and interrupted—were associated with postpolypectomy bleeding.

A recently published meta-analysis included the Feagin study and 8 additional randomized trials comparing postpolypectomy clip placement to a control group.[45] Overall, clipping did not significantly lower the rate of postpolypectomy bleeding (2.2% and 3.3%, respectively), yielding a pooled relative risk of 0.69 (95% CI 0.45%–1.08%). In subgroup analysis, there was a decrease in the bleeding rate for polyps ≥ 2 cm in size, particularly in the proximal colon. Despite pooling results of several studies, there was insufficient data to inform the

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question of prophylactic clipping of large postpolypectomy mucosal defects in patients that require prompt resumption of their antiplatelet or anticoagulant drugs.

In the absence of high-quality evidence, a recommendation cannot be made for or against routine clipping postpolypectomy at this time. Until data are available that demonstrates the benefit of mechanical hemostasis in this subgroup of patients, it makes intuitive sense to consider prophylactically clip closure of defects following excision of polyps greater than 1 cm in patients who require ongoing antithrombotic therapy.

SUMMARY

This review has highlighted several scenarios in which clinical decisions are made using low-quality data. Balancing the risk of postpolypectomy bleeding against the risk of a thrombotic event requires shared decision-making to ensure the patient understands the risks and benefits of antithrombotic drug management before and after colonoscopy with polypectomy. In all cases, this discussion should include the patient's preferences for preventing thromboembolism versus postpolypectomy bleeding risk. Consultation with the patient's cardiologist, hematologist, or neurologist is particularly important if the patient is at high risk of a thromboembolic event.

Polypectomy techniques may also dictate the risk of postpolypectomy bleeding. There is growing acceptance of cold snare polypectomy in subcentimeter polyps while on continuous antithrombotic medications, but further study is needed in patients requiring antithrombotic drugs. Does a patient need to temporarily interrupt an antithrombotic before colonoscopy and cold snare polypectomy? Currently, the data to answer this question are sparse. While clipping polyps larger than 2 cm seems to decrease postpolypectomy bleeding, the benefit of prophylactic clipping following polypectomy of polyps less than 2 cm in size in patients on antithrombotics has yet to be determined. Studies assessing patient preferences regarding antithrombotic interruption in the setting of colonoscopy planning would be a welcome addition to the current literature and help inform shared decision-making discussions.

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KEY POINTS

- Antithrombotic use increases the risk of postpolypectomy bleeding.
- Careful consideration of thromboembolic risk versus postpolypectomy bleeding should be considered, as well as patient preferences.
- Cold snare polypectomy and prophylactic clipping of large polypectomy sites may help prevent postpolypectomy bleeding.

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CLINICS CARE POINTS

- A patient's underlying thrombotic risk and their personal preferences regarding postpolypectomy bleeding versus thrombotic events are essential to consider before undertaking any procedure whereby polypectomy is possible.
- The timing of colonoscopy, decisions concerning temporary interruption, and the endoscopist's choice of polypectomy technique should be dictated by the patient's underlying risk for thrombotic events and the size of the polyp removed.
- Colonoscopy should be deferred in patients during the period when the alteration of the antithrombotic regimen is associated with the greatest risk of adverse cardiac events.
- ASA can be continued for colonoscopy and polypectomy
- DOACs have a short half-life and rapid onset of action resulting in safe temporary interruption for colonoscopy and polypectomy 2 days before the procedure. Prompt resumption of the DOAC is recommended once endoscopic hemostasis is achieved, usually the day after the procedure. There is no need to bridge patients on DOACs with low molecular weight heparin.
- Polyps up to 1 cm in size removed by cold snare polypectomy may be treated as a low-risk bleeding procedure.
  - Consider continuing anticoagulant and antiplatelet therapy
- For polyps ≥ 1 cm, at higher risk of bleeding, consider temporary interruption of anticoagulant and antiplatelet therapy
- Reserve heparin bridging for patients on interrupted warfarin at high risk of thromboembolism
- Prophylactic clip placement of polyps ≥ 1 cm may help prevent postpolypectomy bleeding in patients requiring antithrombotic drugs.

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Table 1

Antithrombotic agents

	Mechanism of Action	When to Stop	When to Resume
Anticoagulant Agents			
Warfarin	Vitamin K antagonist	5 d	Same day
Direct-Acting Oral Anticoagulants			
Dabigatran	Thrombin inhibitor	1–2 d	Next day
Rivaroxaban	Factor Xa inhibitor	2 d	Next day
Apixaban	Factor Xa inhibitor	2 d	Next day
Edoxaban	Factor Xa inhibitor	2 d	Next day
Betrixaban	Factor Xa inhibitor	2 d	Next day
Antiplatelet Agents			
Acetylsalicylic Acid	Platelet cyclooxygenase-1 inhibitor	Do not stop	Do not stop
$P2Y_{12}$ Inhibitors			
Ticagrelor	Platelet $P2Y_{12}$ receptor antagonist	4 d	Optimal timing unknown; preferably within 24 h following the procedure
Clopidogrel	Platelet $P2Y_{12}$ receptor antagonist	7 d	Optimal timing unknown; preferably within 24 h following the procedure
Prasugrel	Platelet $P2Y_{12}$ receptor antagonist	7 d	Optimal timing unknown; preferably within 24 h following the procedure
Ticlopidine	Platelet $P2Y_{12}$ receptor antagonist	10–14 d	Optimal timing unknown; preferably within 24 h following the procedure

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Table 2

Risk of thromboembolism in patients prescribed an oral anticoagulant

Risk Category	Mechanical Heart Valve	Atrial Fibrillation	Venous Thromboembolism
High	• Mitral position (any) • Aortic position (older: caged-ball or tilting disc) • TIA/stroke within 3 mo	• $CHADS_2$ score 5 or 6 • CHA_2DS_2VASc score ≥ 7 • TIA/stroke within 3 mo • Rheumatic valvular heart disease	• VTE within 3 mo • Severe thrombophilia: – Protein C deficiency – Protein S deficiency – Antithrombin deficiency – Antiphospholipid antibodies • Multiple thrombophilias • Venocaval filter • Active cancer[a]
Moderate	• Bileaflet aortic valve prosthesis plus 1 of: – Atrial fibrillation – Prior TIA/stroke – Hypertension – Diabetes – Congestive heart failure – Age > 75 y	• $CHADS_2$ score 3 or 4 • CHA_2DS_2VASc score 5 or 6	• VTE within 3–12 mo • Recurrent VTE • Nonsevere thrombophilia • Cancer within 5 y
Low	• Bileaflet aortic valve prosthesis	$CHADS_2$ score ≤ 2	• Single VTE > 12 mo

[a]Consider pancreatic, gastric, brain, and myeloproliferative.

Data from Refs [10,11].